

The critical success factors involved in the
implementation of a digital classroom in New Zealand.

By

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Abstract

Over the last five years New Zealand schools have set up digital classrooms. In a digital classroom, sets of computers are installed in classrooms and connected to the school's network. The reasons for the schools setting up digital classrooms vary; from a marketing point of view to attract students to genuine teachers who are convinced that Information and Communication Technology (ICT) improves learning in the classroom. There appears to be little co-ordination between schools regarding digital classrooms. The classrooms are autonomous and have continued to develop independently.

The purpose of this study was to investigate the critical success factors for the implementation of a digital classroom. Relevant factors such as resources, class organization, pedagogy, funding and support were investigated. A collective case study approach was used. Six classrooms in four schools were researched and compared. Interviews were carried out with six teachers and the students in all six classrooms were surveyed. A case study methodology was used from which a profile of each classroom was developed. The results of the research outline the success factors in the digital classroom model and provide a definition of the digital classroom.

The research showed that the literature both supports and refutes the impact of ICT on learning. Learning theory is outlined and its relevance to digital classrooms explained. There is very little research available on digital classrooms in the New Zealand context and this study makes a start in contributing to this field.

The key to the success of a digital classroom is the teacher and the type of pedagogy that is used in the classroom. The teacher needs to take a facilitator role, implementing a constructivist learning environment where the student interacts seamlessly with the ICT in a rich multimedia learning environment. To be effective the ICT must be transparent. The inquiry process is an effective pedagogy to use with ICT. The study found that each classroom was at a different stage along the

constructivist continuum. The most effective classroom had the teacher in a facilitator role and the students had freedom to learn using the digital tools. Digital classrooms have the potential to merge the new learning styles of today's students with the power of the new emerging digital tools to produce a new generation of independent literate problem solving students.

Declaration

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This thesis (or dissertation) is submitted in partial fulfilment for the requirements for the Unitec degree of Master of Computing

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Parts of this (or dissertation), as described on the next page, have been submitted and/or accepted for publication in advance of submission of the thesis (or dissertation) for examination.

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TABLE OF CONTENTS

ABSTRACT	ii
ACKNOWLEDGEMENTS	v
CHAPTER 1 INTRODUCTION.....	1
1.1 BACKGROUND	1
1.2 CONTEXT	2
1.4 SIGNIFICANCE OF THE STUDY	5
1.5 CHAPTER SUMMARY.....	5
CHAPTER 2 REVIEW OF THE LITERATURE.....	7
2.1 INTRODUCTION	7
2.2 LITERATURE REVIEW.....	7
2.3 LEARNING THEORY AND ICT	16
2.4 CHAPTER SUMMARY.....	21
CHAPTER 3 RESEARCH DESIGN AND METHODOLOGY.....	23
3.1 INTRODUCTION	23
3.2 THE RESEARCH PARADIGM.....	24
3.3 CASE STUDY BACKGROUND	27
3.4 INTERVIEW METHODOLOGY	29
3.5 QUESTIONNAIRE METHODOLOGY.....	29
3.6 SAMPLE SELECTION	30
3.7 RESEARCH APPROACH.....	31
3.8 RESEARCH QUESTIONS	33
3.9 DATA ANALYSIS	35
3.10 TEACHER INTERVIEWS	36
3.11 ETHICS APPROVAL	36
3.12 DATA GATHERING.....	37
3.13 VALIDITY.....	38
3.14 LIMITATIONS	38
3.15 CHAPTER SUMMARY	39
CHAPTER 4 DATA SET ANALYSIS.....	40
4.1 INTRODUCTION	40
4.2 INTERVIEW DATA SET ANALYSIS.....	40
4.3 INTERVIEW PROTOCOL	52
4.4 TRANSCRIBING	53
4.5 SUMMARY	54
CHAPTER 5 RESULTS TEACHERS.....	55
5.1 INTRODUCTION	55
5.2 DEFINITION OF A DIGITAL CLASSROOM.....	55
5.3 RESOURCES	57
5.4 PROFESSIONAL DEVELOPMENT.....	61
5.5 DIGITAL CLASSROOM ORGANISATION	66
5.6 PEDAGOGY	72
5.6 FUNDING AND SUPPORT.....	82
5.7 STAKEHOLDERS ATTITUDES.....	86
5.8 POSITIVE ASPECTS OF THE DIGITAL CLASSROOMS	91
5.9 NEGATIVE OUTCOMES	95
5.10 IMPROVEMENTS FOR A DIGITAL CLASSROOM	99
5.11 CHAPTER SUMMARY.....	102
CHAPTER 6 RESULTS STUDENTS	107
6.1 INTRODUCTION	107
6.2 DEFINITION OF A DIGITAL CLASSROOM.....	108

6.3 POSITIVE ASPECTS OF A DIGITAL CLASSROOM.....	114
6.4 NEGATIVE ASPECTS OF A DIGITAL CLASSROOM.....	122
6.5 IMPROVEMENTS TO LEARNING	126
6.6 THE DIFFERENCE IN LEARNING BETWEEN A DIGITAL CLASSROOM AND A NORMAL CLASSROOM .	133
6.7 IMPROVEMENTS TO A DIGITAL CLASSROOM	140
6.8 CHAPTER SUMMARY.....	143
CHAPTER 7 DISCUSSION	150
7.1 INTRODUCTION	150
7.2 DEFINITION OF A DIGITAL CLASSROOM	151
7.3 RESOURCES	158
7.4 PROFESSIONAL DEVELOPMENT	160
7.5 CLASSROOM ORGANISATION AND PEDAGOGY.....	164
7.6 FUNDING AND SUPPORT	168
7.07 POSITIVE ASPECTS OF THE DIGITAL CLASSROOMS	171
7.08 NEGATIVE ASPECTS OF A DIGITAL CLASSROOM.....	176
7.09 DIGITAL CLASSROOM MODEL	181
7.10 SUMMARY.....	182
CHAPTER 8 CONCLUSION.....	185
8.1 INTRODUCTION	185
8.2 DIGITAL CLASSROOM DEFINITION	185
8.3 CRITICAL SUCCESS FACTORS.....	186
8.4 RESEARCH LIMITATIONS	191
8.5 CONCLUSION	192
REFERENCES	193
APPENDICES	199
9.1 CONSENT FORM	199
9.2 RESEARCH INFORMATION FORM FOR PARTICIPANTS	200
9.3 ICT EQUIPMENT SURVEY	201
9.4 PROFESSIONAL DEVELOPMENT SURVEY	202

List of Figures

Figure 2.1: Literature map of ICT research.....	12
Figure 3.1: Model of tentative definition of a digital classroom.....	32
Figure 4.1: Interview word count.....	41
Figure 4.2: Units of teacher discourse during interviews.....	42
Figure 4.3: Teacher One coding analysis.....	44
Figure 4.4: Teacher Two coding analysis.....	45
Figure 4.5: Teacher Three coding analysis.....	46
Figure 4.6: Teacher Four coding analysis.....	48
Figure 4.7: Teacher Five coding analysis.....	49
Figure 4.8: Teacher Six coding analysis.....	50
Figure 5.1: Teachers' definition of a digital classroom.....	56
Figure 5.2: Teacher One: professional development.....	61
Figure 5.3: Teacher Two: professional development.....	62
Figure 5.4: Teachers Three & Four: professional development.....	63
Figure 5.5: Teacher Five: professional development.....	64
Figure 5.6: Teacher Six: professional development.....	65
Figure 5.7: Teacher One: classroom organisation/pedagogy.....	72
Figure 5.8: Teacher Two: classroom organisation/pedagogy.....	74
Figure 5.9: Teacher Three: classroom organisation/pedagogy.....	75
Figure 5.10: Teacher Four: classroom organisation/pedagogy.....	77
Figure 5.11: Teacher Five: classroom organisation/pedagogy.....	80
Figure 5.12: Teacher Six: classroom organisation/pedagogy.....	82
Figure 5.13: Teacher One: funding of digital classroom.....	83
Figure 5.14: Teacher Two: funding of digital classroom.....	84
Figure 5.15: Teacher Three: funding of digital classroom.....	84
Figure 5.16: Teacher Five: funding of digital classroom.....	85
Figure 5.17: Teacher Six: funding of digital classroom.....	86
Figure 6.1: Teacher One's students' digital classroom definition.....	109
Figure 6.2: Teacher Three's students' digital classroom definition.....	110
Figure 6.3: Teacher Four's students' digital classroom definition.....	110
Figure 6.4: Teacher Five's students' digital classroom definition.....	112
Figure 6.5: Teacher Six's students' digital classroom definition.....	113
Figure 6.6: Teacher One's students' positive aspects of a digital classroom.....	115
Figure 6.7: Teacher Three's students' positive aspects of a digital classroom.....	116
Figure 6.8: Teacher Four's students' positive aspects of a digital classroom.....	117

Figure 6.9: Teacher Five’s students’ positive aspects of a digital classroom.....	119
Figure 6.10: Teacher Six’s students’ positive aspects of a digital classroom	121
Figure 6.11: Teacher One’s students’ improvements to learning.....	127
Figure 6.12: Teacher Three’s students’ improvements to learning	128
Figure 6.13: Teacher Four’s students’ improvements to learning.....	130
Figure 6.14: Teacher Five’s students’ improvements to learning	131
Figure 6.15: Teacher Six’s students’ improvements to learning	133
Figure 6.16: Teacher One’s students’: the difference in learning	134
Figure 6.17: Teacher Three’s students’: the difference in learning.....	135
Figure 6.18: Teacher Four’s students’: the difference in learning.....	136
Figure 6.19: Teacher Five’s students’: the difference in learning	138
Figure 6.20: Teacher Six’s students’: the difference in learning.....	139
Figure 7.1: Teacher One/Student comparison	152
Figure 7.2: Teacher Two/Student comparison	152
Figure 7.3: Teacher Three/Student comparison	154
Figure 7.4: Teacher Four/Student comparison	155
Figure 7.5: Teacher Five/Student comparison.....	156
Figure 7.6: Definition of a digital classroom Teacher Six/students	157
Figure 7.7: Toolishness is Foolishness	159
Figure 7.8: The pedagogy continuum.....	168
Figure 7.9: Digital classroom model	181
Figure 8.1: Digital classroom model.....	186

List of Tables

Table 2.1: Comparison of teacher/student pedagogy	20
Table 2.2: Classroom environments	20
Table 3.1: Differing approaches to the study of behaviour	24
Table 3.2: Case study guidance	27
Table 3.3: School and teacher Background	28
Table 3.4: Sub-questions: teacher.....	34
Table 3.5: Sub-questions: students	35
Table 4.1: Interview data analysis	40
Table 4.2: Summary of merits of interview versus questionnaire	51
Table 5.1: Summary of comments on the definition of digital classrooms	57
Table 5.2: Summary of digital classroom resources.....	60
Table 5.3: Summary of professional development in the schools	66
Table 6.1: Teacher One’s students’ digital classroom definition	108
Table 6.2: Teacher Three’s students’ digital classroom definition.....	109
Table 6.3: Teacher Four’s students’ digital class definition.....	110
Table 6.4: Teacher Five’s students’ digital classroom definition.....	111
Table 6.5: Teacher Six’s students’ digital classroom definition.....	113
Table 6.6: Teacher One’s students’: Positive aspects of a digital classroom	114
Table 6.7: Teacher Three’s students’: positive aspects of a digital classroom.....	115
Table 6.8: Teacher Four’s students’: positive aspects of a digital classroom.....	117
Table 6.9: Teacher Five’s students’: positive aspects of a digital classroom.....	118
Table 6.10: Teacher Six’s students’: positive aspects of a digital classroom.....	120
Table 6.11: Teacher One’s students’: negative aspects of a digital classroom.....	122
Table 6.12: Teacher Three’s students’: negative aspects of a digital classroom.....	122
Table 6.13: Teacher Four’s students’: negative aspects of a digital classroom.....	123
Table 6.14: Teacher Five’s students’: negative aspects of a digital classroom	124
Table 6.15: Teacher Six’s students’: negative aspects of a digital classroom.....	125
Table 6.16: Teacher One’s students’ learning improvements	126
Table 6.17: Teacher Three’s students’ learning improvements.....	127
Table 6.18: Teacher Four’s students’ learning improvements	129
Table 6.19: Teacher Five’s students’ improvements to learning.....	130
Table 6.20: Teacher Six’s students’ improvements to learning	132
Table 6.21: Teacher One’s students’: The difference in learning	133
Table 6.22: Teacher Three’s students’: the difference in learning	134
Table 6.23: Teacher Four’s students’: the difference in learning.....	136

Table 6.24: Teacher Five’s students’: the difference in learning	137
Table 6.25: Teacher Six’s students’: the the difference in learning	138
Table 6.26: Teacher One’s students’: improvements to digital classrooms	140
Table 6.27: Teacher Three’s students’: improvements to digital classrooms.....	140
Table 6.28: Teacher Four’s students’: improvements to digital classrooms	141
Table 6.29: Teacher Five’s students’: improvements to digital classrooms.....	141
Table 6.30: Teacher Six’s students’: improvements to digital classrooms	142
Table 7.1: Research questions	150
Table 7.2: Digital classroom elements	158
Table 7.3: Learning continuum adapted from Brown (1995) Figure 2.3	167
Table 7.4: Teacher comments on positive aspects of digital classrooms	174
Table 7.5: Student comments on the positive aspects of digital classrooms	175
Table 7.6: Summary of negative aspects of digital classrooms (Teachers).....	176
Table 7.7: Summary of negative aspects of digital classrooms (Students)	178
Table 7.9: Improvements to the digital classroom (Teachers)	179
Table 7.10: Improvements to the digital classroom (Students)	179

Chapter 1 Introduction

“Everything should be made as simple as possible, but not more so”

Einstein

1.1 Background

This thesis emerged from the author’s involvement in the introduction of Information and Communication Technologies (ICTs) in schools over a period of some 20 years. This started with experimenting with the use a Commodore 64 computer in a classroom programme through to becoming a programme manager of a postgraduate qualification in ICT in education.

The introduction of ICTs into schools has been influenced by numerous factors. The New Zealand Government through the Ministry of Education has been very haphazard with the introduction of ICT into schools. Brown, M (1998) commented about the lack of direction from the Ministry of Education regarding the implementation of computers into schools, lack of professional development, lack of funding, and the many stories of failure and abandoned technology. Early-adopter teachers sourced computers for their classrooms and experimented themselves on ways to supplement the classroom programme using ICT, with little support. Computer manufacturers such as IBM, Apple and Acorn marketed their products extensively to schools, often with a combination of hardware and software packages inappropriate to the schools’ needs. Professional development was rarely planned for or delivered. Boards of Trustees and parents put pressure on schools to place computers in the classrooms. Initially the numbers of computers in schools was stifled by high prices. However, this gradually came down over time and technology is now more affordable.

Schools experimented with networking computers in computer suites and linking individual computers in the classrooms. COWS (computers on wheels) laptop trolleys have also been tried. More often than not the computer ended up in a corner of the classroom nearest to the electrical plug. The promised PDA (personal digital assistant) revolution has also failed to happen in schools.

In the last five years some schools have set up digital classrooms where sets of computers were placed in single cell classrooms and networked together. The number of computers varies between classrooms. The reasons for the schools setting up digital classrooms vary, from a marketing point of view to attract students, to genuine teachers who are convinced that ICT improves learning in the classroom. In late 2002 the author spotted a headline in the local paper on a digital classroom. I examined the local literature and could not find a definition of a digital classroom or any information about how a digital classroom was set up. From there I set my goal of my thesis to investigate the nature of a digital class and examine the critical success factors that are involved in the implementation of a digital classroom. There has been little New Zealand research in this area.

1.2 Context

There has been little questioning of the establishment of digital classrooms in New Zealand schools. The media generally represents the introduction of ICT into schools as positive, as seen by the article in the local paper with the headline “Digital Class boosts tuition” (Sutton, 2002). In the Digital Horizons document the Minister of Education (Education, 2002 p.2) states: “Wonderful things are happening with ICT in our schools, and I am constantly amazed at the range and standard of work that children are producing as a result”. In the Digital Horizons document (Education, 2002 p.3) the vision for learners is stated as: “All learners will use ICT confidently and creatively to help develop skills and knowledge they need to achieve personal goals and to be full participants in the global community”. ICT conferences extol the virtues of ICT to improve learning in schools. However, there are some researchers who have begun to seriously question the rapid growth of the use of ICT in our schools (e.g. Brown, 2003; Cuban, 2001; Healy, 1998; McKenzie, 2002; Oppenheimer, 1997). The authors question the value of ICT as it is used in schools today and questions what kind of society we preparing our children to take part in.

In the United States of America there have been many State initiatives to provide one-to-one laptops to students and teachers. Maine is a leader in this area. However

research on the effectiveness of laptops has shown no gains in learning using standardised tests (eSchool, 2006).

As demonstrated in the literature study, there is no clear overall evidence that ICT is making a positive impact on student learning. The evidence is confined to particular contexts and specific uses.

At the start of my research I have tentatively defined a digital classroom. “A classroom that has a ratio of computers to students (1:5) or less, internet access and a range of peripheral devices such as digital cameras and scanners that are readily accessible. The students work collaboratively using the ICT equipment for the majority of their work in the classroom.” This will be modified and redefined at the conclusion of my thesis.

Six Teachers were interviewed that were identified as teaching in a digital classroom environment. The students in the teachers’ classrooms were also surveyed with a written questionnaire.

Main Research Question:

What are the critical success factors for the implementation of a digital classroom in New Zealand?

Questions that guided this research include:

1. What is a digital classroom?
2. What resources are needed for a digital classroom?
3. What professional development in ICT is provided for teachers in a digital classroom?
4. How is the digital classroom organised?
5. What changes in pedagogy are needed in a digital classroom?
6. What funding and support are provided in a digital classroom?
7. What is your perception of the attitude of the major stakeholders in a digital classroom?
8. What are the positive aspects of a digital classroom environment?
9. What are the negative aspects of a digital classroom environment?

10. What can be improved in your digital classroom?

1.) The first question is aimed at finding out the teachers' definition of a digital classroom. The concept of a digital classroom came out of schools, not from literature as has happened in the past, for example with open classrooms. An important outcome of this study is understanding and defining the concept of a digital classroom.

2.) Resources, both hardware and software, are important in setting up a digital classroom. This question aims to find out what hardware and software is needed to set up a digital classroom and how is this linked to classroom organisation and pedagogy.

3.) Research (eg. Anderson, Baskin, and Halbert,2002; McKenzie, 1999a; Ham, 2002) identified professional development as being vital in the integration of ICT into the classroom programme. Therefore it is important to research the professional development the teachers in digital classrooms have undertaken. This can then be linked to pedagogy and classroom organisation.

4.) The question on classroom organisation aims to find out how the digital classrooms are organised, how different are they from single-cell classrooms and what difference the digital environment makes to classroom organisation.(Hill, 2000) states that the class organisation has a direct effect on pedagogy when utilising ICT in the classroom.

5.) The key to the utilisation of ICT in the classroom is the pedagogy used. (Loveless & Ellis, 2001) discussed that to make effective use of ICT changes must be made in the pedagogy used in the classroom.

6.) Inserting hardware and software into a classroom is expensive and funding becomes an issue in schools with digital classrooms. This question seeks to investigate the sources of funding and how this impacts on the digital classroom.

7.) Stakeholders are vital in the support of a digital classroom. It is important to research the differences and influences the stakeholders have on the implementation of a digital classroom. What are the different rationales behind a digital classroom?

8. & 9.) From the teachers' and students' points of view it is important to examine the positives and negatives in the digital classroom environment. Comparisons can be made between teachers and students.

10.) Finally it is important to reflect on the future directions of digital classrooms and how they may change in the future.

In summary this study aims to:

- Provide a definition of a digital classroom.
- Predict the future direction of digital classrooms in New Zealand.
- Identify and examine the critical success factors involved in the implementation of a digital classroom in New Zealand.
- Identify the factors that facilitate or hinder the innovation adaptation of the digital classroom.
- Produce a model of a digital classroom.

1.4 Significance of the Study

After doing a literature search on digital classrooms I found there is very little research on the nature of the digital classroom in New Zealand and little research on the factors that make up a digital classroom. My research in the New Zealand context is significant as it will contribute to the professional literature on the implementation of digital classrooms in New Zealand.

1. The study adds to the literature on the implementation of digital classrooms in the New Zealand education system.
2. The study adds to the international research database on innovation using ICT in education.
3. The study analyses critical success factors in setting up a digital classroom and will assist schools in the future in the establishment of digital classrooms.
4. The study takes a critical look at the rationales for using ICT in education.

1.5 Chapter Summary

This is an exploratory case study, which investigates the digital classroom model in primary and intermediate schools in New Zealand. The purpose of the study is to investigate the critical success factors for the implementation of a digital classroom. Six classrooms in four schools were investigated and compared. Interviews were carried out with six teachers and the students in all six classrooms were surveyed. A case study methodology was used from which a profile of each classroom was developed. The results of the research outline the success factors in the digital classroom model and provide a definition of the digital classroom.

This chapter examined the background of the emergence of digital classrooms in the New Zealand educational system, including how external factors have influenced the introduction of ICT into schools. The context of the educational environment into which digital classrooms have emerged has been examined. The support and scepticism surrounding the introduction of ICT into classrooms has been discussed.

The research questions have been outlined and discussed in relation to the thesis. The relationship of the research questions to the critical success factors has been outlined.

Finally the significance of this research has been explained. There is very little research available on the nature of digital classrooms and their critical success factors. This thesis will contribute to New Zealand research into the digital classroom concept.

The following chapter examines the literature relevant to this research. The research paradigms are discussed

Chapter 2 Review of the Literature

“In the history of education, the 1980s will stand out as the decade during which many countries throughout the world introduced computers in education on a large scale, the first stage of a technological innovation which is unprecedented in its scope”. (Plomp et al. 1996, p. 1).

2.1 Introduction

Throughout the 1980s and 1990s the main-frame computer was replaced by the desktop computer and later the laptop computer in the business world. This was replicated in education. However, the rationales for using ICT in education have been controversial. While many schools in New Zealand have introduced computers into the classroom it is debatable whether this is the first stage in a technical innovation. There has been much research to investigate whether ICT makes a difference in education.

The focus of this literature review is to examine the literature that both supports and discredits the effectiveness of ICT on education. The research paradigms will be outlined which will influence the research method chosen for this study. The findings and the context of the research will be analysed and related to the New Zealand context. A literature map has been constructed outlining the main areas of research. The chapter concludes with the qualitative paradigm dominating educational research into ICT and education. The future directions and the significance of this research are discussed.

2.2 Literature Review

The effectiveness of ICT has been a controversial and much debated issue since computers were first introduced into classrooms. Consequently many research papers and books advocate both sides of the argument as to whether ICT is making a difference in the learning of students. There is also a large amount of literature available on the topic, both in New Zealand and overseas. For this literature review I had little difficulty locating literature on the use of computers in education, the difficult decision was locating the key research papers in this area.

In New Zealand the concept of digital classrooms is new; they have only been established in schools in the Hamilton and Auckland area in the last two years. Following a brief visit to one of the digital classrooms, I formulated a temporary definition. "A classroom that has a ratio of computers to students (1:5) or less. Internet Access and a range of peripheral devices such as digital cameras and scanners that are readily accessible. The students work collaboratively using the ICT equipment for the majority of their work in the classroom."

No New Zealand study could be located that relates specifically to a New Zealand digital classroom. This is because the concept is new. A characteristic of ICT and learning is that it has undergone constant change since the introduction of ICT to the classrooms, both in terms of the hardware and software and also the way the teachers have used the technology in the classroom lessons. This was outlined in a paper by Honey, McMillan, and Carrigg (1999), 'Perspectives on Technology and Educational Research: Lessons from the Past and Present'. Some overseas studies were located that investigated technology-enhanced classrooms or classrooms of the future, (Cooper, 2000, 2001). These research studies, while similar to my research goals, are more specific, concentrating on ICT and a subject area; they relate to evaluating student progress as well as teacher attitudes. American studies relating to digital classrooms are typically related to investigating classrooms that are connected to the internet and are not related to the New Zealand concept of a digital classroom. The definition of a digital classroom differs between countries the digital classroom label seems to be unique to New Zealand.

For the Literature Review I have chosen 25 papers, 9 from New Zealand, 6 from the United States, 6 from Australia and 4 from the United Kingdom. I have chosen to source the research papers from those countries as they have an important influence on the direction of New Zealand education. The papers were chosen by searching the internet using ICT and education as key terms and by a book search in the Unitec and Wintec libraries.

The three main research approaches used in learning technology research are qualitative, quantitative and mixed methods. Research in education is concerned with

understanding the learning process and dealing with people in a social setting. This suits the constructivist paradigm which deals with “understanding, multiple participant meanings, social and historical construction and theory generation” (Creswell, 2003, p.6). The post-positivist paradigm is also used by researchers, involving “determination, reductionism, empirical observation and measurement and verifying a theory” (Creswell, 2003). However, as seen by my sample, “the post-positivist paradigm is usually combined with the constructivist paradigm to give the pragmatist approach” (Creswell, 2003, p. 6).

The qualitative research procedure dominated the literature sample with 13 research papers. Qualitative research, according to Creswell (1994, p.3), “is defined as an inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants and conducted in a natural setting”. The data-gathering method used in qualitative research consists of observations, interviews and surveys which assist in the inquiry process. This form of data gathering was present in all of the qualitative case studies. (Addison, Ertmer, Lane, Ross, & Woods, 1999; Boyd, 1998, 2001; Clark, 2000; Commonwealth Department of Employment, 1996; Cooper, 2000, 2001; Cope & Ward, 2002; Eadie, 2000; Hayes & Yates, 2002; Sandholtz, Ringstaff, & Dwyer, 1995; Shears, 1995)

Only two papers followed a quantitative approach (ERO, 2001; Guha, 2001). Creswell (1994, p.2) defined quantitative research as “an inquiry into a social or human problem based on testing a theory composed of variables, measured with numbers, and analysed with statistical procedures in order to determine whether the predictive generations of the theory hold true”. The quantitative research by Guha (2001) comprised of a survey of 149 teachers’ perceptions of ICT where the results were processed statistically. The ERO (2001) report survey was carried out by ERO officers who are not researchers, and so the quantitative method was more suitable as they would only have to fill out a form. Therefore some questions can be asked regarding the accuracy of the results as some of the questions could be open to interpretation. For example: Is the school providing appropriate ICT professional development? Asked by an ERO officer who is in the process of grading a school, is likely to receive the answer that the teacher or principal wants the ERO officer to

hear. I would question the validity of the ERO conducting the survey, regarding the data collection phase.

Five research papers used the mixed-methods approach, which has been defined by Creswell (2003, p.210) as a study “that focuses on collecting and analysing both quantitative and qualitative data in a single study”. The papers which used mixed methods were Ham (2002), Higgins (2002), McKinnon, Nolan, & Sinclair (2000), Robertson & Fluck (2002) and Taylor (1999). These are all comprehensive reports, validating their data by triangulation.

Five research papers were discussion papers, focusing on examining the consequences and impact of ICT on education. These articles were from professional journals, both book and online versions, for the professional development of teachers. Again they take a very constructivist approach, building on previous knowledge in the learning technologies field. Brown M (1998) in his article, ‘The Use of Computers in New Zealand Schools: A Critical View’, argued that it is good teaching and not necessarily the ICT that improves the performance of the learner. He also argued that the Government and Ministry of Education need to provide the resources (professional development and hardware/software) to allow ICT to be more effective in schools. Blackburn (1999) also stated in his article that schools should be better informed when making decisions about purchasing ICT equipment, taking into account pedagogy and support for teachers. McKenzie (2002) in his online journal *From Now On* (www.fno.org), in an article, ‘The Over Equipped Classroom’, was very sceptical about equipping classrooms with the latest ICT hardware and software. He argued that ICT should be used where appropriate, and has developed a ‘just-in-time’ approach. He also advocates that schools should think carefully about why and how they should use ICT equipment in the classrooms.

Sandholtz et al. (1995) followed a grounded theory methodology where the teachers were required to fill out a reflective diary which contributed towards the research. Creswell (2003, p. 14) defined grounded theory as theory “in which the researcher attempts to derive a general abstract theory of a process, action, or interaction grounded in the views of participants in a study”. Apple have built up a huge database of responses to interviews, observations and coded responses. This Apple-sponsored

study, however, is one of the most positive research papers regarding ICT and learning. Sandholtz et al. (1995, p.17) stated, “Our overall experience with the Apple Classrooms of Tomorrow project suggests lasting, significant change - in teachers’ beliefs about their role, in instructional practices, and in student outcomes.” They do go on to state that teachers need support, professional development, release time and reflection time in addition to the computers in the classrooms. However, with an Apple sponsored report, it would be surprising if it did not support the implementation of ICT into the classroom program. There is little evidence in the paper to substantiate the claims about improvement in student learning.

One paper by Cope and Ward (2002) used a phenomenographical approach. Cope and Ward (2002, p.69) define phenomenographical research as being “to investigate the qualitatively different ways that phenomenon in the world can be perceived, conceptualised or understood”. This is clearly a constructivist approach, and is a type of qualitative research. This research paper is valuable because it investigates the experienced teacher’s perceptions of learning technologies which is very similar to the digital classroom investigation. Cope and Ward (2002, p.73) found that “experienced teachers need professional development in modern research knowledge about the nature of leaning and how learning technologies can be used to encourage enhanced learning outcomes in students”. Cope and Ward (2002) also concluded that further research involving teachers’ perceptions is needed.

Creswell (2003, p. 39) suggested that “to enable a researcher to understand how his or her study of the topic adds to, extends, or replicates research already completed a literature map should be constructed”.

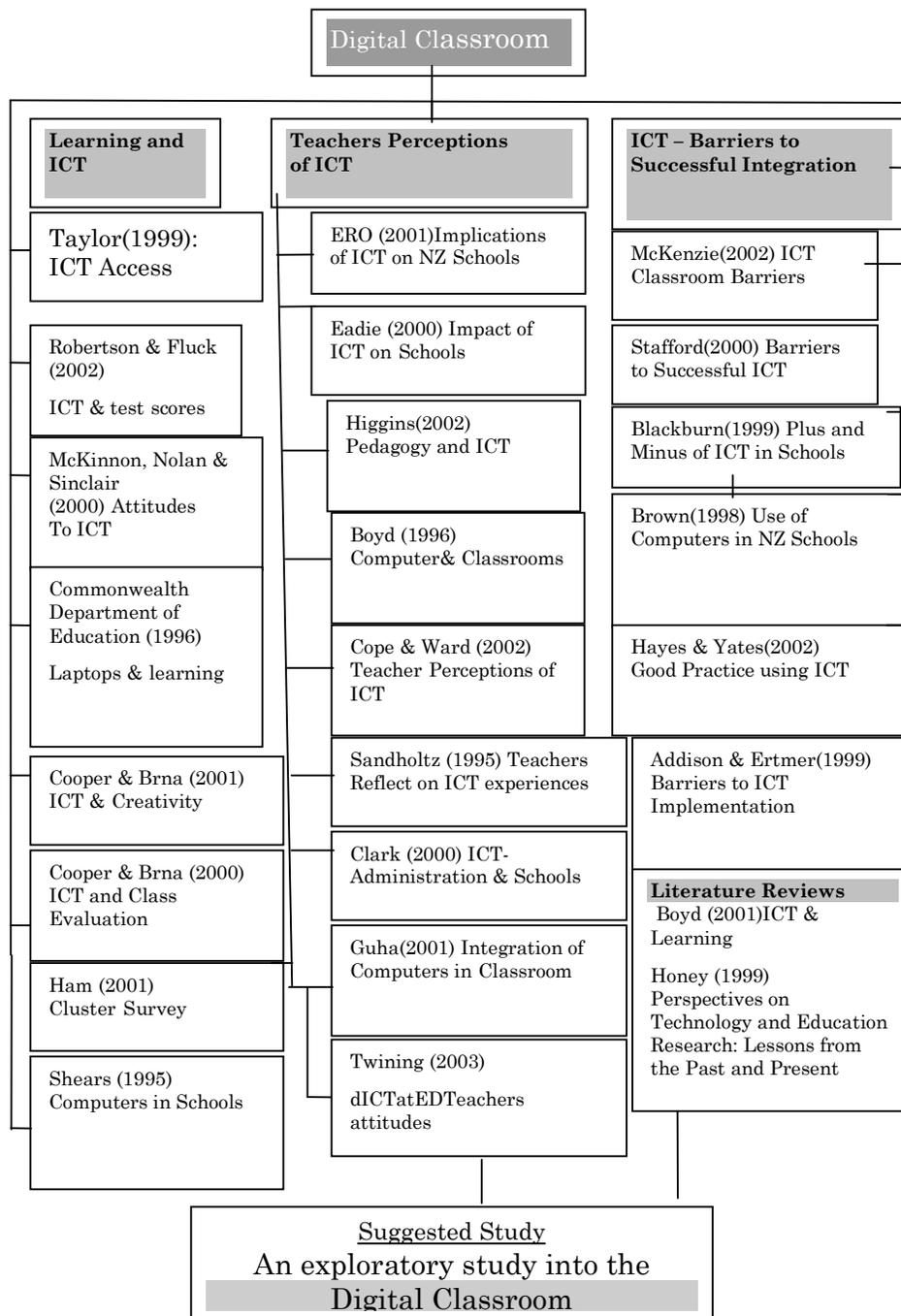


Figure 2.1: Literature map of ICT research

The literature map shows that I have divided the research into four main areas.

Learning and ICT covers the research which was concerned with measuring the effects of ICT on students' learning. There are qualitative case studies (Commonwealth Department of Employment, 1996; Cooper, 2000, 2001) which follow the qualitative method of interviewing, then interpreting the results and then forming a theory, which being a qualitative result is generally applicable only to that study. The mixed-method studies, (McKinnon et al., 2000; Robertson & Fluck, 2002; P. G. Taylor, 1998) use both qualitative and quantitative methods to triangulate the results; the results from these studies would be more transferable and valid, because of the triangulation. Most of the research papers, (Addison et al., 1999; McKinnon et al., 2000; Robertson & Fluck, 2002; Strafford, 2000; P. G. Taylor, 1998) investigated ICT in a traditional classroom where its effect may be constrained by the dynamics of the traditional classroom. In a large survey of schools in Victoria, Australia (Shears, 1995 p. 128) which was both qualitative (case studies) and quantitative (176 schools surveyed) it was concluded that "Do the students learn better? is still an unanswered question. It has been debated hotly but no definitive or acceptable measuring instruments are available". Both positive and negative views were given by teachers as to the influence computers have on learning. This research was all carried out in traditional classrooms. More research is needed in classrooms that have a structure different from the traditional. Here, because of a different organisation and pedagogy, ICT might be making more of a difference. This is one area in which research into digital classrooms can make a worthwhile contribution to the research in learning technologies.

The next group of research papers are the papers that are most relevant for my study. These are about the teachers' perceptions of ICT. The large surveys (ERO, 2001; Guha, 2001) used the quantitative method, although it was interesting that Guha stated that his was an exploratory study, yet the method was very statistical in the analysis.

The survey by Ham (2002) used mixed methods, and was a survey of the teachers in 23 clusters of ICTPD schools in New Zealand. It is very comprehensive, including 10 case study clusters which were researched using a qualitative method, and all the clusters were surveyed using a quantitative method. The resulting report at 136 pages

is very long; however the executive summary contains most of the important findings from the survey. The findings are very positive, and tend to justify the large expense of the cluster model for providing professional development for teachers. The other research papers have used a variety of research methods such as qualitative case study (Boyd, 1998; Clark, 2000), and phenomenography (Cope & Ward, 2002) which has been discussed previously. The ongoing survey by Twining (2003) investigated teachers' attitudes towards ICT, whether it should be an essential component of education and what rationales underpin its use. This is a quantitative survey that makes use of a web-based survey that aimed to get 20,000 responses. Twining has identified 19 rationales for using ICT in education and asks the respondents to rank them. It is different in that you fill in the web-based form and you have the option of getting the up-to-date results emailed to you.

The third group of papers are concerned with barriers to successful integration. These studies generally examined the current situation in classrooms, and then tried to examine the barriers for successful integration of ICT into the classrooms.

The paper by Addison et al. (1999) is a qualitative case study that investigated the barriers to successful integration of ICT into the classroom. This is an example of a very comprehensive and valid survey, with four data sources used for each researcher, and use made of triangulation to increase the validity and reliability. The study contributes to the research base regarding ICT and learning because of its design and thoroughness. It is helped by having five researchers working on the project at once. Its conclusions are similar to other studies, being more focused professional development, a shared vision for ICT, providing reliable technology, and instructional resources during the change process.

The rest of the papers in this category are discussion papers which outline the barriers to successful ICT and suggest some solutions. The paper by Hayes and Yates (2002), discusses an interesting concept. What does enhanced learning through computer-based technology look like? The paper also pointed out that the problem with research into ICT is difficult; because of the rapid technological change it is difficult to catch up with the research. Yesterday's research may not be relevant. The rest of the discussion papers discuss the barriers encountered, three of the papers are New

Zealand-based, sourced from the *Computers in New Zealand Schools* journal, the only current journal readily accessible for New Zealand Primary and Secondary teachers.

The last category of papers consists of the two literature reviews. The Boyd (2001) paper is a very comprehensive survey of the literature for four school-based ICT initiatives in New Zealand. Her conclusions included a suggestion that two or three year longitudinal case studies tend to yield richer results than snap shot studies. Some of the studies in my sample are long-term studies, such as Commonwealth Department of Employment (1996); Cooper (2000, 2001); Ham (2002) and Sandholtz et al. (1995).

Evaluations of projects should include the 'how and why' as well as 'what', this will be of help to me in my research, to make sure I investigated thoroughly the critical success factors of a digital classroom. Honey (1999), in her discussion on the changes that are occurring in educational research on technology, stated that three factors will influence research in the future. One is the changes in technology involved in the research. Secondly, the changes in the kinds of research questions answered, for example in my sample, the relatively high number of mixed methods research approaches. Thirdly, the changes in how research is being done and the methods used need to be considered.

In conclusion, qualitative research dominates the research in learning technologies, but there is a surprising amount of mixed-methods research and there is a likelihood that this will increase in the future. Quantitative research is still the preferred method for large surveys, with computer-based programs helping with the analysis.

The research field is very strong in the USA and the UK, where numerous stakeholders in the learning technology field are keen to justify the inclusion of ICT equipment in the classrooms. Australia also has a strong research base, and the population to generate more research projects than New Zealand. In my sample there was a lack of research into ICT use in New Zealand classrooms. Most of the New Zealand research located involved large-scale research into teacher attitudes, (ERO, 2001; Ham, 2002), or discussion papers (Blackburn, 1999; Brown M, 1998; Strafford, 2000), only case studies by Boyd (1998) who looked at five schools and Nolan

(McKinnon et al., 2000), who researched students attitudes towards computers, were directly focusing on ICT and learning in a classroom. Clearly more research is needed in New Zealand schools regarding ICT and the classroom. My study on digital classroom will contribute in this area.

Research does not prove one way or the other whether, overall, ICT is making a difference in learning and teaching in the primary/secondary classroom. As I have stated earlier, much of the research is conducted in the traditional model of a classroom, where the results concerning ICT and learning have been mixed in overseas studies.

In New Zealand more classroom-based research is needed to evaluate the effects of ICT on learning. From this long- and short-term research, innovative classroom models such as the digital classrooms will have more credibility and a stronger pedagogical base to develop in the future. The digital classroom development in New Zealand is at an early stage. There is little current research specifically on the digital classroom model in the New Zealand context. My research will provide an introduction to this new classroom model.

2.3 Learning theory and ICT

There is considerable debate about the most appropriate use of ICT in education. The literature review identified research that either supported or showed no difference in the effectiveness of ICT in schools. There is no clear consensus regarding the effectiveness ICT to enhance learning.

In this section I will examine the learning theories which support the use of ICT in learning and teaching and how learning theory relates to the use of ICT in digital classrooms.

Taylor (1980) formulated a model where computer use in the classroom took three forms – as a tutor where the computer teaches the student, as a tool where the student uses the computer to complete a task or to produce a product, and finally as a tutee where the student teaches the computer. This is a very simplistic view of how

computers are used in the classroom, the tutor and tool modes are the most common uses of computers in digital classrooms.

The main learning theories fit into two categories – directed instruction/cognition and the various forms of constructivism. Recently a new learning theory has emerged called connectivism (Siemens, 2005) where learning is seen as a network process. The connection of nodes of information and that it is an ongoing process. As the digital classroom concept evolves, this theory will have more relevance in explaining the learning utilizing technology, given that in everyday life students are exposed to text messaging, instant messaging, web 2.0 technologies such as myspace, youtube, blogging, wikis etc. McHugh (2005) discussed the characteristics of the new generation iKid whose whole life is dominated by cellphones, instant messaging and ipods. McHugh (2005) argued that the traditional teaching environment has lost touch with the iKid's learning style. Prensky (2001) also discussed the concept that there is a discontinuity between the learning styles of students of today and the traditional classroom model. Prensky (2001) named the students of today, 'Digital Natives' who are native speakers of the digital language of technology. Siemens (2005) suggests that there have been recent new trends in learning where the students are living, learning and working in a digital connected environment, where students' learning styles are being affected by daily exposure to technology and technology is playing a key role in the way students now think and learn.

Directed instruction is where the teacher transmits knowledge to the learner. This is directed by the teacher and is systematic and structured. The learner is passive, listening to the instruction.

In the digital classroom context, directed instruction is where the computer/ICT/Teacher takes the role of the tutor. This is commonly known as CAI or computer-aided instruction. Directed instruction is further divided into the behaviourist view and the information-processing view.

In the behaviourist theory all learning is seen as observable and measurable. B.F. Skinner is the most prominent advocate of behaviourism (Lefrancois, 1972). Skinner identified two conditions where behaviour is shaped (Lefrancois, 1972). Positive

reinforcement is where a desired behaviour will be reinforced by a stimulus. An example of this is in a Maths game on the computer where a correct response is accompanied by a clapping sound and an appropriate visual. Negative reinforcement is where a desired behaviour will result from the avoidance of a stimulus. An example in a computer game might be when a student selects a correct choice avoiding being “killed” by the computer game. Each learning task is broken down into small steps and the learner is directed through the steps by reinforcement. Most drill-and-practice games use Skinner’s reinforcement theory where students make choices so they get praise from the computer in order to complete a game (Robyler, 2004). The criticism of this theory is that it only is suitable for developing low-level thinking and the learning is repetitive. This does not result in any collaborative learning and is reliant on one person per computer, and so is not suitable for group work.

The other main type of directed instruction theory used with ICT is the information-processing theories (Robyler, 2004). Information-processing theorists see the human brain as a computer with short-term and long-term memories. Unlike behaviorists, information-processing theorists see learning as being internalized where information is processed by the brain in either short-term or long-term memory. Atkinson and Shiffrin (1968, cited in Robyler, 2004, p. 58) stated that “the brain contains certain structures that process information much like a computer”. The key to learning is the quality of the processing. The computer provides a context for the teaching of thinking strategies. Practice exercises help information transfer from the short-term memory into the long-term memory. Some drill-and-practice software is based on the information-processing theory.

The criticisms of directed methods mostly stem from the relevance to today’s digital learner and that the learning methods are old-fashioned. Directed instruction leads mostly to low-level thinking. The main disadvantages of directed instruction are that the students do not learn problem solving and have little chance to apply their skills in authentic tasks. Students also find the learning boring and irrelevant in today’s digital world. Another important point is that to be prepared for the future students must learn to work cooperatively and learning using directed instruction is mostly carried out individually.

Constructivist learning theories are currently the most influential relating ICT to learning. In constructivist learning emphasis is placed on the learner's prior experience and the students build their own cognitive structures during their learning experience. Knowledge is individually constructed and ICT helps to create a rich learning culture or environment for discovery. Learning is an active process where students construct their own knowledge. The teacher's role is to facilitate these learning experiences. In a digital classroom the technology is used to provide a stimulating, problem-based learning environment. Roblyer (2004, p. 68) defined constructivism as: "Constructivist goals focus on student's ability to solve real-life, practical problems, and its methods call for students to construct knowledge themselves rather than simply receive it from knowledgeable teachers." Constructivist classroom organization also allows for students to work in groups while solving problems. Constructivism also allows students to work at their own pace. Constructivism is centred around building on the student's experience and this is where the digital classroom is relevant as in today's world computers and technology are very much part of a student's experience in all aspects of their life. For example, a study by Radosevich and Kahn (2006) where their research at Monclair State University using tablet technology and recording software to enhance pedagogy indicated that the inclusion of technology can facilitate a constructivist learning environment where learners can share their experiences and to generate new meanings. It was also found that a suitable pedagogy had to be instituted for the technology to be effective. The key is that the learner takes an active part in the learning process utilising the technology.

Vygotsky's Socio-Cultural theory states that learning is a social and cultural experience (Roblyer, 2004). Barfurth (1995, p.2) stated that Vygotsky's theory is based on the concept "social interaction is at the core of the developmental process and children's learning. Individual cognitive development is a process related to transforming socially regulated and mediated knowledge". The second key aspect of Vygotsky's theory is the Zone of Proximal Development which is the "distance between the actual development, as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, cited in Brown, 1995). Teachers can provide scaffolding to enable the child/novice to bridge the zone into the adult/expert level of cognitive functioning (Roblyer, 2004). In the

context of this research the teacher can use ICT to help bridge the zone. The Social-Cultural theory places emphasis on the students' culture where the student learns what to think and how to think. Language is very important along with guidance from the

Knowledge Instruction (Teacher-centred)	Knowledge Construction (Student-centred)
Facts	Concepts/Understanding
Teacher-talk	Student involvement in learning
Individualistic	Group Work
Quantity	Quality
Tests	Portfolio
ICT drill and practice	Constructivist

teacher leading to independent problem solving by the child.

Table 2.1 Comparison of teacher/student-centred pedagogy

Interaction is important, between the student and peers, between student and teacher and within the classroom environment. This theory also places much emphasis on group work and collaboration. This is where the digital classrooms become complex with a mixture of group and individual work using technology. The teacher is the key factor when examining classroom dynamics.

Knowledge Instruction	Knowledge Construction	
	Teacher-centred (didactic)	Learner-centred (interactive)
Classroom activity	Fact teller (always expert)	Collaborator (sometimes learner)
Teacher role	Listener (always learner)	Collaborator (sometimes expert)
Student role	Facts (memorization)	Relationships (inquiry & invention)
Instructional emphasis	Accumulation of facts	Transformation of facts
Concept of knowledge	Quantity	Quality of understanding
Demonstration of success	Norm-referenced (multiple choice items)	Criterion referenced (portfolios/performance)
Assessment	Drill and practice	Communication (Collaboration, information access, expression)
Technology use		

Table 2.2 Classroom environments. (Gibson, 2001)

This table clearly shows the different roles in a teacher-centred (directed instruction) classroom and a learner-centred (constructivist) classroom. The role of the teacher in a

directed instruction classroom is that of an expert while the student has a passive role of a listener. The main use of technology is through the drill-and-practice software where the computer takes the role of a tutor. This leads to low-level learning of facts often with little understanding. The learning is individualistic with no interaction with peers. In a constructivist classroom the teacher takes on a facilitator's role and the student takes a more active role in the learning process. The use of technology is more learner-centred where the technology is used for collaborating, retrieving information and expression. This leads to a higher level of cognition where the learner builds on previous knowledge and has a deeper understanding/ownership of the concepts. Group work for collaborative learning is also a feature of constructivist classrooms.

The learning theories of behaviourism and the information processing when used with ICT lead to low-level thinking in isolation and are not relevant to learning in today's world. For certain concepts they are relevant such as learning basic facts in maths. However in a digital classroom environment they should not dominate as they do not lead to effective problem solving and learning how to learn.

The constructivist-based theories are well suited for use in a digital classroom environment. It has been shown that the teacher's use of pedagogy is vital in determining the effectiveness of constructivist-based learning in a digital classroom. Constructivism leads to the development of a problem solving environment utilising ICT. A rich learning culture is present in the classroom. Collaborative learning is encouraged where students use ICT to explore and discover ideas and concepts. The learning is authentic and learner-centred.

2.4 Chapter Summary

- Research both supports and rejects the idea that ICT supports learning in schools.
- The digital classroom concept in New Zealand is unique.
- Tentative definition of the digital classroom has been formulated.
- No New Zealand research on digital classrooms has been located.
- The method of research into ICT and education is largely qualitative.

- There is no conclusive evidence to support learning attributable to ICT.
- Research into the effectiveness of ICT is difficult because of the rapid development of new ICT applications.
- More research is needed in New Zealand on the link between ICT and learning.
- The digital classroom concept in New Zealand is at an early development stage.
- The two main learning theories are directed instruction/cognition and constructivism
- There is a mismatch between today's digital learners and traditional classroom pedagogy.
- ICT can enrich a constructivist learning environment.
- The teacher plays a key role in the appropriate use of ICT in a constructivist-based classroom.
- The new emerging theory of connectivism offers an explanation into the way students learn with technology.

The following chapter contains an outline of the research design and methodology used in the research.

Chapter 3 Research Design and Methodology

3.1 Introduction

The main aim of this study is an investigation into the digital classroom model in primary and intermediate schools in New Zealand. The study is about the implementation of a new teaching model (digital classroom) that has been recently introduced to the New Zealand education system.

The purpose of the case study is to investigate the critical success factors for the implementation of the digital classroom. Six teachers were interviewed and the students in the six classrooms were surveyed. A collective case study approach Stake (1995, p. 4) was used. Stake cited in Creswell (2003, p.15) stated that, "Case studies, in which the researcher explores in depth a program, an event, an activity, a process or one or more individuals. The case(s) are bounded by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period of time". The thesis is a collection of individual case studies that has been researched in order to gain a fuller picture of the digital classroom model. The thesis is a qualitative study looking at a series of cases. In selecting the cases I chose the digital classrooms carefully to achieve balance and variety in the samples. Stake (1995) suggested that achieving balance and variety are important in selecting cases to research. "A case study can be viewed as an in-depth study of interactions of a single instance in a closed system" Opie (2004, p.74). The aim is to provide a picture of a real situation with real people within the digital classroom environment. A snapshot of each digital classroom was taken and analysed using the case study method. The case study method is the best method for understanding a problem in order to improve practice (Merriam, Mott & Lee, 1998).

"The qualitative researcher emphasises episodes of nuance, the sequentially of happenings in the context, the wholeness of the individual" Stake (1995, p.xii).

3.2 The Research Paradigm

There are three main research paradigms for research, each of which could be used as a basis for digital classroom research.

Normative	Interpretive	Critical
Society and the social system	The Individual	Societies, groups and individuals
Medium/large-scale research	Small-scale research	Small-scale research
Impersonal, anonymous forces regulating behaviour	Human actions continuously recreating social life	Political, ideological factors, power and interests shaping behaviour
Model of natural sciences	Non-statistical	Ideology critique and action research
'Objectivity'	'Subjectivity'	Collectivity
Research conducted from the outside	Personal involvement of the researcher	Participant researchers and facilitators
Generalising from the specific	Interpreting the specific	Critiquing the specific
Explaining behaviour/seeking causes Assuming taken for granted	Understanding actions/meanings rather than causes	Understanding, interrogating, critiquing, transforming actions and interests
Macro-concepts:society, institutions, norms, positions, roles, expectations	Micro-concepts: individual perspective, personal constructs, negotiated meanings, definitions of situations	Macro and micro concepts: political and ideological interests, operations of power
Structuralists	Phenomenologists, symbolic interactionists, ethnomethodologists	Critical theorists, action researchers, practitioner researchers
Technical interest	Practical interest	Emancipatory interest

Table 3.1: Differing approaches to the study of behaviour (after Cohen, L., Manion, L., & Morrison, K. 2000, p. 35)

This table illustrates the three paradigms of the study of behaviour. The research is strongly interpretivist for the following reasons:

“The central endeavour in the context of the interpretive paradigm is to understand the subjective world of the human experience. To retain the integrity of the phenomena being investigated, efforts are made to get inside the person and to understand from within” (Cohen, Manion, & Morrison. 2000, p. 22). In this study the researcher starts

out with the teachers and students then set out to interpret their perceptions of a digital classroom. The theory will emerge from the research. A digital classroom model will be formulated that fits in with the data I have gathered on digital classrooms.

My research is small-scale and is focused on individuals (teachers) and groups (students) in our society. I was concerned with investigating human actions which are in a constant state of change. Because my data gathering was mainly through interviews and open-ended questionnaires my analysis has to be mainly non-statistical.

My approach is very constructivist in that I have interpreted the meaning of the digital classroom through the teachers and students. Crotty, (1998 cited in Creswell, 2003, p.9) identified several assumptions:

1. “As human beings interpret the world they construct their own meanings. Open-ended questions are used by qualitative researchers to allow participants to express themselves freely.
2. When human beings engage with their world they use their historical and social perspective for interpretation. Culture is an important influence in the interpretation process. Qualitative researchers need to have an understanding of the setting/context of the participants. This is done by visiting the setting personally. The interpretation is influenced by the researcher’s experiences and background.
3. Meaning is always generated in a social context. In qualitative research the meaning is generated from the data collected in the field.”

From examining these three points made by Crotty (1998, cited in Creswell 2003) it is clear that the digital classroom research is within the interpretive paradigm. The research has focused on examining the meanings constructed by the digital classroom teachers and students as they respond to the open-ended questions in the interview and surveys. I have also investigated the digital classroom in the context of the New Zealand educational system. Because a digital classroom is a rich vibrant community of learners I have been interested in generating meaning from the interaction with teachers and students.

In the digital classroom research the researcher has taken a subjective stance. “Here knowledge is regarded as belonging to the individual as a result of his or her own consciousness and thoughts.” Opie (2004, p.7)

The researcher has been involved in delivering professional development to teachers in the use of ICT in education. Although the researcher has no contact with the schools surveyed, the researcher does work in the field of ICT education and it could be said that the researcher has some personal involvement in the specific field. Also the majority of the schools were located through contact with the researcher’s students.

Through the analysis of the interview data and questionnaires, the interpretation enables meaning to be gained from the specific instances. This results in an understanding of the actions rather than identifying the causes of the behaviour.

In the study the researcher was concerned with personal constructs, negotiated meanings and a definition of the digital classroom concept, all strong factors in the interpretive paradigm.

The results of my research will be of practical value to educationalists interested in the classroom concept. The critical success factors have been outlined and their reasons for contributing to a successful digital classroom is explained. The case study fits in well with the interpretive paradigm. However, it can be placed along a continuum and has elements of the normative and critical paradigm as well.

It could therefore be classified as being located within the interpretive and subjective paradigm of social science, fitting into the qualitative approach.

3.3 Case Study Background

In planning the case study I have used the following issues for guidance:

1. The particular circumstances of the case	a. The possible disruption to individual participants	By telephone contact before interview to explain study
		Organising interviews in lunchtime or negotiating release time for teachers
		Giving a maximum time period for the interview
	b. Negotiating access to participants	Working through the principal
	c. Negotiating ownership of the data	Copy of completed thesis will be presented to the school
	d. Negotiating release of data	Giving an approximate time when thesis will be completed
2. The conduct of the study	a. The use of primary and secondary sources	Interview of teachers and questionnaires for students
	b. Opportunities to check data	Not completed as transcripts not shared with teachers
		Teachers checked student questionnaires
		Interviews transcribed and re-checked
	c. Triangulation	Achieved by surveying teachers and students and comparing results
	d. Data collection methods	Used open-ended interviews and open ended questionnaires
		Following correct interview practice
e. Data interpretation and analysis	Analysis of interview transcripts and questionnaires	
	Coding used to interpret interview transcripts and questionnaires	
Writing of the report	Separate conclusions from evidence	
	Balanced illustration with analysis and generalisation	
3. Consequences of research for participants	a. Anonymizing of the research participants	Coding used for names
	b. Anonymizing the schools	Coding used for schools

Table 3.2: Case study guidance

Source: Cohen, L., Manion, L., & Morrison, K. 2000 p.189

Teacher	Profile	School Description
Teacher One	Male 20-25 years Year 7/8 class	School One State Intermediate School Provincial City Roll 600+ Decile 3 CoEd
Teacher Two	Male 20-25 years Year 7/8 class	School One State Intermediate School Provincial City Roll 600+ Decile 3 CoEd
Teacher Three	Female 20-25 years Year 4 class	School Two State Primary School Large City Roll 700+ Decile 9 CoEd
Teacher Four	Male 20-25 years Year 4 class	School Two State Primary School Large City Roll 700+ Decile 9 CoEd
Teacher Five	Female 25-30 years Year 8 class	School Three State Intermediate School Provincial City Roll 400+ Decile 4 CoEd
Teacher Six	Female 20-25 years Year 5 class	School Four State Primary School Large City Roll 300+ Decile 9 CoEd

Table 3.3 School and teacher background

From Table 3.3 it can be seen that all the teachers are relatively young in the 20-30 years of age group. A balance of gender has been achieved in the sample. The schools surveyed are all state schools: two primary and two intermediate. The schools are all large schools with rolls ranging from 300-700 students. The decile rating varies from three to nine, though I did not take this into consideration with this research. The schools all come from a large provincial city or a major city.

3.4 Interview methodology

“The research interview has been defined as a two-person conversation initiated by the interviewer for the specific purpose of obtaining research-relevant information, and focused by him on content specified by research objectives of systematic description, prediction, or explanation” (Cannell, C. F., & Kahn, R. L. (Eds.). 1968, p. 526). The primary purpose of the interviews was to source information to answer the research questions.

“Interviews should encourage respondents to develop their own ideas, feelings, insights, expectations or attitudes and in doing so doing ‘allowing respondents to say what they think and to do so with greater richness and spontaneity” Oppenheim, A., (1992, p. 81). For this reason the researcher used a semi-structured interview using ten open-ended research questions. The interview style was flexible and if appropriate was followed up by asking questions to further probe an interesting point. Opie (2004) suggests that some interviewer bias can creep in using the probe questions. This was countered by making sure I always came back to the research questions.

3.5 Questionnaire methodology

Wilson and McLean, 1994, cited in Cohen et al. (2000, p.245) have stated that, “the questionnaire is a widely used and useful instrument for collecting survey information, providing structured, often numerical data, being able to be administered without the presence of the researcher and often being comparatively straightforward to analyse”. I chose the questionnaire method to gather data from the students because I was able to survey all the children at once, they were able to retain their anonymity (students did not write their name on the questionnaires but were given a number by the teachers), open-ended questions were asked with room for the students to write down their thoughts. The teachers all agreed to supervise the administration of the questionnaires and all but one classroom completed the questionnaires and mailed them to the researcher. All of the students in the class did not complete the questionnaires due to absences from school or the students being in other parts of the school during the questionnaire time. Except in the case of Teacher Two the majority of the students in the digital classrooms completed the questionnaire.

Cohen et al. (2000, p. 247) state that, “if a site specific case study is required, then qualitative, less structured, word-based and open-ended questionnaires may be more appropriate as they can capture the specificity of the particular situation.” The questionnaire design has followed these lines; the students are asked an open-ended question such as: What is a digital classroom? A space is then provided for the student to write an answer. The questions are written in a way so the students can easily understand and answer. Cohen et al. (2000, p. 255) note that the open-ended questionnaire “puts the responsibility for and ownership of the data much more firmly into the respondents’ hands”.

A limiting factor is the ability of the students to express themselves in written language. The students were asked to write the answers to the questions in the text boxes below the question. To process the questionnaire data a coding process was used. Cohen et al. (2000, p. 265) stated that “the primary task of data reduction is coding, that is assigning a code number to each answer to a survey question”. Each response was analysed and recorded into an Excel spreadsheet. In this way a class profile was produced which illustrated how the students responded to the open-ended questions.

An important role of the questionnaire was triangulation of the data. Cohen et al. (2000, p.112) had defined triangulation as “the use of two or more methods of data collection in the study of some aspect of human behaviour”. The questionnaire was important in matching the teacher’s perceptions of the critical success factors in the implementation of a digital classroom with the students’ perceptions. Campbell and Fiske (1959) cited in Cohen et al. (2000, p.112) stated that “triangulation is a powerful way of demonstrating concurrent validity, particularly in qualitative research”.

3.6 Sample Selection

The selection of the four schools and six teachers was achieved by mostly contacts within the Graduate Diploma of Information Technology in Education (GDITE) students at the Waikato Institute of Technology (Wintec). Students became aware of the digital classroom research through a posting that the researcher placed on the nzcomped listserv. School One was selected as it featured in a local newspaper article

on digital classrooms. The school was contacted and a meeting was arranged to explain the research.

School Two was selected as the author became aware of the school through the nzcomped posting and a personal email reply. School Two is a very large primary school located in a large urban area. School Three was recommended by a current student in the GDITE course. School Three is an intermediate school located in a provincial city. School Four was also recommended by a GDITE student, who had attended a professional development seminar taken by the digital classroom teacher.

When contacting each school I tried to get a balance of male and female teachers, of the six participant teachers, three are male and three are female.

3.7 Research Approach

Nisbet and Watt (1984, cited in Cohen, Manion & Morrison, 2000, p. 181) stated that, “a case study is a specific instance that is frequently designed to illustrate a more general principle”. Cohen et al. (2000) discussed that an instance is a bounded system, giving examples such as a class or school. The case study provides a unique example of real people in real situations enabling the readers to understand the ideas. Using this reasoning a case study was the general research approach that the researcher has used for the research on digital classrooms. The case study has been further refined in the following paragraphs.

Overall this is a qualitative case study looking at a series of cases. A snapshot has been taken of a collection of different cases.

This is a collective case study, which investigated the digital classroom model in primary and intermediate schools in New Zealand. The researcher is not aware of any digital classroom models operating in the high school area. The purpose of the study was to investigate the critical success factors for the implementation of a digital classroom in New Zealand. Six classrooms in four schools were investigated and compared. Interviews were carried out with six teachers and the students in all six classrooms were surveyed with a questionnaire. A collective case study methodology was used from which a profile of each classroom was developed. The results of the

research outlined the success factors in the digital classroom model and provide a definition of the digital classroom.

Digital Classroom

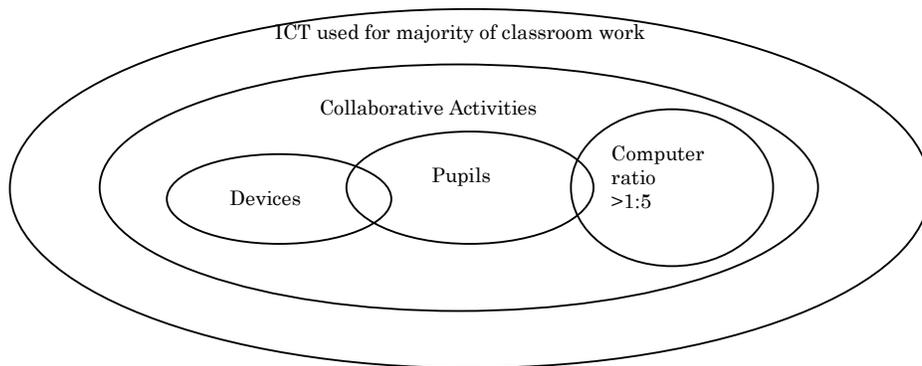


Figure 3.1 Model of tentative definition of a digital classroom

The process of finding evidence to support the research questions was mostly by a one-to-one interview with the digital classroom teachers. For the resource question a short form was given to the teachers to complete to save time in the interview. A form was also given to the teachers to summarise the professional development relevant to ICT completed in the last 12 months.

The initial likely success factors was identified as: resources, professional development of teachers, classroom organisation, classroom pedagogy, funding and support and attitudes of the stakeholders. During the course of the research new critical success factors were sought. These factors were explored in detail by interviewing the teachers in the case study schools. Both the positive and negative factors in a digital classroom were investigated.

The main focus during the research is on the teacher in the digital classroom, investigating the critical success factors that relate to the teacher's role in the classroom. The students were surveyed briefly to investigate their perceptions about the effect the digital classroom has on their motivation and learning. This aided in the triangulation of the results.

3.8 Research Questions

A collective case study approach was used. “The cases are bounded by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period of time”, Stake (1995, p. 149). The individual teachers were interviewed and for triangulation purposes the students in each digital classroom will also be surveyed. Protocols were used to cross-check the results of the research (Stake, 1995). Each student was given a short questionnaire to complete to see if their views on a digital classroom match up with their teacher’s.

The epistemology used is from the subjectivism paradigm. An interpretive approach was used in the case study research. Creswell (2003, p. 8) noted that “assumptions identified in these works hold that individuals seek understanding of the world in which they live and work”. My main aim was to get an understanding of digital classroom through the views of the teachers and students. From this information I have developed a model of how digital classrooms operate. I have acknowledged as an ex-teacher involved in ICT in schools and from my position as a facilitator working with ICT and teachers this may have influenced the way I interpreted the results of my investigation.

Creswell (2003, p. 181) also states that “Qualitative research is emergent rather than tightly prefigured. Several aspects may emerge during a qualitative study.” While my study was guided by the central question and sub-questions, I have made allowances for fresh issues arising from the data collection stage.

According to Creswell (2003, p. 105): “In qualitative study inquirers state research questions, not objectives or hypothesis”. These research questions assume two forms: a central question and associated sub questions.”

Central question:

What are the critical success factors in the implementation of a digital classroom in New Zealand?

Research question	Evidence needed	Research Strategy
What is a digital classroom?	A definition from the teacher of a digital classroom.	An interview on a one-to-one basis with the digital classroom teacher.
What resources are needed for a digital classroom?	List of the ICT equipment present in the digital classroom.	Form for teachers to fill out to record the amount and type of ICT equipment present in their classroom.
What professional development in ICT is provided for teachers in a digital classroom?	A list of appropriate professional development that the teachers have undertaken in the last two years.	Teachers record on form the professional development that they have had in the last two years. This is to be completed after the interview.
How is the digital classroom organised? (seating, grouping, daily activities etc..)	An outline of how the digital classroom is organised and what the students do during a typical day.	An interview on a one-to-one basis with the digital classroom teacher.
What changes in teaching style (pedagogy) are needed in a digital classroom?	An outline of teaching strategies used in the digital classroom and how this differs from the traditional approach.	An interview on a one-to-one basis with the digital classroom teacher
What funding and support are provided in a digital classroom?	Information provided as to where the funding for the digital classroom comes from and what support the teacher receives.	An interview on a one-to-one basis with the digital classroom teacher
What are the teachers' perceptions of the attitudes of the major stakeholders in a digital classroom?	Information provided as to the perceived opinions of the major stakeholders.	An interview on a one-to-one basis with the digital classroom teacher
What are the positive aspects of a digital classroom environment regarding learning?	An outline of what the teacher considers is the positive aspects of teaching in a digital classroom.	An interview on a one-to-one basis with a digital classroom teacher.
What are the negative aspects of a digital classroom environment regarding learning?	An outline of what the teacher considers are the negative aspects of teaching in a digital classroom	An interview on a one-to-one basis with a digital classroom teacher.
What do you think can be improved upon in your digital classroom?	An outline of what the teacher considers are the changes that need to occur.	An interview on a one-to-one basis with a digital classroom teacher.

Table 3.4 Sub questions: teacher

Research question	Evidence needed	Research strategy
What is a digital classroom?	A definition from the student perspective of a digital classroom.	A survey question with enough space for the student to write an answer.
What I like most about the digital classroom is...	A written answer about what the students like about digital classrooms.	An open-ended question using a short written survey
Do you feel that the digital classroom improves your learning? Why or why not?	A written answer about how the digital classroom improves or does not improve their learning.	An open-ended question using a short written survey.
What I don't like about digital classroom is...	A written answer giving some of the perceived negative aspects of a digital classroom.	An open-ended question using a short written survey
I think digital classrooms could be improved by...	Some feedback to how a digital classroom could be improved.	An open-ended question using a short written survey

Table 3.5 Sub questions: students

Peshkin (cited in Campbell, 1997, p.122) “summarises the range of outcomes emanating from four basic categories of analysis in qualitative research studies: description, interpretation, verification and evaluation”. For the digital classroom research the analysis will be largely interpretative. There will also be an element of description in my analysis. From the analysis and interpretation of my data my goal has been to formulate an evaluative framework by which to interpret the results of the research.

Creswell (2003) further stated that because qualitative research is interpretive it is difficult to eliminate any personal interpretation. Creswell stated that reflection is an important characteristic of qualitative research, it is important that the researcher reflects on his/her role in the research process.

3.9 Data Analysis

The Data Analysis and Interpretation will follow the procedure outlined by Creswell (2003, p.191).

Step 1: Prepare the data for analysis (transcribing interview, collating survey results).

Step 2: Read through the data. Notes/comments jotted on sheets.

Step 3: Detailed analysis with a coding process.

Step 4: Use the coding process to generate a description of the setting or people as well as categories or themes for analysis.

Step 5: Advance how the description and themes will be represented in the qualitative narrative.

Step 6: Making an interpretation of the data.

3.10 Teacher interviews

The teacher interviews were transcribed and read through thoroughly by the interviewer. Through transcribing the interviews myself I gained an excellent understanding to the interview content. I was also able to listen to the interviews picking up differences in tone, intonation etc.

The transcripts were then coded, analysed and the results were recorded in the results chapter. Similarities and differences were outlined between the teacher's responses and the responses to some research questions were summarised into diagrams which outline the relationships in chapter 5.

3.11 Ethics approval

A research proposal was completed and submitted to the sub-committee of the Board of Postgraduate Studies at Unitec. For each teacher a consent form was viewed and signed by each teacher. A consent form was also given to all the teachers for the parents of the students in the digital classroom to sign.

An information sheet was given to each teacher participant outlining the aims of the research, researcher information and contact details. A brief outline was given of the interview process and time needed. The participant was given the option of withdrawing from the research process up to the final draft stage. A confidentiality clause was also included.

Permission for the student's participation in the research process was obtained from the parents or the teacher who is acting in the loco parentis. The student's contribution was anonymous and voluntary. Students were given a number which they recorded onto the questionnaire sheet.

In all schools the principal was contacted by telephone and verbal permission was obtained before written consent was obtained from the teachers.

3.12 Data gathering

Each school was contacted by phone and an appointment made with the principal. All the principals were very supportive of the research and consented to their teachers being interviewed. Interviews were arranged with the teachers of the digital classrooms in the middle of term two, 2004. At the same time a survey was administered to the students in the digital classrooms. The results will be reported back to the schools at the conclusion of the thesis.

The interviews followed (Creswell, 2003, p. 188) where, "interviews involve unstructured and generally open-ended questions that are few in number and intended to elicit views and opinions from the participants". During each school visit the researcher observed the layout of each digital classroom. Most interviews were conducted either during release time or during lunchtimes. The interviews were all conducted in the schools which meant that the teachers were more likely to feel at ease and relaxed.

Each teacher was interviewed separately and a tape recording was made of each interview. The tape was then transcribed by the researcher. At the conclusion of each interview the teachers were given the student survey to be completed by the students. The survey when completed was posted back to the researcher. All the student surveys were completed except Teacher Two who was moving to another teaching position shortly after the interview.

3.13 Validity

Validity is important to effective research.

According to (Creswell, 2003, p. 195), validity, “is seen as strength of qualitative research, but is used to suggest determining whether findings are accurate from the standpoint of the researcher, the participant or the readers of an account.” During my research I have used a number of methods to ensure validity in my research.

- Triangulation, here I have surveyed both the teachers and the students in order to examine the evidence from different sources and using it to build a coherent picture of a digital classroom.
- I have used a “rich, thick description” Creswell (2003, p. 196) to convey the findings. This will allow the readers to understand fully the setting and an appreciation of shared experiences.
- I have identified the bias that the researcher brings to the study. “This self-reflection creates an open and honest narrative that will resonate well with the readers.” Creswell (2003, p. 196)
- I have presented, “negative or discrepant information that runs counter to the themes.” Creswell (2003, p. 196)
- I have used a representative sample, six teachers from four different schools.
- I have achieved a gender balance in the participating teachers.
- The interviews have been taped and transcribed by the researcher.
- All the data has been analysed consistently.
- Worked closely with the thesis supervisor regarding interpretation of the data.

3.14 Limitations

One of the limitations is the length of time it has taken to process the interview and questionnaire data and write up the discussions. This is because the researcher has worked full-time during the thesis process. This means the data becomes dated as the interviews were a snapshot in time and the digital classroom concept is constantly changing and evolving.

The sample is a small sample compared to the total number of digital classrooms in New Zealand schools. However, using the interview data-gathering technique, it is not possible to interview a large number of teachers. The positive side is that a representative sample of digital classrooms have been investigated and analysed in-depth.

As illustrated in the literature review the concept of the digital classrooms is relatively new to New Zealand schools and there is a lack of research into this area. This means the researcher has limited access to a wide number of studies to compare the results and discussion against. However, there are a large number of studies looking at the areas the research questions investigated.

3.15 Chapter summary

This chapter has provided a description of the case study methodology and the rationale for its adoption. A collective case study approach has been used enabling a comparison between cases leading to an understanding of the digital classroom model from which recommendations can be made to improve teaching practice in the future. The qualitative approach has been used which fits into the interpretive paradigm where the research is subjective, and has looked at understanding actions and meanings rather than causes. The background of the case study was set in the New Zealand educational setting. The rationale behind the data-gathering techniques of the interview and questionnaire fits into the qualitative approach. The justification for the research questions has been outlined and discussed. The validity and limitations of this research have been outlined.

The next chapter contains an analysis of the teacher transcripts.

Chapter 4 Data Set Analysis

4.1 Introduction

This chapter contains an analysis of the transcripts from the teacher interviews. Each teacher was interviewed using the same base set of questions. The questions are based around the sub-questions of my investigation.

1. Can you define a digital classroom?
2. What resources are needed for a digital classroom?
3. What professional development in ICT is provided in your school?
4. How is your digital classroom organized?
5. What changes have you undergone in your teaching style for a digital classroom?
6. What funding and support is provided for your digital classroom?
7. What is the perception of the major stakeholders for the digital classroom?
8. What are the positive aspects of a digital classroom?
9. What are the negative aspects of a digital classroom?
10. What improvements would you like to make to your digital classroom?

4.2 Interview data set analysis

Teacher	Transcript word count	Units of Teacher discourse (identifiable chunks of conversation)	Discourse style (there was considerable variation across the interviews)
1	4178	38	Very positive about the digital classroom. Very open about interview.
2	2918	38	Enjoys teaching in digital classroom, had issues about administration and reasons for the digital classroom.
3	2947	32	Assumed leadership role in school, very positive about digital classroom organization.
4	1361	22	New to school, unsure of himself, short answers to questions. Guarded.
5	5526	59	Very enthusiastic, totally committed to digital concept, very vocal. Very open.
6	5293	42	Nervous, but very committed to her digital classroom concept. Very vocal and explained things well

Table 4.1: Interview data analysis.

Units of Teacher Discourse are identifiable chunks of conversation. This is where the interviewee talks about a separate idea in the conversation. The researcher has gone through the interview transcript, identified and counted the separate units of teacher discourse. These have then been entered in the Units of Teacher discourse in Table 4.1. Overall the teachers were very passionate and enthusiastic about their digital classroom concept. Teacher Four was very new to his digital classroom and was less sure of the concept. There was considerable variation in discourse style due to differences in personalities, experience and confidence. The teachers were very positive about the digital classroom concept. Teacher Two had issues about the administration and support.

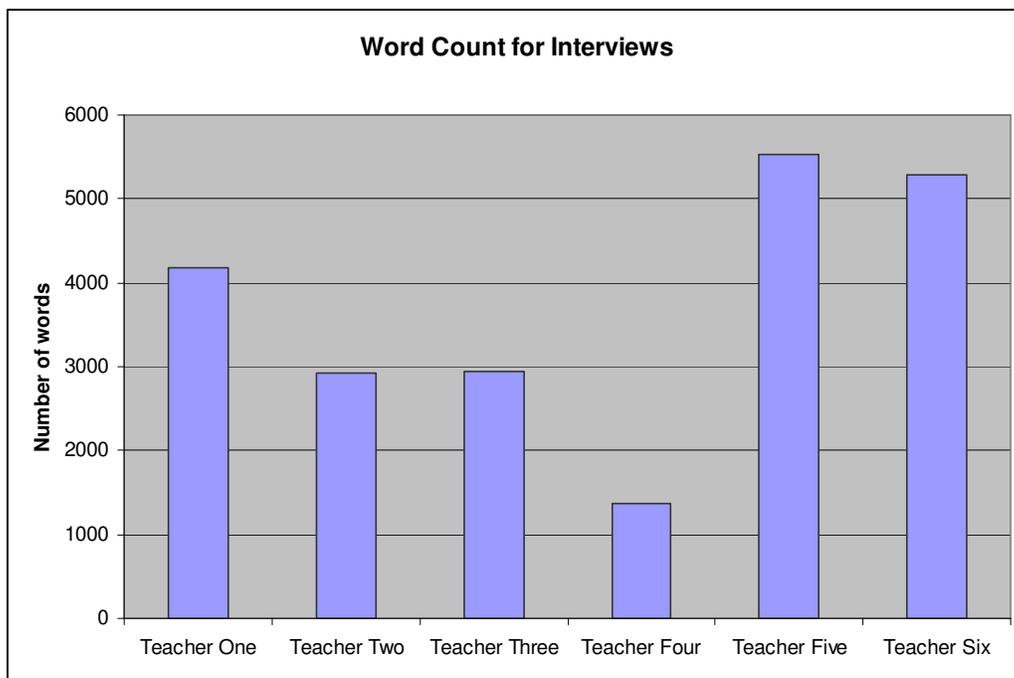


Figure 4.1: Interview word count

It can be clearly seen by the word count graph that Teachers Five and Six spoke the most words during the interviews. Their answers to the questions were detailed and related to the question. Both these teachers were instrumental in the set-up of the pilot digital classroom at their respective schools and were very enthusiastic. At the other extreme is Teacher Four who did not give full answers to the questions, a teacher who was new to the digital classroom concept. Teacher Four lacked confidence and experience with digital classrooms.

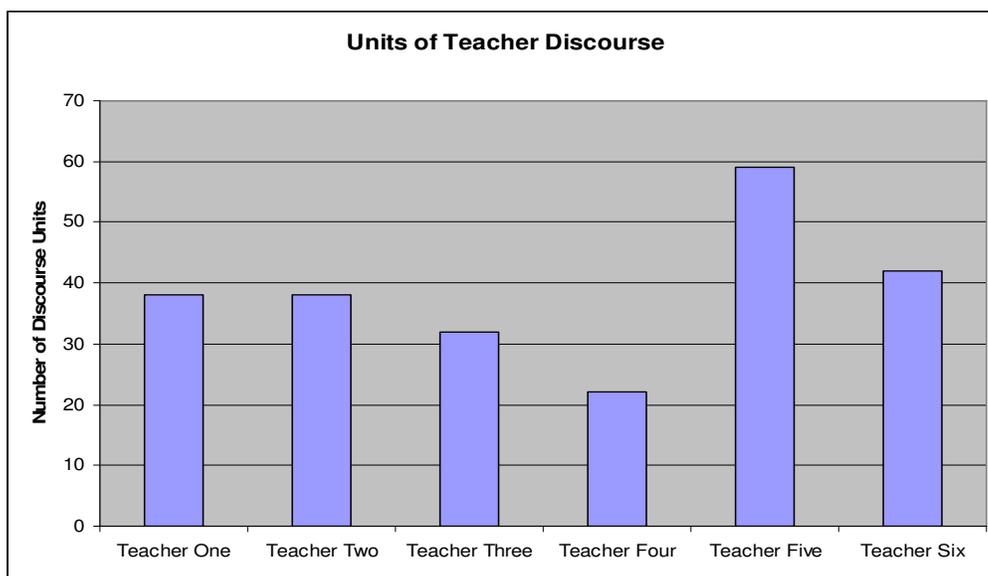


Figure 4.2: Units of teacher discourse during interviews.

This graph shows a similar pattern to Figure 4.1, p.52 with Teachers Five and Six having the largest number of individual chunks of ideas. These were when they were explaining how their digital classroom operated. Teacher Two also had a large number of discourse units; he talked about a large number of ideas but did not go into them in detail. Teacher Four did not contribute a large number of ideas.

There was a wide variation of interview styles as indicated in Table 4.1, p.52. Teacher Five exuded enthusiasm and passion for using the digital classroom model in her school. Teacher Five had also set up the digital classroom model from scratch, from the design and layout of the classroom, to the purchase and setup of the hardware/software and networking. Teacher Six had also had a major role in researching and setting up her digital classroom. She appeared to be constrained by the fact that she only had the students for one term; then they moved back into mainstream classrooms. Teachers One and Two appeared to have less freedom and were conforming to their school vision of a digital classroom. Teacher Three was very enthusiastic about her innovative class organisation where the students had some choice about organizing their day. Teacher Four was very unsure of his role, was new to the school and the digital classroom concept and gave short answers to the questions and had the most conservative classroom organisation.

Teacher One:

Teacher One was released from his classroom for the interview. The interview was carried out in the staffroom of the school. There were some teachers coming in and out of the staffroom during the interview. The teacher was very positive about the digital classroom concept and was reasonably relaxed in the interview. The questions were answered in detail. Teacher One was comfortable discussing his digital classroom and enjoyed sharing his information.

An example from the interview of Teacher One's enthusiasm.

What do you consider are the positive aspects of the digital classroom regarding learning?

Enhancing independence, enhancing students to become a lot more pro-active and taking a lot more responsibility for their own learning. Instant access to information which means learning becomes quicker there is not such a structured need for time and time management and as far as ok we need to have this done by Tuesday and then we can get it published in the IT suite.

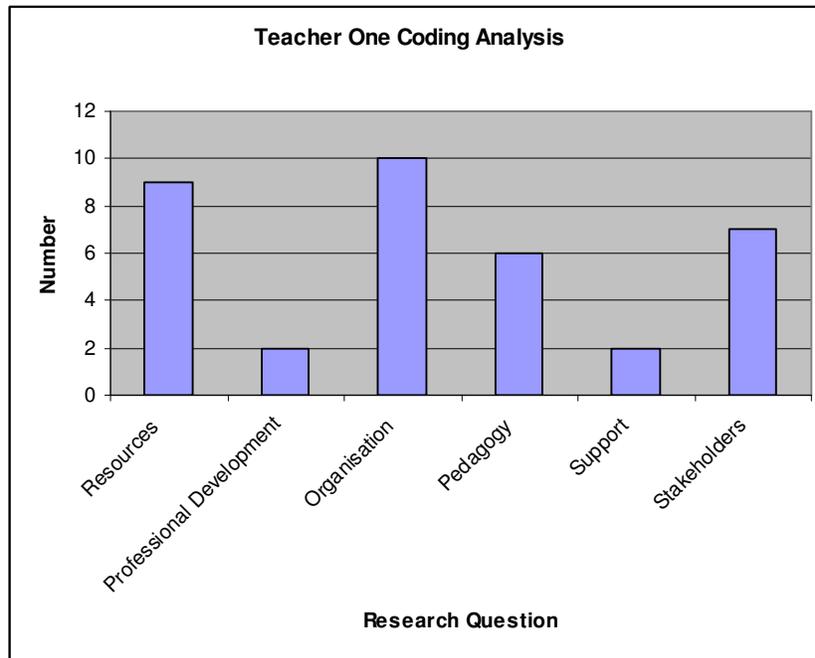


Figure 4.3: Teacher One coding analysis

This graph shows that Teacher One spoke a great deal about classroom organization and resources for a digital classroom. Teacher One was also concerned about meeting stakeholder expectations. The pedagogy in the teaching of a digital class was also discussed. Professional development and support were the least discussed in the interview.

Teacher Two:

Teacher Two indicated that he was about to leave the school at the end of the term and move into another age group to teach. The interview was carried out in the staffroom and there were some disturbances as students and teachers came into to prepare the staffroom for interval. Teacher Two indicated that he did have some issues with the digital classroom concept and that he lacked support in his classroom. He did enjoy talking about the teaching aspect of the digital classroom. However he indicated that he worked on his own and did not get support from others at the school.

Teacher Two thinks motivation is a large factor in a digital classroom, then questions whether it is the teacher or other factors.

What do you consider are the positive aspects of the digital classroom regarding learning?

But just the motivation of the kids, kids are real happy coming to school, my kids were happy before I had a digital classroom too, is it the classroom? Is it the teacher? Is it the way things have been going? Is it just different kids? For me being in that classroom, I can offer so much more to those kids, I feel like I can, something different perhaps.

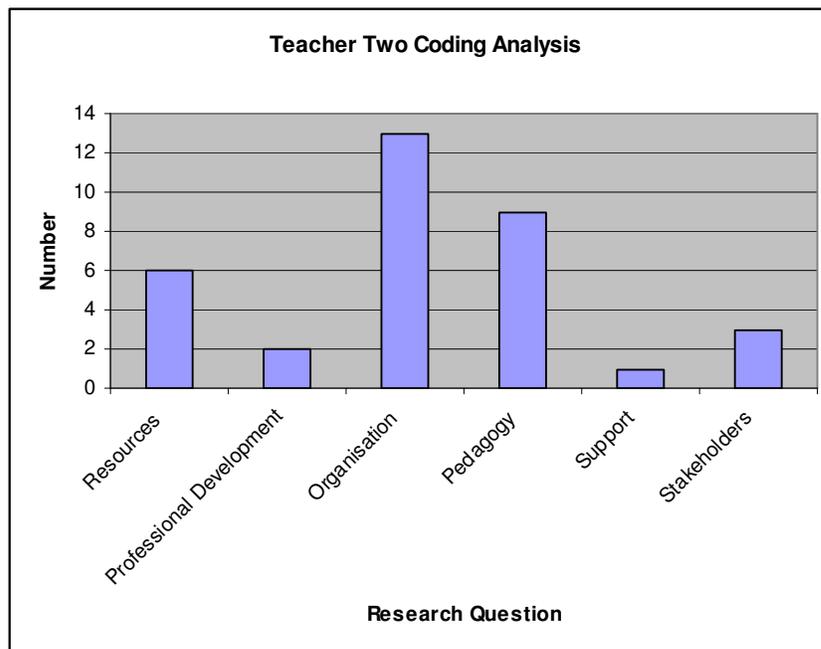


Figure 4.4: Teacher Two coding analysis

The Teacher Two profile shows that classroom organization and pedagogy were discussed and were high in Teacher Two’s reflections. The low counts for ‘professional development’, ‘support’ and ‘stakeholders’ reflects the lack of professional development opportunities and the lack of support that Teacher Two felt he was getting from the school. Resources were another area where Teacher Two felt he was lacking support.

Teacher Three:

Teacher Three was the syndicate leader of the Middle syndicate in the school. The interview was carried out in her classroom during the lunch hour. She was somewhat nervous during the interview. She was a syndicate leader in her school. She enjoyed speaking about the innovative way she had organized her classroom using the ICT environment. Teacher Three indicated that she was well supported within the school.

Teacher Three's students are motivated by the digital environment.

What are the positive aspects of the digital classroom?

I think it is very motivational because the things you are doing are really exciting sort of different opportunities than if you didn't have the computers, video cameras or whatever else. If children are motivated you don't have any of the behaviour problems it becomes an enjoyable, you don't have any problems like that.

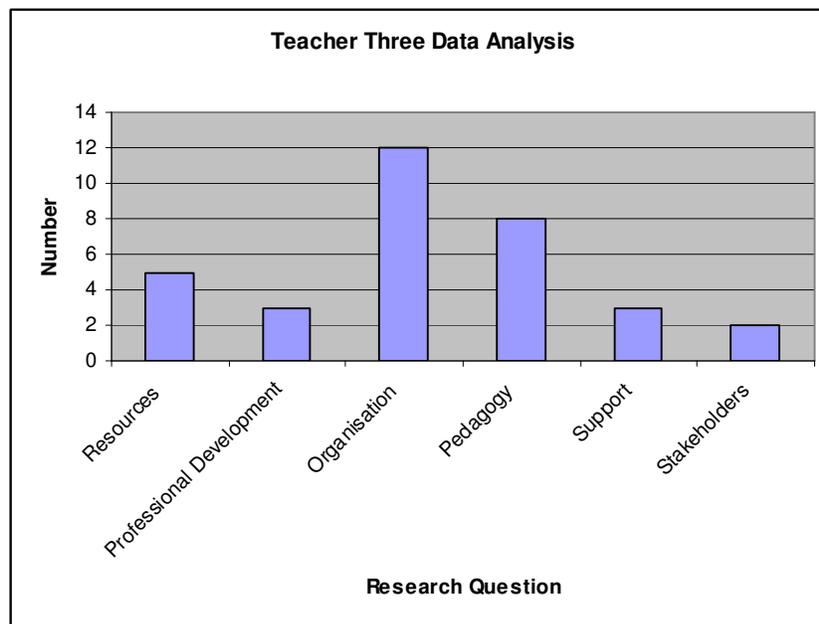


Figure 4.5: Teacher Three coding analysis

Teacher Three primarily discussed classroom organization and pedagogy change. Teacher Three was passionate about her innovative classroom organization where

students could organize their own timetable and was interested in the different pedagogy offered by the digital classroom. Resources were also discussed.

Teacher Four:

Teacher Four was new to the digital classroom concept and did not appear confident during interview. The interview was carried out in the classroom during the lunch hour. The teacher was relatively new to the school. He still seemed to be coming to grips with the concept. As a result his answers were very short and lacked detail. He was also English and was possibly still adapting to the New Zealand education system.

Teacher Four highlighted the presentation skills of his students as being a positive factor.

From this years experience in a digital classroom what are the positive experiences for you?

Nice to see the children present their work in a different way, using PowerPoint or Hyperstudio, it's nice to see their work not just on paper but on the computer as well. It also enables us to hone their presenting skills because that is a skill in itself.

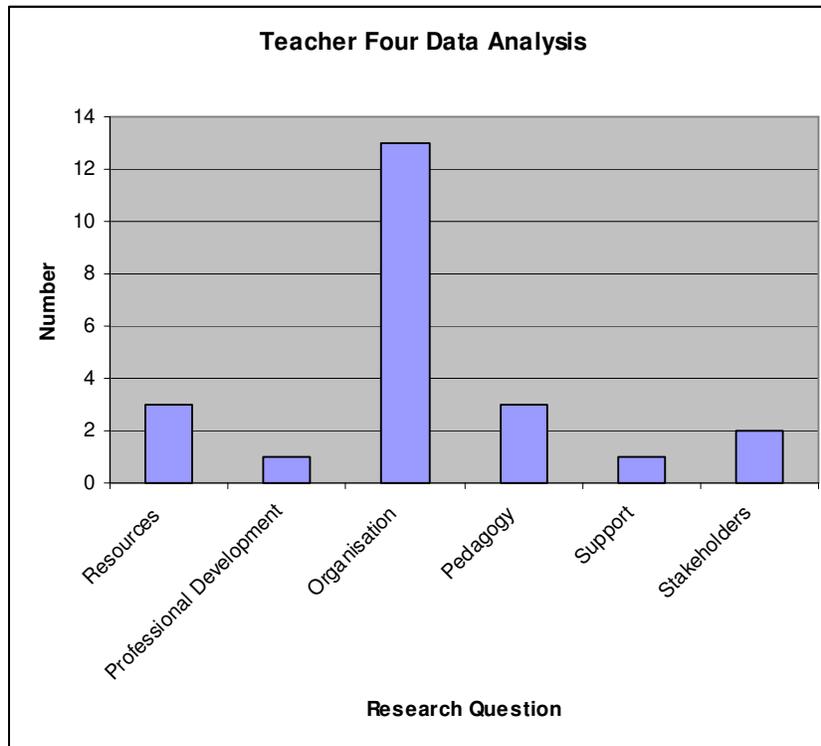


Figure 4.6: Teacher Four coding analysis

Teacher Four was very much focused on classroom organization. This reflects the short answers Teacher Four gave to the questions for the other research questions. Teacher Four was new to the digital classroom environment and lacked confidence to discuss the concepts in detail.

Teacher Five:

Teacher Five was very enthusiastic about the digital classroom concept. The interview was carried out in an interview during classroom release time. She was passionate about using ICT to enhance the learning of the students. All the questions were answered in detail. The interview was long with lots of interesting discourse.

Teacher Five highlighted the learning to learn aspect and the independence that is being developed in her students. Teacher Five was passionate about her digital classroom setup.

What do you think are the positive aspects of the digital classroom regarding learning? So what do you think the advantages are?

The fact that they learn to learn and they're motivated to learn and they can take it as far as they want to. Most students will get so involved in what they're doing that they will go two steps further than was where I expected them to go.

So, they're pushing themselves to their boundaries and even extending their boundaries because they're motivated to do it. But the fact that it's all there at their finger tips if their struggling with some idea they can just hop online and just go and solve that problem in 5 -10 minutes and then move on it's not frustrating for them. They find that they can do anything, find anything.

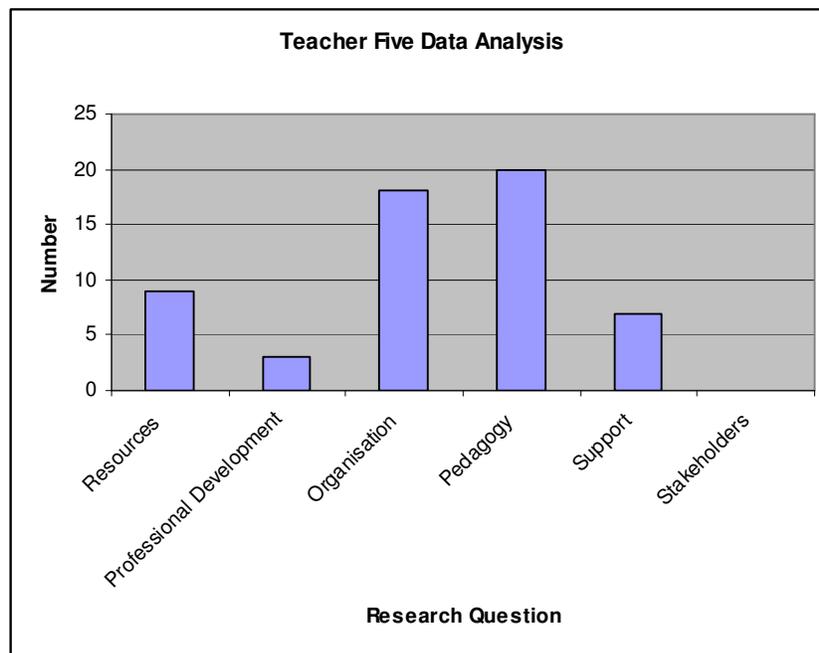


Figure 4.7: Teacher Five coding analysis

Teacher Five primarily discussed the changes of pedagogy involved in a digital classroom and the classroom organization. Teacher Five was passionate about the pedagogy and how she organized the classroom. Resources were also discussed. Professional development was not discussed in depth. The support and stakeholders categories were discussed together.

Teacher Six:

Teacher Six appeared to be nervous at the start of the interview and became more relaxed as the interview proceeded. Teacher Six gave full answers to all the questions. The interview was carried out in the classroom during the lunch hour so had to be terminated once the bell rang.

Teacher Six thought motivation was a positive of the digital classroom.

Looking at your classroom, what are the positive aspects of the digital classroom?

Motivational. The less able kids seem much more keen and interested and easier to motivate because they can do much more things on the computer than what they can do on pen and paper. Learning outcome wise I think the children are more interested and enthusiastic and more. Like we were doing the Olympics and someone was going home and finding more information about the Olympian they were studying that little bit of extra effort being put in outside of the classroom as well as in the classroom.

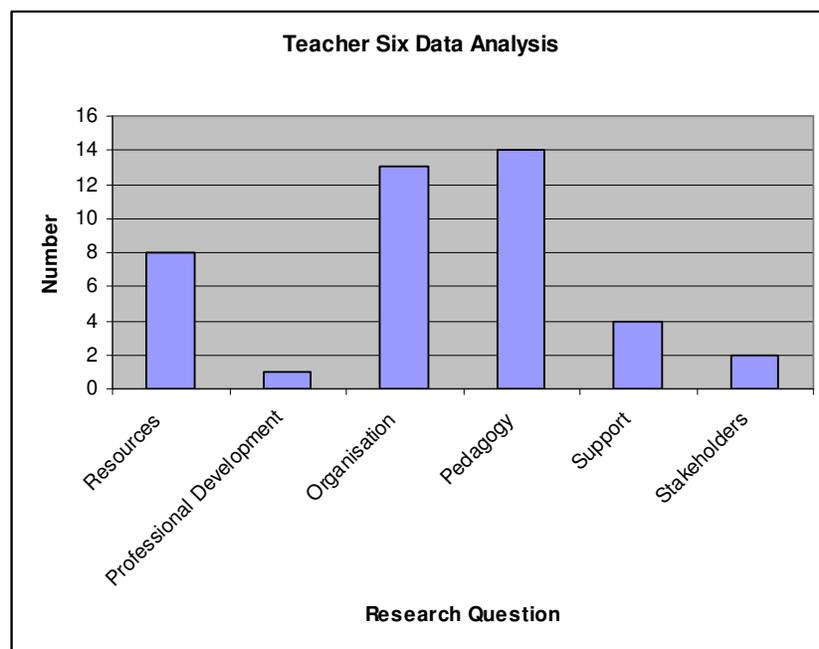


Figure 4.8: Teacher Six coding analysis

Teacher Six registered a high number of discourse units in the areas of resources, classroom organization and pedagogy. This reflects Teacher Six's role in setting up the digital classroom by gathering and organizing resources, organizing the classroom in her way and her reflection on the pedagogy involved. Professional development was not discussed widely.

Consideration	Interview	Questionnaire
Personal need to collect data	Requires interviewers	Time, can require a secretary
Major Expense	Payment to interviewers Travel expense	Postage and printing
Opportunities for response-keying (personalization)	Extensive	Limited
Opportunities for asking	Extensive	Limited
Opportunities for probing	Extensive	Difficult
Relative magnitude of data reduction	Great (because of coding)	Mainly limited to rostering
Typically the number of respondents who can be reached	Limited	Extensive
Rate of return	Good	Poor
Source of error	Interviewer, instrument, coding, sample	Limited to instrument and sample
Overall reliability	Quite limited	Fair
Emphasis on writing skill	Limited	Extensive

Table 4.2: Summary of merits of interview versus questionnaire. (Tuckman, 1972)

This table outlines clearly the merits of the interview and the questionnaire, in my data gathering I have used both, the interview for the teachers and the questionnaire for obtaining the students' views. All questionnaires were returned except Teacher Two's students as he was soon to leave the school.

4.3 Interview Protocol

1. Interviewee was identified and contacted.
2. The purpose of the interview was explained and a date/time arranged for the interview.
3. From the research questions a list of open ended questions was formulated.
4. A interview consent form was sent to the Interviewee.
5. The signed consent form was given to the Interviewer prior to the Interview.
6. Permission was asked to tape the interview.
7. The interview was started, the interviewer did not take notes during the interview. The interviewer tried to make all the teachers feel at ease by asking them to define a digital classroom at the start of the interview.
8. Interviewee was thanked at the conclusion of the interview.
9. Interview tapes were transcribed by the researcher.

I chose interviews over questionnaires because I wanted to get a rich description of a digital classroom. The interview also allows the researcher to follow interesting leads and gives the subject more freedom to express their views than a questionnaire which is often seen as a burden by teachers. Also the face-to-face contact is refreshing and the fact that I have taken the trouble to travel to the teacher's school for the interview shows some commitment on my part

The interview strategy was a mix between a structured interview and an in-depth interview. Stake (1995, p. 64) stated that "Much of what we cannot observe for ourselves has been or is being observed by others. Two principal uses of case study are to obtain the descriptions and interpretations of others. The case will not be seen the same by everyone". This is strong justification for using the interview to get the teacher's views of a digital classroom. The researcher also needs to get the interpretation from a variety of teachers. During the interviews I tried to keep a balance between asking the research questions and having the flexibility to follow up any interesting leads.

Interviews Five and Six tended to be more like an in-depth interview where the interviewee was passionate about the use of ICT in the classroom. Interview Four was

very structured and little deviation was made from the set questions. The other interviews, One, Two and Three tended to be a mixture of structured and in-depth interviews. During a structured interview there is little deviation from the interview questions whereas with an in-depth interview the interviewer pursues interesting leads.

Patton (Patton 1990, cited in Mahoney, 1997, p.6) put forward these reasons for using in-depth interviews:

- What does the program look and feel like to the participants? To other stakeholders?
- What are the experiences of the program participants?
- What do the stakeholders know about the project?
- What thoughts do stakeholders knowledgeable about the program have concerning program operations, processes and outcomes?
- What are the participant's and stakeholders expectations?
- What features of the project are most salient to the participants?
- What changes do participants perceive in themselves of their involvement in the project?

These interviews were to give an in-depth account of the digital classroom concept from the point of view from the teachers. The teachers were asked to share their experiences of the digital classroom model. The teachers were asked to share their experiences of the digital classroom setup, organization and pedagogy. The teachers were also asked to give an evaluation of the positive and negative aspects of the digital classroom. These all support Patton's reasons for using an in-depth interview. In most cases I deviated from the set questions to pursue an interesting lead in the interview process .

4.4 Transcribing

The interview conversation between the interviewer and the interviewee was transcribed word for word by the researcher. The transcriptions were listened to by the author and typed into the word processor. The questions and the responses were

analysed by carefully reading the teachers responses to the questions and coding the responses. I transcribed the data myself as I was able to listen carefully to the interviews and understand the tone and intonation of the interviewee. As I am a beginning researcher I transcribed all the conversations. The data was then written up in the results chapters.

4.5 Summary

This chapter has analysed the interview transcripts of all six teachers. It has outlined the reasoning behind using interviews over surveys. Each interview has been analysed and the differences between the interview styles has been explained. A coding analysis was carried out on each interview. The coding system was based around the sub-questions in the digital classroom investigation.

In analyzing the word count Teachers Five and Six were very vocal and passionate about the digital classroom concept. Teacher four was very unsure of himself and guarded in his comments. Teachers One, Two and Three were comfortable in their digital classroom role and happy to share their reflections.

The units of teacher discourse were very similar to the word-count pattern with Teachers Five and Six displaying the highest number of discourse units.

Each teacher's interview style was then discussed relevant to their transcript details. This showed a wide variation in interview styles which led to the marked differences in the transcripts.

The reasons for choosing interviews over questionnaires were discussed. The differences between the data-gathering methods were compared.

In the next chapter I will outline the results from the digital teacher interviews.

Chapter 5 Results Teachers

5.1 Introduction

The previous chapter covered an analysis of the teacher transcripts.

The results presented in this chapter comprise the findings from six interviews with teachers who work in a digital classroom environment.

The interview transcriptions were analysed and the relevant results are presented under sub-question headings. The results are presented with brief comments and, if appropriate, a diagram has been included to aid the understanding of the concept.

5.2 Definition of a digital classroom

When asked to give their definitions, five teachers (Teachers One, Two, Three, Four & Six) focused on the 'digital' concept and one teacher (Teacher Five) focused on the 'classroom' concept. The majority of the teachers defined the digital classroom by emphasizing the technology while Teacher Five emphasised the pedagogy change required.

The five teachers who focused on the 'digital' stated that the number of computers in the classroom was important, as was the ratio of computers to students, available access to ICT equipment and integrating the ICT equipment to enhance learning. All the teachers defined digital as not being just about computers, they mentioned printers, scanners, cameras and other ICT equipment.

The teachers saw the use of ICT as enhancing the curriculum, using ICT to achieve aims of the normal classroom programme. Teacher Four stated that integrating the use of computers into lessons was important. Teacher Six mentioned presentation of school work. Teachers Two and Three stated that the access to ICT equipment increased the opportunities available to students. Teachers One and Two felt there

needs to be a balance between bookwork and the use of computer work. Teachers Four and Six also stated that the digital classroom was self-contained.

Teacher Five said, *'It's about the pedagogy of teaching.'* This teacher stated that it is not about computers and that she had to change her teaching style so that the ICT would fit in with the classroom environment, using an inquiry approach to learning. She also mentioned that developing lifelong learners was important using inquiry and developing self-responsibility.

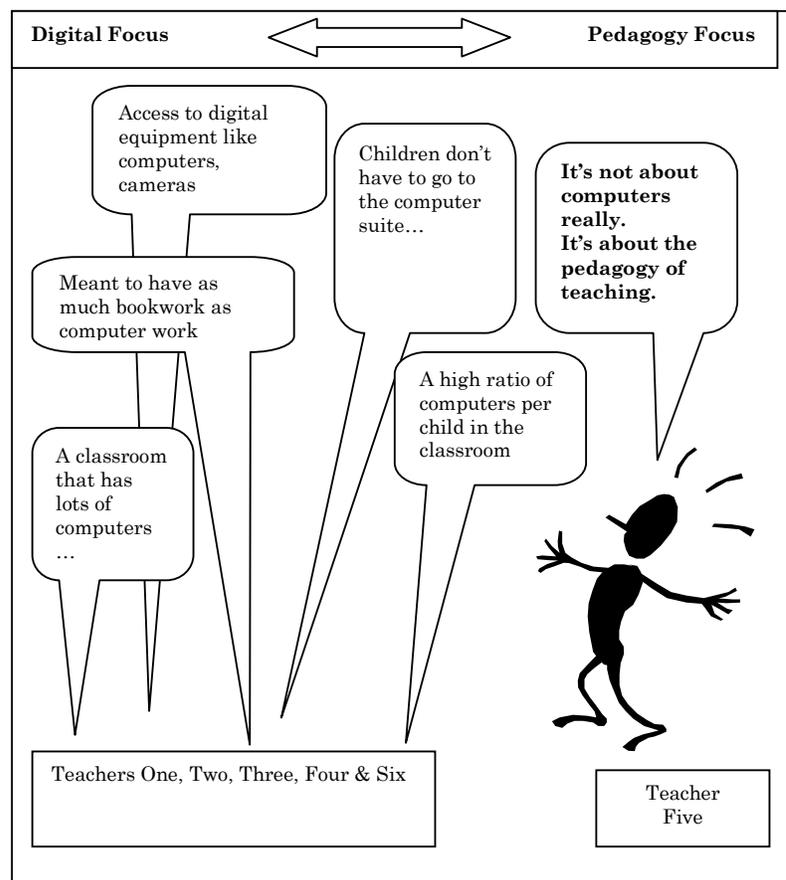


Figure 5.1 Teachers' definition of a digital classroom

Digital classroom definition: Summary of Teacher Comments		
	Definition	Purpose
Teacher One	Student access to digital equipment	To enhance learning
Teacher Two	Opportunity to use digital equipment	To extend students
Teacher Three	High ratio of computers to students, access to hardware	To enhance learning
Teacher Four	To use computers in classroom rather than go to suite.	Integrate ICT into lessons
Teacher Five	Its not about computers really, its about the pedagogy of teaching	Inquiry, life-long learners
Teacher Six	Lots of computers available for students to use	Presentation

Table 5.1: Summary of comments on the definition of digital classrooms

In conclusion, there seems to be no clear common definition of a digital classroom among the interviewed teachers. The majority were focused on hardware and access to computers to enhance learning. Teacher Five believed that the pedagogical change in teaching was important, having to change her style of teaching to use the ICT equipment more effectively using the inquiry process and the concept of developing life long learners.

5.3 Resources

While, all the classrooms had networked computers available to the students, the ratio varied. Scanners and printers were also present in all classrooms. All classrooms were equipped with broadband internet access.

The classrooms were all networked via an ethernet network and one had a wireless access point in the classroom for wireless-enabled laptops. The ethernet networks all had password access to individual accounts with a personal folder and access to public folders. Two teachers commented that they placed activities in shared folders for the students to access. The students choose either to save their work in their personal folder or a shared folder. One class had chosen to install cheaper basic computers as dumb terminals hooked up to a citrix network where a terminal server completes all the processing. For any multimedia work the class laptops are used. The class with the extra wireless access point in the classroom also installed an extra wireless access

point in the school library so the students can take their laptops to the library for internet research.

Two teachers from School One stated that if the network went down, then the class computer would also be unusable and this caused problems, the teacher had to think of alternative activities at the time. One teacher felt that the number of computers on the school network had grown at a fast rate and the existing network was struggling to cope. The network needed to be upgraded to cope with the extra computers. Teacher Two also commented that it is important that the computers should be still functional as stand-alone units if the network crashed. Another teacher in the same school stated that a reliable network is a must if computers are to be used extensively in class lessons; otherwise the teacher would become frustrated and give up planning to use the computers as part of the daily programme.

The ratio of computers to students varied from one-to-one and one to four students. Some teachers used their own leased laptop for teacher and student use. One teacher was trying to get all the planning and activities on the laptop rather than rely on pen-and-paper resources. As an extra computer resource one school had access to a COW unit (computers on wheels) containing six laptops. If a terminal goes down, one of these laptops can be used. All the classrooms had been modified to fit the computers in, usually on a bench around the outside.

In Teacher Five's class eight laptops were owned by the students. The purchase of the laptops was optional. They are brought to school each day and locked away in a cupboard. They are brought out when needed. The class also had a computer that had been modified as a media centre. It had a TV card installed and is hooked up to a DVD player and video.

All classrooms had access to a video camera, whether as part of the digital classroom or shared with the school. All classes had access to digital cameras, Teacher Six had purchased a set of ten cheap digital cameras for use exclusively by that class; she was pleased with the results from the digital camera use. The teachers with one digital camera could see the advantages of access if they had at least three or four.

All classes had a networked printer available in the classroom. No classes had access to a permanent data projector, although two classes in the same school had access to a syndicate shared portable data projector. Teachers One and Two had access to the school data projector which had to be booked well in advance. All teachers indicated that they would like to see a data projector as part of the digital classroom equipment. Teacher Five had a 29-inch television screen permanently mounted in the corner of the classroom, connected up to the teacher's workstation. This was used for demonstration and modeling purposes.

All classes had access to broadband internet from their network. Teacher Two stated that safeguards for children using the internet were necessary.

All classes had access to microphones if needed. One teacher stated microphones for every computer were essential for presentations using the data projector. Headphones were also in most classrooms. One class had access to five webcams and two classrooms had shared access to one webcam.

The Fax access for all classes is through the school office. Two classes in the same syndicate, Teachers Three and Four, had access to a shared fax. The same two classes had access to a Polycom Audio Conference unit. Teachers Five and Six had access to electronic drawing tablets. Teacher Five's class had access to a Personal Digital Assistant (PDA) also to a DVD video player. Also one school (Teachers Three and Four) had a digital microscope that was shared between the digital classrooms.

Networking was a common feature of all the classes. Only one classroom had the flexibility of a wireless access point. Printers were located in all the classrooms and were networked. Each class had access to a scanner.

Regarding other computer peripherals, some classes accessed what they needed from a shared resource room while other classes had peripherals available all the time in the room.

Teacher 1 (30 students)	Teacher 2 (30 students)	Teacher 3 (29 students)	Teacher 4 (30 students)	Teacher 5 (28 students)	Teacher 6 (30 students)
15 Computers	15 Computers	7 Computers	7 Computers	20 Computers	15 Computers
1 Teacher laptop	1 Teacher laptop	1 Teacher laptop	1 Teacher laptop	8 Student laptops	1 Teacher laptops
1 Networked printer	1 Networked printer	1 Networked printer	1 Networked printer	2 Networked printers	1 Networked printer
1 Scanner (shared)	1 Scanner	1 Scanner	1 Scanner	2 Scanners	1 Scanner
1 Video camera	1 Video camera	2 Video cameras	2 Video cameras	3 Video cameras Shared with school	1 Video cameras
1 Digital camera	1 Digital camera	1 Digital camera		2 Digital cameras 1 shared with school	10 Digital cameras
15 Microphones		5 Microphones		20 Microphones	2 Microphones
Broadband internet	Broadband internet	Broadband internet	Broadband internet	Broadband internet	Broadband internet
Ethernet network	Ethernet network	Ethernet network	Ethernet network	Ethernet network wireless network	Ethernet network
Fax: school office	Fax: school office	Fax: school office	Fax: school office	Fax: school office	Fax: school office
		1 Webcam (shared) data projector (shared) digital microscope (shared)	1 Webcam (shared) data projector (shared) digital microscope(shared)	5 Webcams 2 tablets COWS access 29 inch colour TV DVD player video player PDA air-conditioning	1 Tablet

Table 5.2 Summary of digital classroom resources

5.4 Professional Development

Professional development (PD) available for digital classroom teachers varies from none provided, to a Board of Trustees scholarship where course fees and travel are provided. There is no common PD provision between schools.

Teacher One: 'Predominately they are skills-based as opposed to incorporating pedagogical change. The general theory is once you learn the skill, every teacher has a different way of delivering the curriculum so it is up to them to make, but likewise there are sections on most courses that do have how we will use this, this is how a successful teacher has used this, they do look at the teaching process but generally it is about learning the new software and learning the different skill.'

Teacher One was asked to look at a booklet that offered ICT-related courses; the teacher was to select courses according to that teacher's needs. The teacher then approached the Deputy Principal (DP) who booked the teacher on the course. The courses available were mostly skills-based and it was up to the teacher how the ICT development was applied in the classroom. Generally the courses are about learning new software skills.

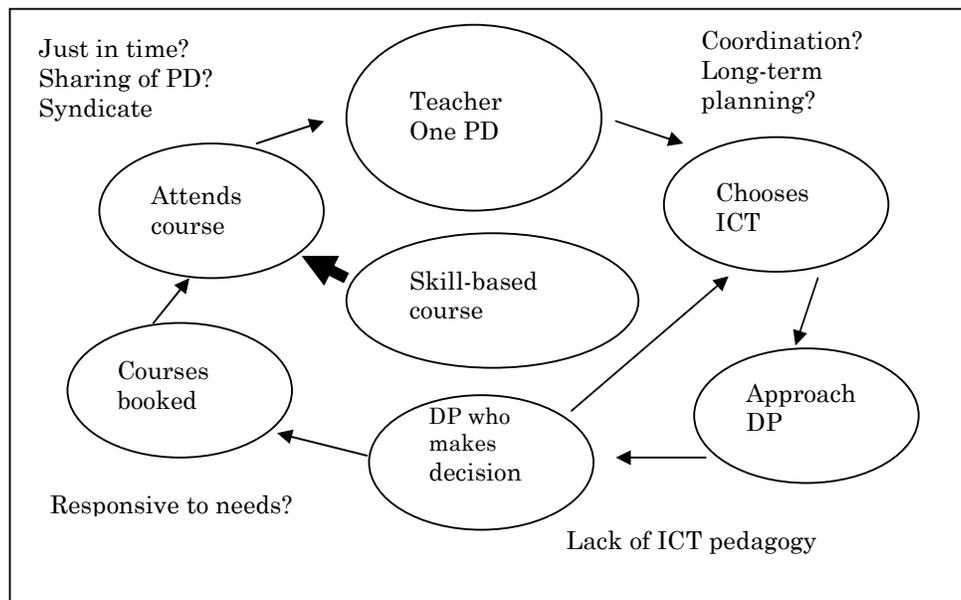


Figure 5.2 Teacher One: professional development

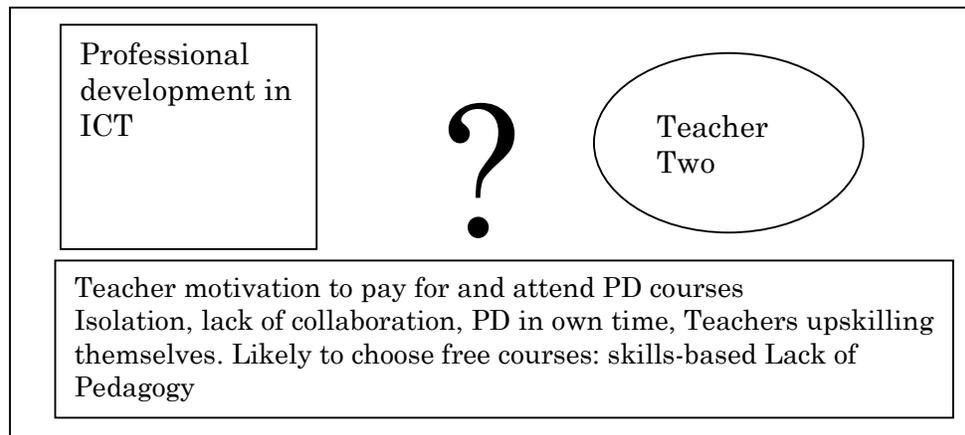


Figure 5.3 Teacher Two: professional development

Teacher Two reported that there was no PD offered at his school. He reported that he has noticed a wide variation between the skills of the teachers teaching in digital classrooms. Teacher Two responded to the question about PD related to ICT with:

Teacher two: None, not even offered, not talked about, nothing.

Teacher Three's school had put a large number of staff through the Graduate Diploma of Information Technology in Education (GDITE) programme. The school also has compulsory ICT PD where the teachers have to attend five one-hour sessions a term in the ICT room after school. The teachers completing GDITE are not required to attend the compulsory after-school sessions. The ICT PD is compulsory and is part of the teacher's performance agreement.

School Three also has special curriculum meetings every Tuesday where the ICT specialist introduces new ICT skills and updates. There is also a slot in every Tuesday staff meetings for ICT updates.

Teacher 3: The school thinks it is quite important so we have as part of our professional development you have to attend five one-hour sessions in the ICT room after school.

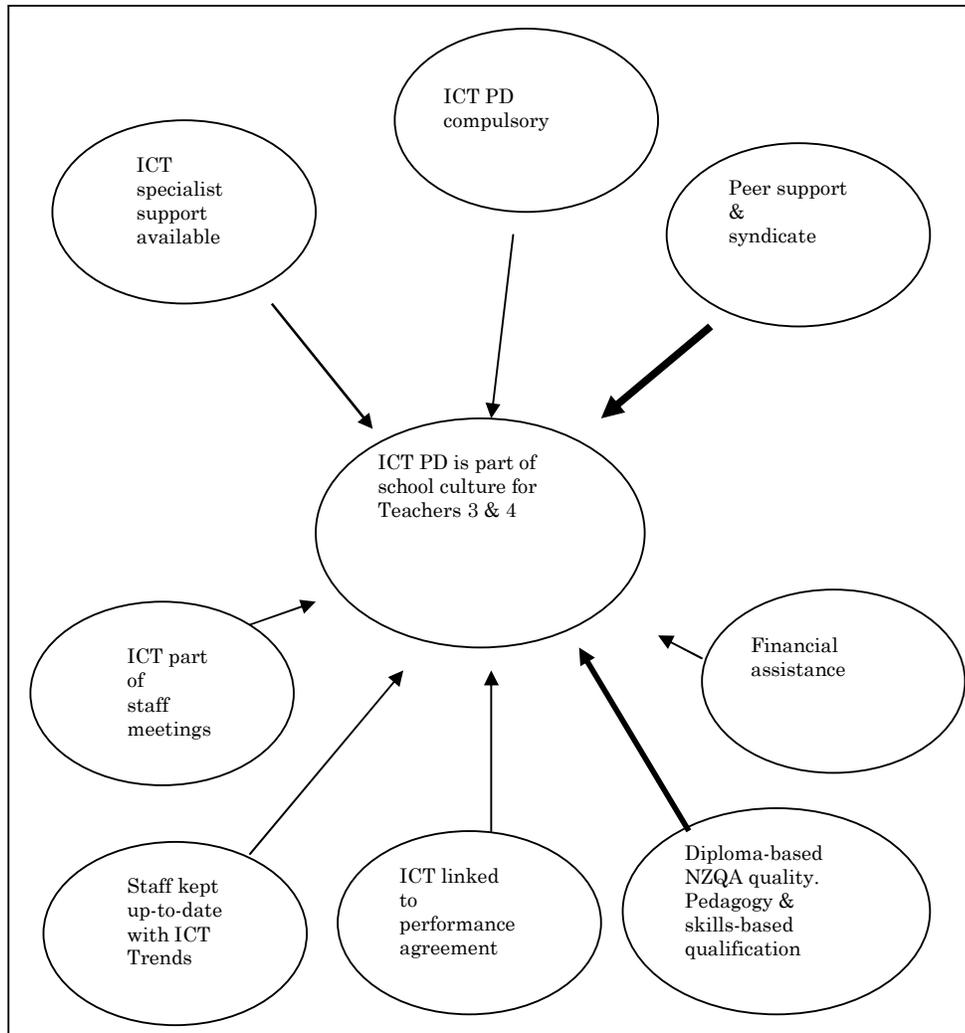


Figure 5.4 Teacher Three & Four: professional development

Teacher Five's school is part of a Ministry of Education ICT PD cluster. The school shares the cluster with other schools in the local district. There are three mentor teachers at the school, including the digital classroom teacher. Through the ICT PD cluster, the mentor teachers are able to go to ICT conferences. The ICT facilitator visits the school for one day every five weeks.

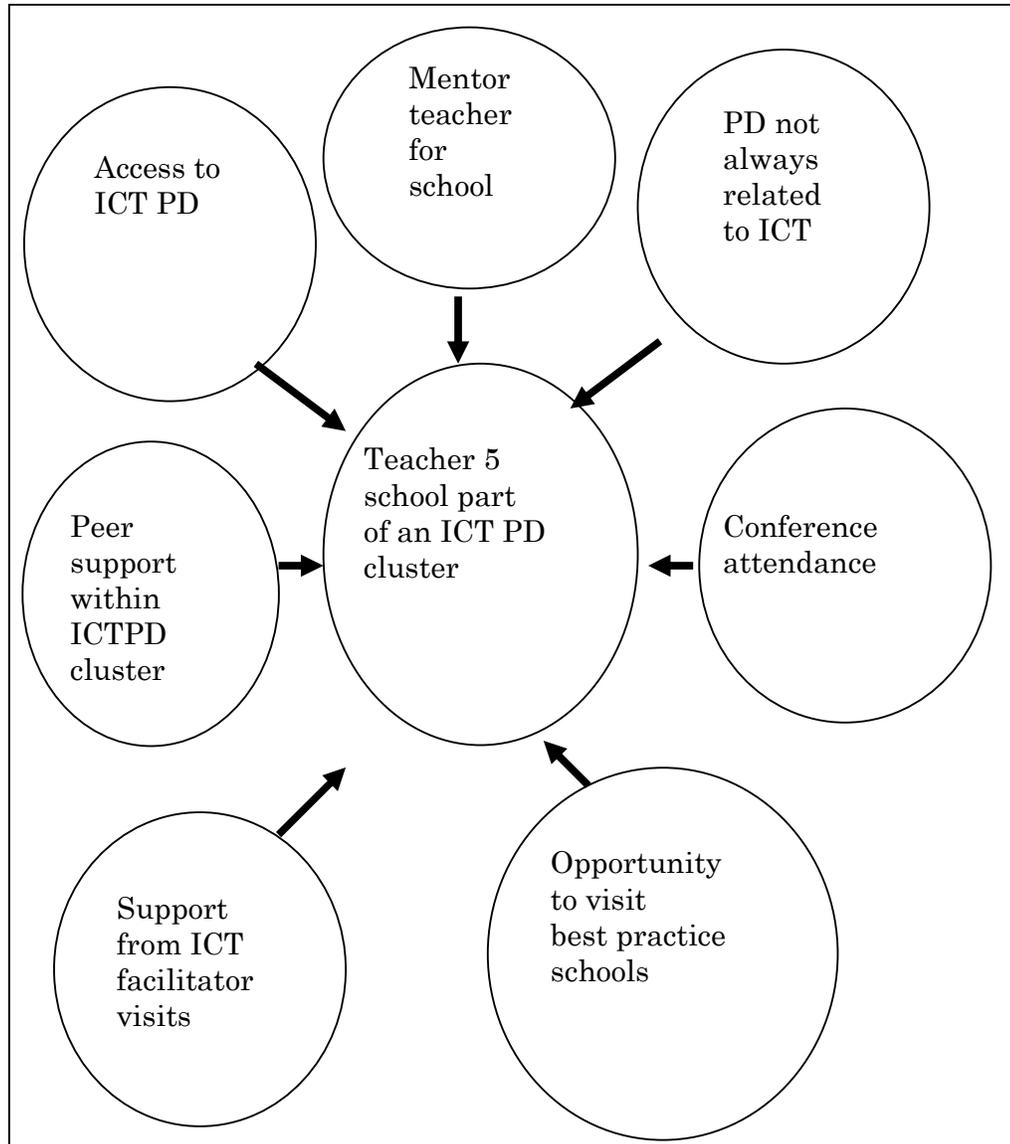


Figure 5.5 Teacher Five: professional development

Interview Question: So, have you found the ICT PD cluster useful?

Teacher 5: It's not what we wanted. We were looking at basically ICT. We wanted purely ICT but its gone for another...Clusters can offer another tangent which has been helpful and it's been interesting. So in some ways it's been good and in some ways it hasn't like, I suppose all those projects are.

Teacher Six was very interested in using ICT effectively in the classroom. She approached the Board of Trustees and was awarded a scholarship to upskill herself in ICT and visit local schools where ICT was effectively used in the classroom. The

teacher also enrolled into GDITE courses and completed her diploma .After the teacher had gathered her information about digital classrooms she reported back to the Principal and Board. She was then given the go ahead to start her own digital classroom.

Teacher Six: From that initial scholarship I was able to go and do some simple Microsoft courses from ACE and I had opportunities to allow myself time to go and look at other schools so about what they were doing, I had heard they were doing some good things with ICT so we went and had a look at their setup. From there I came back and reported back to my principal and told her what I had seen and done. She came to the party when I asked her if I could start one up here.

The amount and provision of professional development varies considerably between the interviewed digital classroom teachers. The opportunities for PD in ICT are different in the surveyed schools. The table clearly outlines the different PD opportunities that are available in the different schools. The opportunities for ICT PD vary within a school and between schools. Apart from the teachers enrolled on the GDITE programme the ICT PD offered is predominantly skill-based.

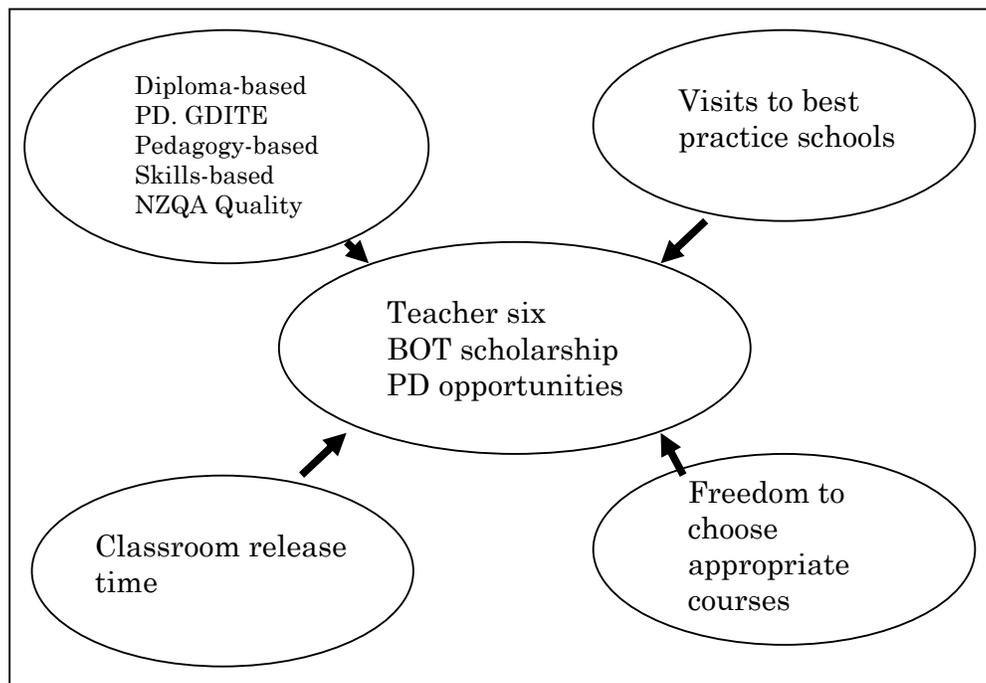


Figure 5.6 Teacher Six: professional development

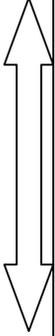
Professional Development in ICT					
		School One	School Two	School Three	School Four
 Pedagogy			Teacher Three: Compulsory attendance at 5 one hour ICT sessions at school. Large percentage of staff have been enrolled in the GDITE programme. Pedagogy covered in GDITE programme. ICT is part of teachers performance agreement.	Teacher Five: Mentor teacher as part of a Ministry of Education ICTPD cluster. PD not always ICT-based. Collaborates between cluster schools on ICT PD. ICT PD facilitator provides ICT PD. Attends ICT conferences.	Board of Trustees scholarship made available. Teachers spent time upskilling in ICT Software. Teacher visits other schools to observe best practice. Enrolls in GDITE programme for both pedagogy and skills-based courses. Attendance at ICT conferences.
		Teacher One: ICT professional development optional. Teachers choose courses that are appropriate to their needs. Deputy Principal books staff on courses. Skills-based courses are predominantly taken. For example using how to use new software.	Teacher Four: not long in school. ICT slot part of staff meetings and curriculum meetings. ICT part of teacher performance agreement.		
ICT Skills		School One: Teacher Two stated that no ICT professional development was offered in ICT for the digital classroom teachers			

Table 5.3 Summary of professional development in the schools

5.5 Digital classroom organisation

Teacher One

Teacher One commented that his digital classroom doesn't have individual desks and he initially relied a lot on seating plans for management of the digital classroom. The room has cooperative round tables at which anyone can sit. The room has four distinct learning areas. The digital area, the cooperative area, a library-type environment and a large area on the floor for group work. The class setup is very flexible and the class works on a rotation basis. The computers are used for mathematics or spelling. For topic studies, the computers are used for group work. The subject determines the class organisation.

A day's programme starts with physical education, then maths. For maths there will be a teaching session of five to ten minutes, and then one group will be directed to the computers (to a website, piece of software, or a challenge based on the computers). One group will work in their maths books while the other group stays with the teacher. Over the course of the week the groups will rotate. Generally each group could work on the computers three times in two weeks.

For spelling, the groups are rostered around bookwork, using spelling software and one group working with the teacher. Once the teacher's group has some independent work the teacher can rotate around the groups. The teacher can monitor the students on the computers. It gives time for instant feedback for the students on the computers. If the student is writing on the computers the teacher can give feedback as the work progresses.

During Language and Literacy the teacher will have a writing and a reading project which is ongoing. It depends on the task which group is using the computers. The teacher uses PowerPoint for the students to deliver responses to books. This is done via group rotation. These are later shared with the class.

During the topic time the students are very independent. The computers are used to present the results of their research. An example is the writing up of a Science Fair presentation. For topic-based research the students are given ten minutes to research a topic using internet search engines. The teacher sets the research questions. The advantage in the digital classroom is that the students can search instantly, rather than waiting until the class visits the computer suite. The teacher uses group work for research.

If there are any spare computers they are used by individuals for research. Teacher One commented that they have noticed that the digital class can lose its group identity because of the amount of time that some individuals spend alone working on a computer. It is important to focus on group work.

Teacher Two

The class is split into two groups for subjects such as handwriting or spelling that requires writing in books while the other half work on the computers using a programme such as moviemaker. The teacher commented that it is hectic because he needs to teach a group of 15 students working in their books while teaching the other half skills in the computer software they are using at the time. In maths, at the time of the interview, everyone is on the computers working in groups. The teacher commented that it depended on what activity is being done.

This teacher commented that he doesn't have a normal day in his classroom; the students work in groups, which change during the term. The structure changes from week to week. The classroom routine is handwriting and spelling when they first come in the morning. Then the class homework is covered. After that, the day is broken up into a unit of maths, PE and topic work. The usage of the computer varies. The teacher stated that he uses the computers if they are suitable; the computers are not used just because they are there.

Just about everything in class is done in groups. The class can be easily split in half, girls or boys, or year 7 or year 8s. The year 8s teach the year 7s the computer skills. This has two benefits: the year 7s learn from the year 8s and the year 8s learn by teaching the year 7s.

Teacher Three

The Teacher Three divides the class into six mixed ability groups and divides the day into six blocks – two before morning tea, two before lunch and two in the afternoon. The groups are named by colours. The timetable for the week is worked out. The teacher blocks in the times for the compulsory sessions each day that the group must attend. This makes sure that everyone attends the literacy and numeracy sessions.

The teacher works out the week so she can have time with every maths and reading group. The children have small planning booklets that they fill in on Monday morning. The teacher signs and checks these booklets in the day. All the compulsory sessions are marked in red pen, the rest in pencil. The students usually get four 45-

minute sessions on a computer per week. The teacher commented that it is healthy that they don't spend any more time on the computer.

The activities that the children spend on the computer are related to the topic they are studying at the time. For example when the researcher visited it was maths week; the students were completing an online maths challenge, so that they could gain credits for an online auction and bid for real prizes. Sometimes it could be researching on the internet or constructing a PowerPoint in a group for a topic-based activity.

The teacher feels any computer-related activity should enhance what they are doing in the classroom. She commented: *'I don't like to see it being a task for computers sake.'* In a week where there was no topic-based activity, each student has her or his own webpage. So the students might end up linking some of their work to the webpage. The students all saved their work to their own personal folders. They can access this from anywhere in the school. Every year they start up a new folder and save their current work into it. When they get to year 6 all their work is burned onto a CD to take home.

Because there is an ICT specialist in the school, every fortnight the class goes to the ICT room for a 45-minute skills session. The class has been taught FrontPage web skills. All the students in the school get a chance either in year 5 or year 6 to be in a digital classroom.

Teacher Four

The teacher has seven computers located at the back of the classroom. During reading time when they have finished the students can complete a quiz on the computer. In the afternoon the students have half an hour to use the computer to work towards a project they are completing. This means three sets of seven students get to use the computers for half an hour each. During maths or written language a group of seven are working on the computers while the rest of the class are working at their desks.

During the unit study time the students use the computer to complete a task related to the unit. Usually the students use the computers individually. For example, during the

Olympic Games they went onto a site and filled in a digital diary so by the end of the Olympics they had a table of results.

On a Monday morning the teacher lets the students know what they are doing on the computers for the rest of the week.

It is important to note that the students work alone on the computer and there are no group activities using the computers. The student use of the computers is very teacher directed.

Teacher Five

This teacher has had the classroom modified for the digital classroom concept to give extra space for the computers. Twenty desktop computers are set up around the perimeter of the classroom with five large tables set up in the middle of the room for group work..

The computers are used for core subjects in the morning until interval. Extensive use is made of group activity on the central tables for brainstorming and group organization. The students then go to the separate computer to complete the task.

Parents were concerned that the students would be sitting alone at a computer all day. This does not happen as the majority of the day the students are involved in group activities.

An intermediate school runs a timetable system like a high school; so the students have three cores subjects with their tutor teacher then they have a technology period in which they go out to specialist teachers.

After lunch is reading time, the class does 45 minutes reading.

Another option is that the students come back to the digital classroom and complete some ICT-related activities. This has included online learning programmes such as Learnz which is a virtual field trip activity. They have also been creating E-books using Power Point.

ICT skills are taught then integrated into the programme. Once an ICT skill is taught it is integrated back into the class programme. The same skill may be used several times during the year. Some forward thinking is needed on behalf of the teacher.

Teacher Five also set up some interesting tasks for her students using ICT. Sometimes the students get to share their ICT skills with other students or teachers from the school. Claymations (animation using plasticine objects) or how to use key words to search the internet are good examples.

Teacher Six

The digital classroom is run solely in the senior school for the year 5 and 6 students. Every child in years 5 and 6 area gets the chance to be in the digital classroom for a term. There are 120 children in the senior school; the digital classroom has been offered a term at a time. The school split 120 children three ways, with each home class having 40 children. What the school does is take 10 children out of each class to make up the digital class for that term. The children are in the digital class for the whole term. Then there is a swap after the term and the teachers take another ten out. This then becomes their home class.

Teacher Six... I kind of like to think of it as, instead of doing all our work in books, we look at ways we can do it on the computer.

The children rotate during classroom time on the computers. The reading programme in the morning runs on a rotation system. In the morning there is one student per computer so the students have a chance to practice their ICT skills.

For writing and language the class is divided in half so some students work with the teacher while the rest are on the computers. Sometimes the students work in pairs on the computers.

The parents were concerned that the children would miss out on the normal classroom programme by being in the digital classroom. The digital classroom studies the same topics as the normal classrooms.

Teacher Two also feels that there is room to develop creativity in students. The digital tools give his students more options to present their work. Students who have poor handwriting skills are able to present their work neatly suitable for wall presentation. Motivation is a key factor in a digital classroom.

Teacher Two... I have kids here at 7:30 in the morning, so School doesn't even open until 8 so, kids want to come to school, they want to do their stuff. These kids are all striving to do the best that they can.

Problem solving is an important part of the class. The students are given problems to solve. The students find the information then present it as a poster or PowerPoint using their ICT skills.

Group work is also an important part of the class...

Teacher Two... I'm putting them together in a group where they weren't going to work well with the other person on purpose, taking them outside their risk taking, I usually do

Teacher Two mentioned the difference between how girls and boys behave in a digital classroom. The boys like creating animations and the technical side of PowerPoints. Teacher Two wants to extend the boys as they are often underachievers with poor literacy skills. Girls also enjoy using the ICT equipment.

Teacher Two also noticed an improvement in reading and spelling.

Teacher Two... Yep, I have just had parent interviews and all the parents were saying it is making a big difference, we do a lot of it in class, you can't just get away from it.

The pedagogy is characterised by offering freedom to his students, the use of the inquiry process supported by ICT and developing creativity. Teacher Two also believes that motivation and the students striving to do their best are important factors.

The teacher has strategies in place to assist the boys' development and feels that the digital classroom environment is helping the boys to achieve. Literacy is another area

that the teacher feels is enhanced in the digital classroom. The teacher states that the parents have commented on this in recent parent interviews.

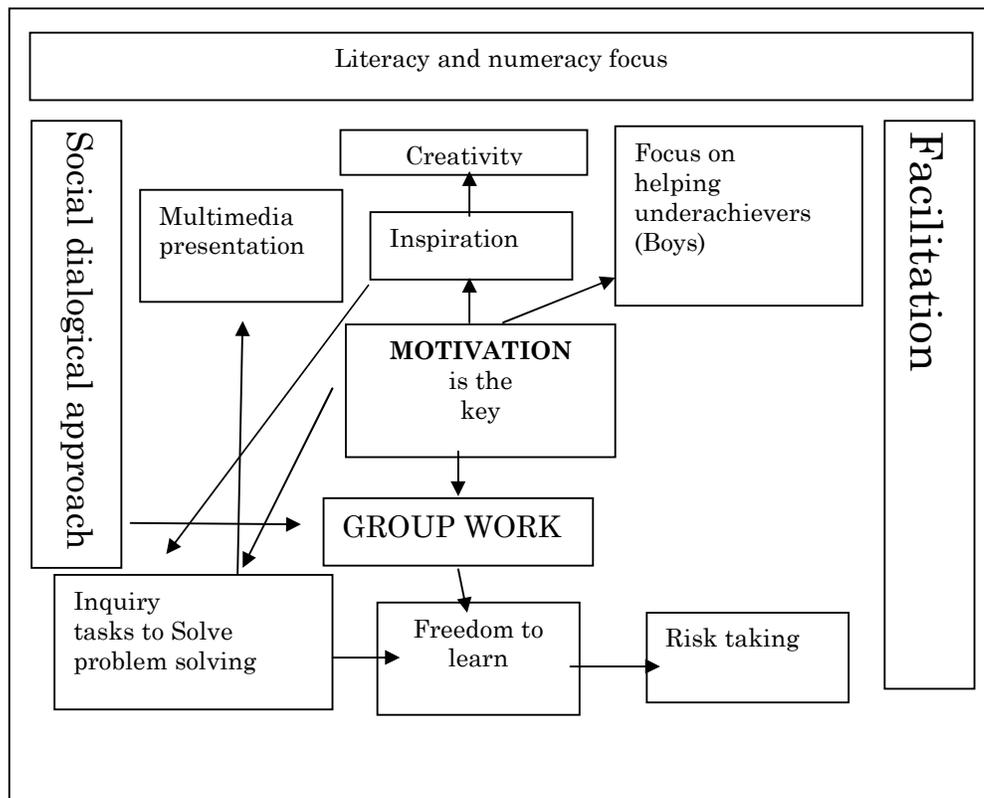


Figure 5.8:Teacher Two: classroom organisation/pedagogy

Teacher Three

In this classroom the students get an opportunity to plan their own day. The teacher felt threatened with the loss of control. The students all have their own timetables.

The teacher needs to use check lists to ensure the work is completed.

The pedagogy in Teacher Three's digital classroom gives the students some control over their learning.

Teacher Three... It is really good, it gives them ownership, it gives them planning, time management skills, they have the time that they can plan it and I have done a survey I have done with the children and it was something like 98% prefer planning their own day rather than having a teacher structured day, and the one child that didn't like it was a really talented student and he thought he had to think more and do more work rather than the teacher providing the work for him.

Other changes needed to be made by Teacher Three. Teacher Three stated that she needs to run a constructivist pedagogy with group work and collaborative activities. Because of the large amount of group work, it frees up some time for the teacher...

Teacher Three ... Yes you can do, the other thing it allows for because your not all the time apart from taking other groups it gives you a lot more opportunities to work with individuals, more individual conferencing or small-group conferencing. It, from that style, it frees your day up as a teacher a bit more, you are able to work individually with students

Teacher Three also commented on how the students adapt to the digital classroom. The digital classroom does not suit all students. Some students find it difficult to become an independent learner and need extra teacher support.

Independence and freedom of choice is a characteristic of this digital classroom. A constructivist environment is created where the students work in groups on ICT and non-ICT tasks. The independent nature of the classroom environment allows the teacher to work with some students on a one-to-one basis.

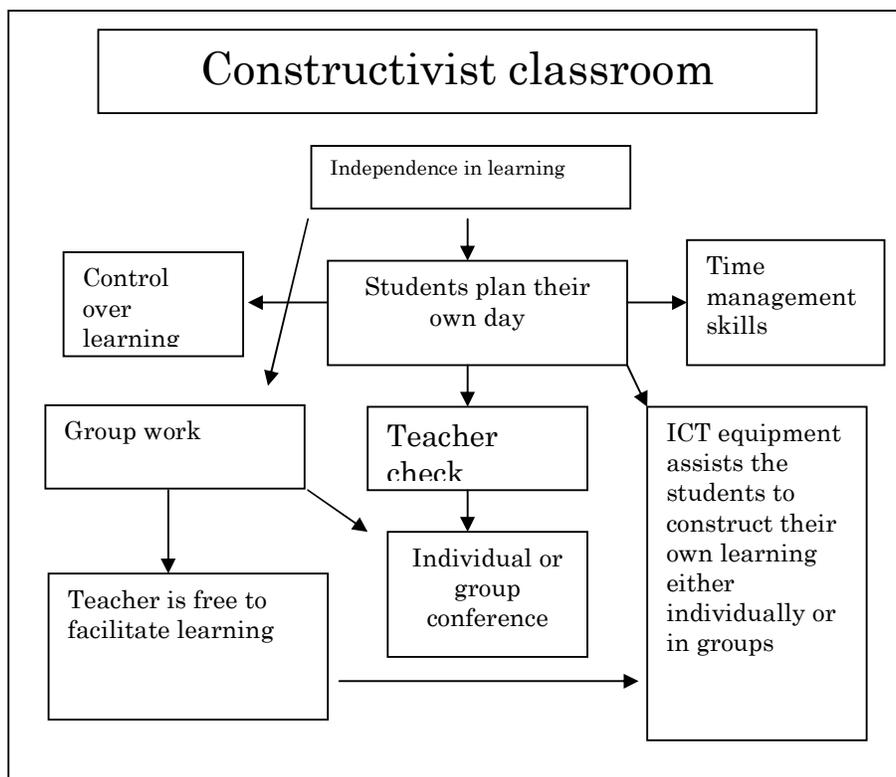


Figure 5.9 Teacher Three: classroom organisation/pedagogy

Teacher Four:

Lesson planning had to change because at any one time there would be a group not involved in the main activity. This teacher did not see much change from the mainstream classroom environment.

Teacher Four ... There was not much of a change really, it just the way, the fact that one of the groups go on the computer and sometimes it takes much longer to complete the task because overall they spent part of the session on the computer. I just allow more time to complete both the main task and the computer task.

There also seems to be a difference between the way boys use the computers compared to the strategies used by the girls. The boys enjoy using the computers and are able to present their work neatly.

Teacher Four states that his classroom does not run much differently than a mainstream class. In any lesson a group of students is working on a related activity on a pod of seven computers. The students work individually on the computers. The teacher relates that some students see to learn better using the computers than others. Boys seem to enjoy working on the computers more than the girls and for boys they are able to present their work to a higher standard.

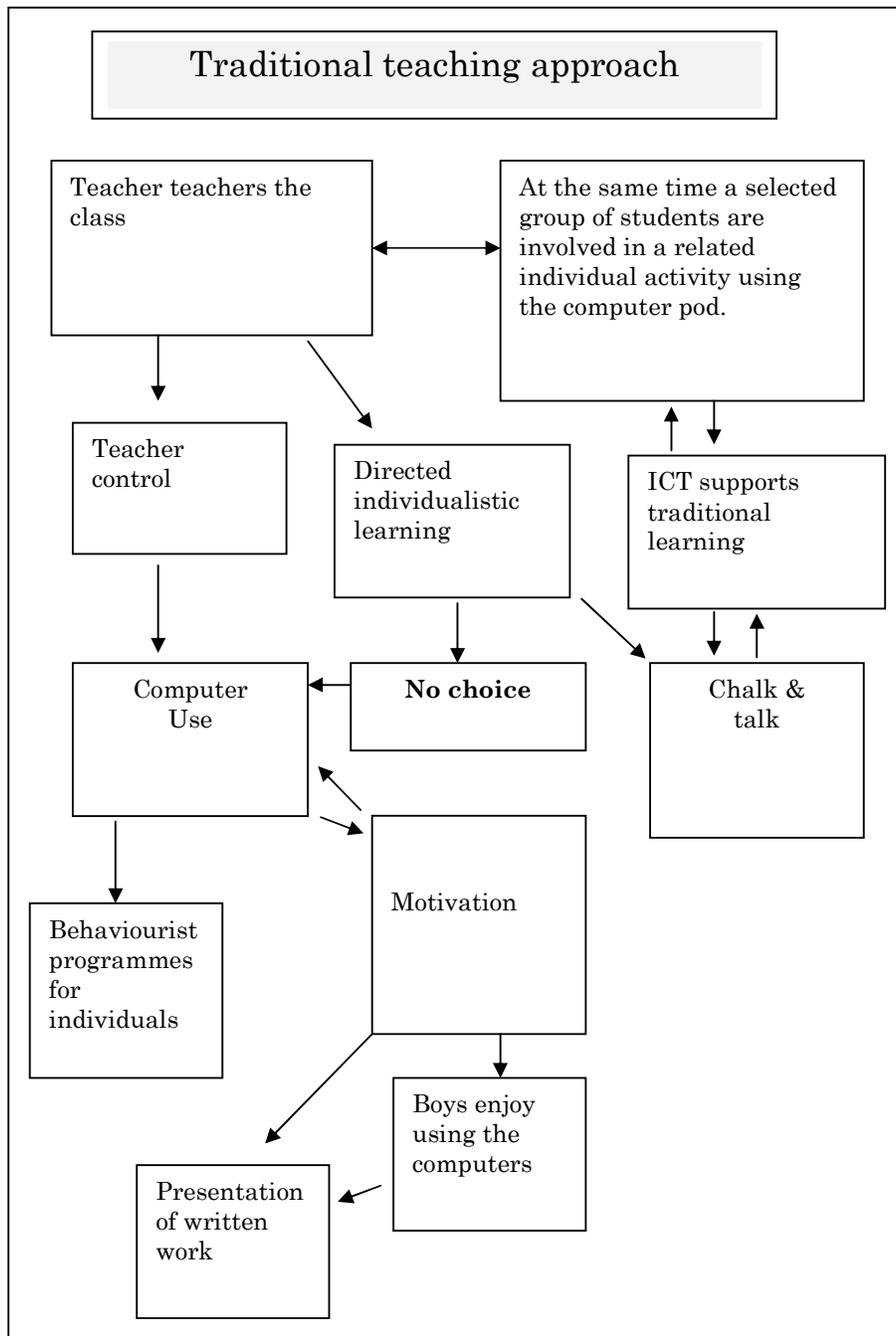


Figure 5.10 Teacher Four: classroom organisation/pedagogy

Teacher Five:

When the teacher was in a normal classroom previously she found it very much teacher-directed, teacher-orientated, with the traditional classroom model of the teacher at the top and the teacher directing the students.

Teacher Five has setup her students for independent learning. The teacher has taken on a facilitator role and often takes a step back to observe the learning process in the classroom. The classroom organisation has taken a lot of effort to setup. Once established the classroom runs almost independently.

From the start of the year there is a gradual transition into the teacher facilitator role. *Teacher Five explains... It's a gradual transition. We'll start off the year like a normal classroom. I'm facilitating everything and then by the middle of the year they are facilitating everything. It's quite amazing to watch but they get so motivated in their learning that they become the major role player in the classroom and that's by teaching them how to enquire. It's teaching them how to be self responsible and how to motivate themselves to find out. It was very hard for me to do at the beginning, to actually step back and let them take control. Gradually it's getting easier.*

This digital class has some freedom to learn, however there needs to be some deadlines for completion of work. Otherwise the students go off on tangents and work is unfinished.

Self discipline and control of behaviour is a feature of this digital classroom. *Teacher Five ... Very little behaviour problems. Normally in the two years that the classroom has been running there has be no behaviour problems. What we find is that they become very, very close knit. They become like a big family. There are no little groups happening in the classroom, they're all just sharing amongst themselves. Often teachers walk into the environment in totally unbelievableness at the fact that they're all sitting there working away or they're all discussing and sharing with each other. That you possibly wouldn't find in a normal classroom.*

Teacher Five puts the success down to having a collaborative classroom setup.

Teacher Five explains how the class webpage is in the digital classroom. All of the class tasks are posted to a webpage which the students access regularly. This gives the teacher a chance to work with some students on an individual basis.

The Teacher workload increases in a digital classroom. Teacher Five estimates the workload is double that of a normal classroom.

The inquiry process seems to dominate the topic-based studies. To make this approach successful it requires a lot of background and preparation on behalf of the teacher. The students are given problems to solve that involve internet searches. A variety of challenges are given to the students in all areas of the curriculum.

Teacher Five's classroom is very student-centred where the teacher takes on the facilitator role. The ICT fits in with the constructivist pedagogy that predominates. The students' learning is self-directed with students sometimes filling the teacher's role.

From the start of the year the classroom changes gradually from a teacher-dominated class to a student-centred learning environment. The teacher is able to step back and the students will carry on learning without the teacher control. The students become learning independent. The students are highly motivated and use the inquiry process as a major part of their learning. The ICT helps facilitate this process.

An inclusive supportive class atmosphere aids the learning. Through collaboration and shared learning the students produce a large amount of work. This is usually saved electronically in a shared marking folder. The teacher uses the ICT environment for planning, guiding and evaluating the learning.

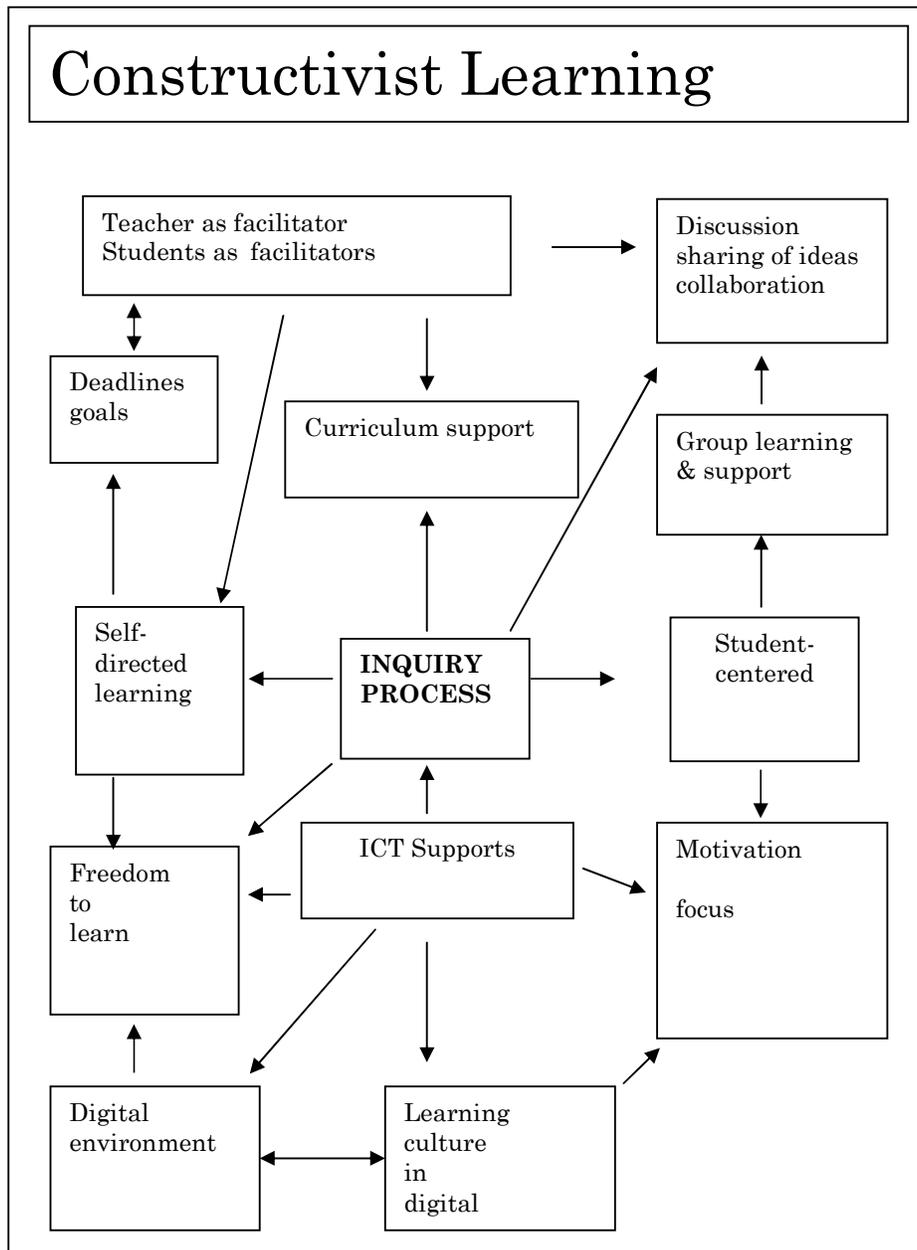


Figure 5.11 Teacher Five:: classroom organisation/pedagogy

Teacher Six

Teacher Six describes her pedagogical style when teaching in a digital classroom.

I have never been a chalk-and-talk style teacher anyway, I think you move away from that direct impart teaching, you step back and you are more facilitating, I often find myself going to say something to a child and biting my tongue, because the

conversation between the kids is learning and they don't actually need me, they are getting it off each other. That kind of interaction has changed the way I teach because you are more open ended and more facilitating, more so than directive.

An example is that Teacher Six sometimes learns with her students. Teacher Six learns alongside her students when using unfamiliar software. The teacher and students solve problems together.

Teacher Six's classroom tone could be described as hectic with lots of different things happening at once. The groups all work independently completing the set tasks.

The students involvement in the digital classroom is reflected at home.
Yeah they do, I have had a few interesting comments from parents who have said that at home they are not using them solely for playing games they are using them to write stories or make up their own Power Points and those kind of things there is a change obviously an influence in what is happening in the home as well.

The digital classroom also has a motivating effect on the students learning. The students come in before school to complete unfinished work. Some students are keen to improve their typing skills.

Teacher Six conveys that her normal teaching style was never in the traditional teacher mould. However the teacher still needs to remind herself of the facilitator role and let the students solve the problems on their own and not interrupt meaningful conversation between students.

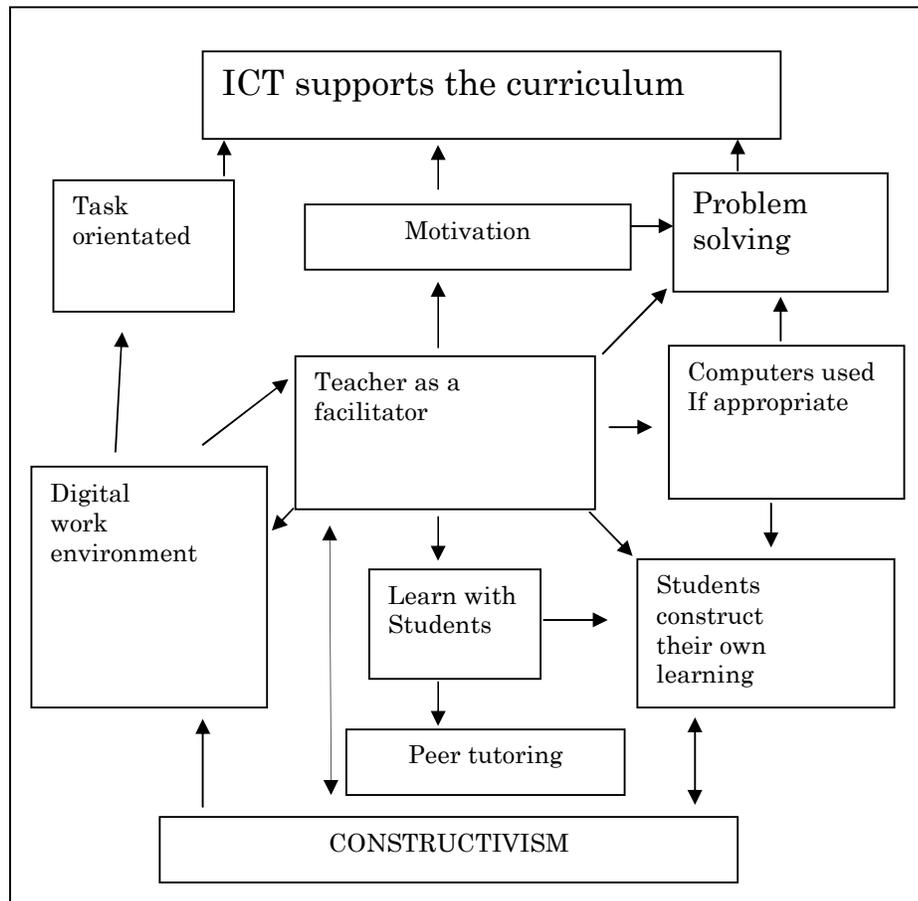


Figure 5.12 Teacher Six: classroom organisation/pedagogy

5.6 Funding and Support

Teacher One

Software resources are obtained by the school through the DP. The senior teacher then passes onto the software onto the digital classroom teachers. Teacher One does not have a budget to spend on digital resources; every classroom in the school does have a budget, but this is for day-to-day classroom resources.

The teachers need to identify a need then ask for it,

Teacher One if you ask for something, more often than not you will get it.

Teacher One stated that one of the other digital classroom teachers has just had a permanent data projector installed on the ceiling of his classroom with a remote tool

that he can access his laptop from. The teacher was unsure of what budget is set aside for digital classroom resources. There is some parent funding per student basis of the digital classroom.

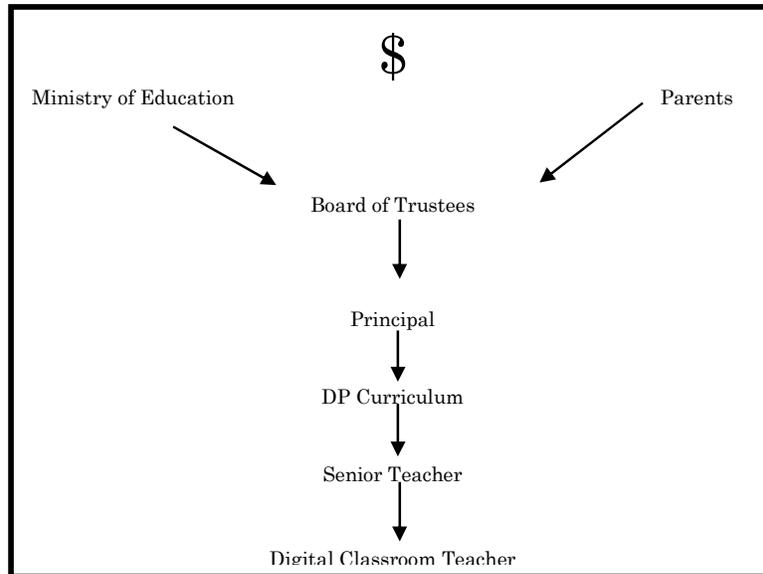


Figure 5.13 Teacher One: funding of digital classroom

Teacher Two

Teacher Two did not feel supported financially in his digital classroom. The teacher obtained freeware from the net or used the standard Microsoft Office programmes provided by the Ministry of Education.

Teacher Two: There has been none offered to me, wherever the money comes from it has got nothing to do with me. We have said we wanted software, but it has not been forthcoming. What we have got is either free or downloaded.

There is some parent funding of the digital classroom on a per student basis.

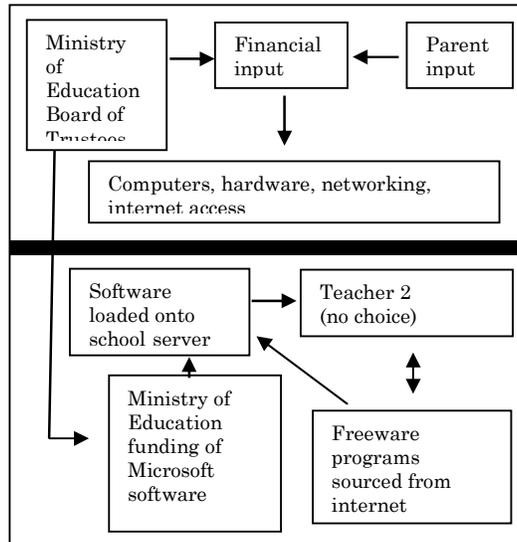


Figure 5.14 Teacher Two: funding of digital classroom

Teacher Three

Teacher Three stated that the school purchased the computers, using Telecom Supporters' money. The Board of Trustees also funds the computers directly out of its funds.

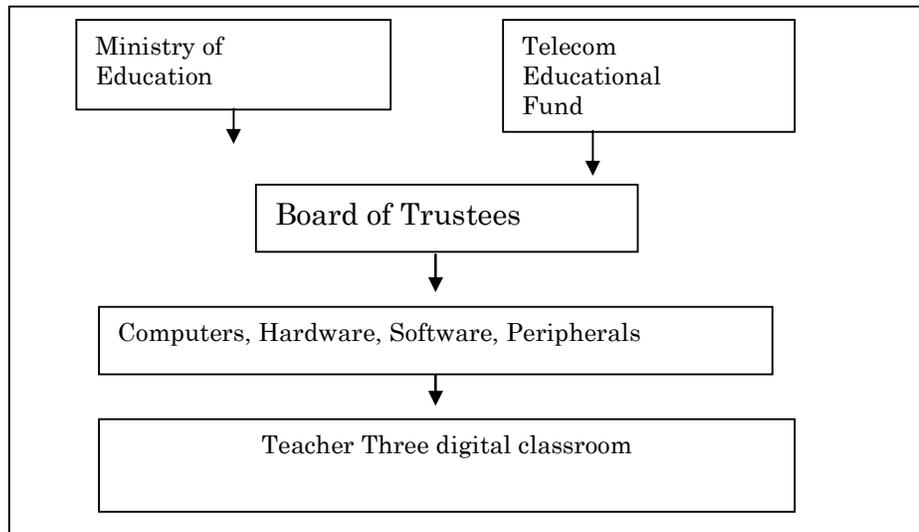


Figure 5.15 Teacher Three: funding of digital classroom

Teacher Four

Teacher Four was not sure about how the digital classroom was funded. The teacher was happy with the equipment funding. The Board of Trustees is the source of the funding.

Teacher Four: I am not sure entirely, I know that we are well equipped.

Teacher Five

Teacher Five first praised the computer technician in the school who has managed to build their infrastructure very cheaply using recycled computers and networking using a citrix networking system where the computers are dumb terminals utilizing a power server to do the computing work for them.

Teacher Five reflected on the support she received from the School and Board of Trustees following in the success of the digital classroom concept.

Teacher Five: The school, the Board of Trustees did the initial cost and once they realized that the classroom was working and that it was producing some very good results, they put some more money into the classroom and gave us air conditioning and took the toilets away to give us more room.

In Teacher Five's classroom the school provides all the funding. However, some parents chose to purchase a laptop for use by the student in the digital classroom.

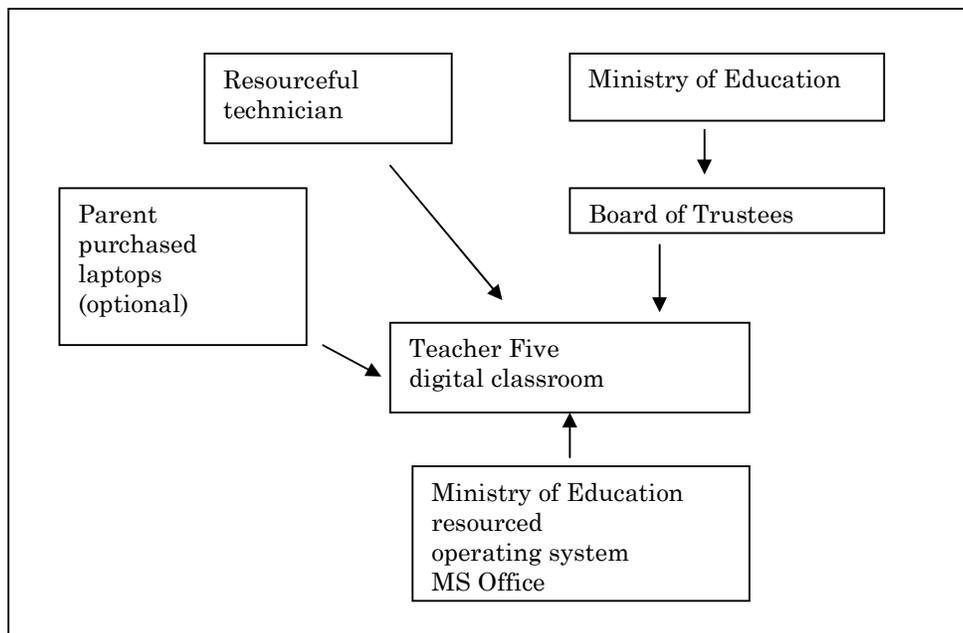


Figure 5.16 Teacher Five funding of digital classroom

Teacher Six

Teacher Six was unaware of the funding for the digital classroom. When setting up the digital classroom the teacher went and budgeted out the equipment needed for funding and submitted the budget to the Principal. The principal then did some equipment negotiating, and then took the package to the Board of Trustees who approved the finance. The money came out of the Board of Trustees operating budget. There is no parent funding for the classroom.

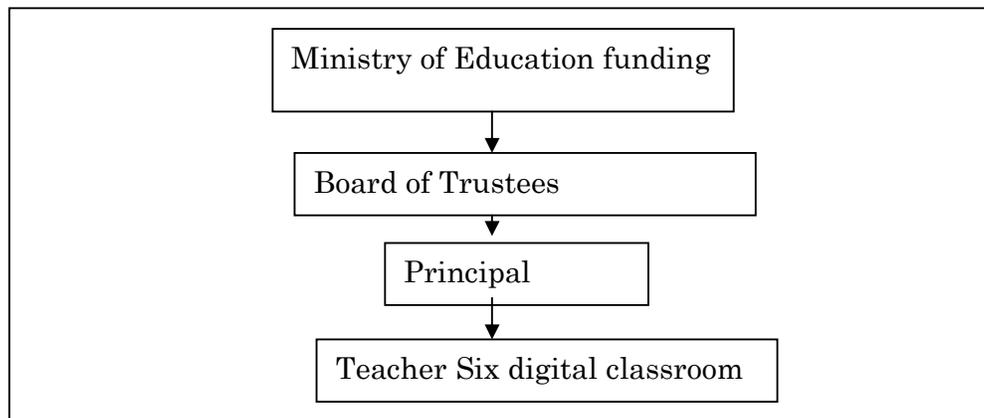


Figure 5.17: Teacher Six: funding of digital classroom

5.7 Stakeholders attitudes

Students, Parents, Senior Teachers, Principal

Teacher 1

Teacher One felt that the parents should have a greater say over what happens in a digital classroom. This reasoning is that the parents at his school pay a fee for the students to be in the digital classroom. He likened it to a private school.

Teacher One then reflected on the support the teacher receives from the parents.

Teacher One: they have funded their children to go into these classrooms and they want the best and they are very supportive obviously if they feel there is a problem they're very quickly onto it a lot quicker than parents in mainstream.

Teacher One also commented that there is some pressure and expectation from the parents and students that computers will be used on a daily basis.

Teacher One: occasionally you will have times when unfortunately you haven't used the computer for say two days....what will happen after the third day you will start to get comments from some of the students, the parents are wondering why you haven't been using the computers...

Teacher One had little knowledge of the Board of Trustees support, stated that they are supportive of digital learning.

Teacher One thought that the Principal and senior staff had high expectations of the results from digital classrooms. The senior staff believe that digital classrooms are the future of learning and expect progress from year to year in both teachers and students. There is a strong expectation that they are successful.

The students initially are unsure of the digital classroom environment; over time they get used to using the computer as a learning tool without asking permission. The boys are able to present their work to a high standard, using the computers publishing ability.

The teacher commented that the boys are very motivated to use the computer, they like using the technical programs. The girls like the fact that they can be very artistic on the computer.

Teacher Two

Teacher Two's perception of the views of the Principal and Senior teachers is that they don't want it to fail. Teacher Two feels that there is a large amount of pressure put on the digital classroom teachers' to make a success out of the concept – that they are trying to prove that the digital classroom is better than a normal classroom.

Teacher Two also felt that the Board of Trustees wanted the digital classroom concept to make the school look good. Also that the digital classroom is a concept used to attract more students to the school.

Teacher Two felt that there is extra pressure from parents of the digital classroom students.

Teacher Two: For the kids to want to come to school, for kids to achieve great things, kids to be motivated. There is a big push from the parents at home as well. No parents are going to pay money for the kids to come to school not to turn up. Not to enjoy it. So the kids have got to go home they have got to tell them we enjoyed it, this is what we are doing at school, these are the cool things that are happening.

Teacher Two stated that motivation is a major factor in the students' perception of the digital classroom.

Teacher Two: They want to learn new stuff, they want to have fun, in my class they want to do stuff that the other classes aren't doing, even the other digital classrooms. They are looking to do stuff that is just a little bit different and that is my push as well.

Teacher Three

Teacher Three felt very supported by the senior staff in the school. One reason is that the senior staff had all completed the Graduate Diploma of Information Technology in Education , and that they can see the benefits of using computers and ICT in the classroom. The school has a shared vision of using ICT to support the learning process. Teacher Three felt the school culture supported the use of ICT and there was plenty of support from a specialist ICT support teacher through to the provision of up to date reliable equipment.

Teacher Three: We are lucky because the principal and deputy principal have done GDITE with us as well, so they can see the benefits of having computers and ICTs in the classroom.

The Board of Trustees were very supportive in Teacher Three's school. She commented that the Board initially were concerned that the computers were being used more for entertainment, the teachers report to the BOT once a year and the Boards are very happy and positive about the digital classroom concept.

Teacher Three feels that the parents were initially concerned that the children were spending too much time on the computer. Once the teacher explained that the computers were being used as a tool to enhance the learning, that the students are very positive about using the computers and the skills they are learning are going to be valuable to them in the future, the parents are happy.

Teacher Three also commented that the students are highly motivated in the digital classroom.

Teacher Three: So they are always motivated and I know my kids just love coming to school to throw up their gear and see what we are doing especially in maths week, we have them in here from 8.30 and some of them stay until 4pm with parents permission, they can stay and work then.

Teacher Four

Teacher Four felt well supported by the Board of Trustees and was happy with the amount of ICT equipment in his room. Teacher Four also felt well supported in his digital classroom syndicate of six teachers.

Teacher Four stated that he is well supported by the senior staff and the school was developing a digital infrastructure to support digital classrooms. The senior staff also had high expectations about integrating ICT into the curriculum.

The parents are positive about their children being in digital classrooms. The teacher could also see an advantage for the boys, whom he felt liked using the computers for learning.

Teacher Four: They are glad that their children are in a digital classroom, especially the boys who seem to like learning in that particular way, at the parents evening we make a point of showing parents what the children have been doing in terms of ICT.

Teacher Five

Teacher Five felt very well supported by the Board of Trustees. The Board is happy with the way the digital classroom is running and approved the installation of air conditioning and the removal of the toilet block to give the digital classroom more room. The Board of Trustees has also funded a second digital classroom due to the success of the first one.

Teacher Five's Principal is also very supportive of the digital classroom concept. He was very supportive of Teacher Five's proposal. The principal has a strong interest in ICT.

Teacher Five stressed the importance of the parental support. The parents are very supportive of the digital classroom concept and are interested in what the students are doing.

Teacher Five also maintains a website where the students' homework is posted and there is gallery of photos and some of their work online. The parents check out the website regularly. At a recent sharing evening where the parents could come in and have a look at some of the work that the students were doing; 95% of the parents turned up which is an indication of the support from the parents.

Teacher Six

The Board of Trustees are very supportive of the digital classroom concept and continue to fund the classroom. The Board also provides scholarships for professional development.

The Principal has been totally behind the digital classroom concept from the start. Teacher Six can go and discuss any issues openly. An example is that Teacher Six felt that she needed more computers to bring the ratio to one computer to two children, the Principal after consultation approved the purchase of more computers.

The senior staff are also very supportive and let Teacher Six independently organize her own programme. Teacher Six commented that she often gets teachers from other schools visiting, a result of the senior staff networking with other teachers and discussing the digital classroom concept.

The students in Teacher Six's class are very motivated.

Teacher Six: They love it. They are just so keen. They are always champing at the bit to get in there. They are always asking if they can come in at morning tea, lunch time or before school.

Teacher Six also feels that students who often struggle with pencil and paper writing are helped by working on the computer.

Teacher Six: The children that you really struggle with because they hated writing with pencil and paper, put them in front of a computer and give them the same sort of writing task and the motivation in there. It is much more interesting.

Teacher Six also stated that the boys write better using the computer and produce more output compared to using pencil and paper.

Teacher Six: I would usually get one or two sentences out of him on pencil and paper. Give him the same task on the computer and I would get two or three paragraphs; the opportunity for him to do his work on the computer was far more interesting and motivating for him than doing work on pencil and paper.

Teacher Six has noticed that the students use computer more for publishing their work and often do the same kind of things they have been doing at school on the computers at home. Parents have related to the teacher how the children at home create PowerPoints, Word and Publisher documents rather than use the computer just for games.

5.8 Positive aspects of the digital classrooms

Teacher One

Developing Independence in the students so they can become more proactive and develop responsibility for their own learning. The students have instant access to information. It speeds up the learning process and the students are able to answer their questions quickly.

For the teacher there is instant extension available to any lesson, the teacher needs to pre-research the internet and bookmark some sites. The teacher sets up challenges for individual webpages.

The digital classroom teacher is able to cater for a wide range of abilities in the classroom.

Teacher One: The software we use has a levels base to it and it is not so obvious using the digital equipment at which level the other students are at. It is important to the other students not to stand out... The spelling software we have got is spelling force you are doing exactly the same thing as every other kid using that program at

the same time, the words that you use are different, like people are not going to notice it. It gives the students the confidence to work at their own level.

Teacher One also likes the instant access to the internet because it allow the teacher to find the answer to any question that may crop up in class discussion.

Teacher One: Now we can solve that almost straight away in the digital classroom. You very rarely loose a moment in a digital classroom. I think it is the biggest thing.

Teacher Two

Teacher Two had spent three years as a digital classroom teacher and had only had one year as a traditional classroom teacher. Teacher Two was about to leave the digital classroom into a normal classroom setup. Upon reflection Teacher Two thought that motivation was the key factor.

Teacher Two: Just the motivation of the kids, kids are real happy coming to school, my kids were happy before I had a digital classroom to, is it the classroom? Is it the teacher? Is it the way things have been going? Is it just different kids?

Teacher Two also though that parent support was another important factor; he stated that in his first year in a non-digital classroom he had only five parent interviews, in the digital classroom the teacher gets 32-34 interviews. The teacher also reflected that the absenteeism rate is low in a digital classroom and the students were keen to learn.

Teacher Three

Motivation was an important factor for Teacher Three. The reasons being there are more exciting opportunities for learning using the ICT equipment. The teacher also reflected that if the students are motivated then there are fewer behaviour problems and teaching is more enjoyable.

Teacher Three: If children are motivated you don't have any of the behaviour problems it becomes enjoyable, you don't have problems like that.

The internet as a resource is another positive aspect; it gives the teacher access to more resources. For example, for current events the news can be instant, live. The children can take virtual tours that they wouldn't otherwise be able to undertake. Having access to a data projector means the students can easily share their work. The teacher also feels that they are preparing the students for life skills they will need in a

secondary school and in the workplace. Also the teacher feels the students are becoming literate.

The teacher also feels giving the students the opportunity to plan their own days has advantages; the teacher has time to work with individuals and track progress better. The students also learn about time management skills and independent learning skills they can use in college.

Teacher Three: With the planning of their own days you can work with more individuals as opposed to having the whole class or large groups you can work a lot more individually and track progress that way.

Teacher Four

The students being able to present their work in a digital multimedia format (Powerpoint or Hyperstudio). The ICTs also allow the students to improve their presenting skills.

Teacher Four stated that the advantages of the digital classroom suited some children who enjoyed using technical skills such as searching, drawing, cutting and pasting etc. Teacher Four also thought that it was an advantage if the students had already picked up some ICT skills in previous years; so in the digital classroom they can put them into practice.

Teacher Five

The fact that the students are learning to learn and the how motivated the students are to learn.

Teacher Five: Most students will get so involved in what they are doing that they will go two steps further than I expected them to go.

Teacher Five also linked the ICT to the inquiry process and extend the learning boundaries.

Teacher Five: But the fact that its all there at their finger tips: if their struggling with some idea they can just hop online and just go and solve that problem in 5-10 minutes and then move on its not frustrating for them.

Teacher Five also stated that the students have instant access to ICT equipment during their learning.

Teacher Five: They don't have to book in for the library or they don't have to wait until the video camera is free. They get an idea, they can go and do it right away and its showing that learning not just about books.

Again Teacher Five stressed the motivation advantage of learning in a digital classroom.

Teacher Five: Yeah, it's where they want to go. They can do it and its not causing any frustrations and they just get so motivated, highly motivated.

Teacher Five also discussed how the digital presentation format helped some students who had difficulty expressing them selves in the traditional pencil-and-paper format. The ICT has given them an alternative way of expressing themselves.

Teacher Five: A lot of the students have been identified because of their presentation skills. They have it up here, up in their head and they can verbally express it but when it come to putting it down on paper, often due to handwriting or sentence structure, they've struggled. So this has given them a new way to produce their work without those hang-ups.

Teacher Five also discussed the difference between the performance of the boys and girls in the classroom. She felt the girls performed stronger in the digital classroom compared to boys. She was surprised how easily the girls picked up the technical skills. The class has 14 boys and 12 girls.

Teacher also stated that the class has bonded well and are very helpful to each other. A strong collaborative learning community has developed.

Teacher Five: Positive aspect of the class is that they all have something in common so they all get on really well. They feel that they're all just one bunch of friends and that helps towards their learning because they can go to anybody in the class. If they know someone's strong in one area, you'll see them walking off towards that person to help.

Teacher Six

Motivation was a major positive in Teacher Six's classroom.

Teacher Six: Motivational, the less able kids seem much more keen and interested and easier to motivate because they can do much more things on the computer than they can do on pen and paper.

Teacher Six also commented that the motivation extended outside the classroom.

Teacher Six: Like we were doing the Olympics and someone was going home and finding more information about the Olympian they were studying that little bit extra effort being put outside the classroom as well as inside the classroom.

Another positive that Teacher Six discussed was the increase in group work and its advantages.

Teacher Six: Mostly they work in pairs on the computer; I find paired work quite interesting the conversations that happen and the learning that goes on is amazing.

Access to information on the internet is seen as another main advantage.

Teacher Six: Nice to be able to use new resources that we can pick off the internet.

Teacher Six also felt that Interactive Fiction problem solving software was a great learning experience for the students. This was also integrated with the inquiry process. There was also some cooperation between the students in the problem solving process.

Regarding learning outcomes Teacher Six commented that the students are being exposed to higher order thinking skills.

Teacher Six: They talk through that and strategise that is a big learning outcome. It is more process-based and skills-based learning outcomes than knowledge-based.

5.9 Negative outcomes

Teacher One

Teacher One thought that losing structure is a concern and a change in the teacher management style. The teacher thought the structure loss is a result of the increased flexibility that is present in the digital classroom in catering more effectively for a wide range of students.

Teacher One: You lose structure and I know it's at times as a teacher you need structure and I know at times as a teacher you need structure it is easier for you to cope with and so I have had to deal with a change in my management style, how I deal with students.

Students' attitudes to computers when first arriving into a digital classroom is an issue. They are used to the computer being used to entertain rather than as a learning tool.

Teacher Two

Teacher Two is concerned about the pressure that has been put on himself as a digital classroom teacher by the management of the school. The digital classroom was the newest in the school and the teacher has had many people visit the class during class time. He has found this disruptive to the daily class routine.

Teacher Two also feels that there is pressure for the digital classroom students to perform better than the traditional classroom students in the school. This leads to extra stress on the teacher and the students. This is also linked to the fact that the parents contribute financially to the digital classroom funding on a yearly basis.

Teacher Two: I think all these kids are meant to perform and they are meant to perform better than those kids that aren't in a digital classroom.

Another negative Teacher Two mentioned is server reliability as connection to the internet crashes. This disrupts a lesson that has been planned and the teacher needs to be prepared for an alternative lesson.

Regarding improvements to the digital classroom setup in the school, Teacher Two would like more educationally related software available and some say in the purchase of the software.

Teacher Two would also like to see a digital classroom syndicate formed where the ideas could be shared and planning coordinated between the teachers.

Teacher Three

Teacher Three is concerned at the class administration side, so that when the students are rostered onto the computers they are not missing out on any core literacy or number lessons. This is helped when the students plan their own days as it is made compulsory that the students attend a set number of literacy and maths sessions.

Teacher Three's school employs a specialist ICT teacher and a computer technician who maintain the ICT equipment to a reliable standard. The schools' internet connection is via a satellite connection, and so occasionally the internet connection is lost during periods of heavy rain. Teacher Three stated that the teacher needs to be flexible, ready to change the programme at short notice.

Teacher Four

Teacher Four states that there is often not enough time for all the class to complete both the paper-based task and the related ICT task during topic time. The positives outweigh the negatives.

The teacher does not have a computer task for every lesson, and uses ICT only when it is relevant.

Teacher Four: I don't have a computer task in every lesson because I think sometimes you can have things happening just because it is a digital class.

Teacher Five

Teacher Five is concerned that there is not enough time in the day to complete all the learning objectives. The school runs on a modular system where there are specific learning outcomes that have to be completed at the end of each block. The teacher tries to achieve quality learning, so all the objectives are not necessarily covered in the set time. The teacher thinks that the learning achieved in a digital classroom is of a higher standard than a traditional classroom.

Teacher Five: Whereas in a normal classroom you could spend one period doing something, in a digital classroom we could spend a whole week doing that topic. Just because we go deep into it.

Teacher Five also stressed that the digital classroom teacher needs to be flexible. If a lesson is going well, the children carry on and make up the missing subject time later in the week.

Teacher Five surveyed the students and they thought that they didn't get out and do as much physical education (PE). The teacher commented that was probably because at the start of the year PE time would come around and the class would be halfway through some work, and the teacher would give them the choice of PE or staying in and finishing their work, more often than not they would stay in.

Teacher Six

Because all the year 6 students are rostered through Teacher Six's digital classroom, she has to make sure each term the students leave at the same level. The teacher has to make choices over what topics the students will cover.

There has been some parental concern over the lack of handwriting, but the teacher feels this is off set by the increased key boarding skills which will be valuable for the students in the future.

The teacher is aware of the amount of time that the students can sit in front of computers and tries to take the students out for PE as much as the other classrooms. Teacher Six incorporates art into the curriculum as much as she can. At the end of the term the digital class publishes a class newspaper and the students spend more time on the computers to get the newspaper published, the teacher feels that this is valuable learning time for the students.

Funding is another issue, also related to providing correct ergonomic seating.

Teacher Six: Funding is always a negative, I think you are having to prioritise and you have to, like I am desperately in need of some decent chairs I am finding that my year 5s are short and being able to get them to sit at the right height...when you have to budget a year out and you have to put it off to next year because you have not got any funds left.

The other staff are also aware of the extra money that is being spent on a digital classroom, and so were negative at first. After they saw the quality of work that was being produced and how hard the students were working they became more positive.

5.10 Improvements for a digital classroom

Teacher One

Teacher One would like more resources; the computers in his classroom are the oldest in the school and he has only one CD-writer in his class. He needs to let the students use his teacher laptop to gain access to the CD-writer. He feels he should have more up to date technology, especially a digital projector. Because of the lack of access to a digital projector Teacher One finds he has to print off copies of lesson instructions for his students rather than use a multimedia presentation.

Teacher One: I find it rather ironic that in the digital classroom I have an overhead projector that is 30 years old and I am still having to print off stuff onto acetate and display it on the whiteboard.

Another example Teacher gave was access to scanners. He has only one scanner in his room; scanning is a time-consuming activity and, with 15 students wanting to use the scanner, it is a long wait. With only one video camera, this requires careful equipment management when groups of students want access. In the digital classroom environment access to ICT equipment needs to be immediate.

Teacher Two

Teacher Two would like access to a variety of educational software that is loaded onto the server. He would also like the teachers to be consulted in the type of software purchased by the school. A digital class syndicate of teachers would also help in planning and classroom preparation.

Teacher Three

Teacher Three would like the data projector permanently mounted on the ceiling of her classroom where it would be available for immediate use. At present the projector is shared between the team, having to set it up is a problem because you have cords running to it and it can be knocked. This discourages teachers from using the equipment. Also, it is locked in a cupboard in the team leader's classroom.

At present the computers are in a row at the side of the room, so the students can be easily supervised when they are on the internet. This layout makes it more difficult for groups of students to work on one computer. The row layout also allows more space in the rest of the classroom, sometimes the desks need to be separated for individual testing such as pupil achievement tests. The room layout needs to be more flexible.

Being a Team Leader, Teacher Three tries to keep up to date with research and keep up with professional reading in ICT developments. She likes to reflect on the digital classroom concept and make changes with her syndicate. The syndicate shares what classroom tasks they are doing weekly and record their achievements on the school intranet. The students are encouraged to find out class goals and plans from the intranet.

Teacher Three is aware that there are different perceptions of what a digital classroom is. She tries to talk with other teachers about the concept. She has found that other teachers run their classrooms quite differently. The teacher finds it frustrating that there is no model available of how a digital classroom is run.

Teacher Four:

Teacher Four thought that a permanently mounted data projector would be an advantage because he could model easily what he wanted the students to do. At the moment they gather around one computer or he borrows a data projector from the team leader of the syndicate.

The teacher finds the background noise from seven computers can be an issue and he does not want anymore computers in his classroom. At present the computers are set up in a row and group work is difficult. Sometimes he seats a more able student next to a student and the student is able to help. On the other hand some students are better working on a computer on their own for behavioural reasons. One solution the teacher mentioned was a block of five computers suitably spaced, and then a separate another two.

Teacher Five

At present the computers are using the terminal server configuration in the digital classroom. Teacher Five would like the computers to be upgraded to faster machines; she did say they serve their purpose at present, but an upgrade would be nice.

Teacher Five would like to see her students contributing to the wider community; at the end of the year she has planned a programme where the students will go and work as a volunteer in small community-based groups to share their ICT skills. For example, a small person may work from home and the student may be able to design a webpage or produce some business cards.

Teacher Five has also worked in with Waikato University; some students attended some computer science lectures and got involved in 3D graphic design and the response from the students was very enthusiastic.

Teacher Six

Teacher Six would like to see the network infrastructure improved because her classroom is a pilot scheme the wiring is external and visible in the classroom. The seating also needs to be improved upon so the students are sitting on adjustable computer chairs. Teacher Six would also like a permanent data projector mounted in the classroom so it can be used whenever necessary. More software for specialised applications such as video editing would be useful. The school has the cameras but needs a more powerful computer for editing.

Teacher Six is trying to encourage another teacher at the school to run a digital classroom. She finds it difficult to find another teacher to try the digital classroom concept.

The teachers were asked to raise any other issues.

Teacher One commented that he found the digital classroom environment very enjoyable to work in.

Teacher Two was leaving the school, not because he did not enjoy working in the digital classroom environment, but he wanted to teach in another age range.

Teacher Three would like the digital classroom teacher role clarified, and would like a model provided for some guidance as to how her school was going.

Teacher Four had nothing further to comment.

Teacher Five said she found teaching in the digital classroom environment very rewarding; she said the students and parents loved the concept. She enjoyed coming to school because the students were so highly motivated.

Teacher Five: 28 highly motivated students who want to listen to you, who have high respect and high regard for what you're trying to do with them.

Teacher Six would like to be able to expand the digital classroom concept within her school. She is in the process of mentoring another teacher with the possibility that he will run a digital classroom next year. She would like to see the ICT skills develop school-wide.

5.11 Chapter Summary

In this chapter the data has been presented. The following points have been made:

Definition of a digital classroom

- Each teacher had a different definition of a digital classroom.
- Five teachers thought the technology was important in the definition.
- Teacher Five thought that the pedagogy was important rather than the technology.
- All the teachers felt that ICT should enhance the learning in a classroom.
- The definition of a digital classroom will include pedagogy.

Digital classroom resources

- All classrooms were networked.
- All classrooms had broadband connection to the internet.
- Computer ratios to students varied from 1:1 to 1:4.
- Scanners, video and digital cameras are common to all classrooms.
- Access to ICT peripheral equipment varied from room to room.
- Network and internet crashes disrupted classroom organisation.

- Teacher Five had the classroom extensively modified to make allowances for the ICT equipment.

Professional development (PD) in ICT

- Variation in ICT PD overall.
- Variation exists between teachers in same school.
- Variation between ICT PD between schools.
- One teacher received no PD.
- PD offered was mostly ICT skills-based.
- Except for School Two ICT PD is optional.
- There is no action research carried out by any school.

Digital classroom organisation

- Except for Teacher Four group work is a feature of every classroom.
- Students are rostered onto the computers at certain times.
- Every teacher had a different method of organising the class regarding ICT use.
- Classroom organisation in each class was very flexible.
- One teacher allows her class to choose their own timetable over a week.
- Teacher Six has a class of students for one term only, then another group has a turn in the digital classroom, a total of four groups over a year.

Pedagogy in a digital classroom

- Teacher One: Flexible organisation, grouping, ICT and a bookwork part to the classroom, moving between the instructor and facilitator role.
- Teacher Two: Students have freedom to learn, high motivation, use of problem solving, and use of groups in learning.
- Teacher Three: Individual responsibility for learning, constructivist approach with the teacher taking a facilitation role.
- Teacher Four: Traditional teacher approach with the learning being directed by the teacher. Individual use of computers.
- Teacher Five: Constructivist Learning environment, teacher as a facilitator, student-centred inquiry-based learning. Group work on computers.

- Teacher Six: Constructivist learning environment, teacher as facilitator working alongside students. Problem solving-based environment.

Funding and Support

- Two teachers' source funding from the parents in the form of an annual fee.
- All classrooms are funded by the Board of Trustees.
- Four teachers were funded totally by the Board of Trustees.
- In Teacher Five's classroom it was optional for the students to provide their own laptop.

Stakeholders' attitudes

- Teacher One thought that the parents should have a greater say over what happens in the digital classroom; his reasoning was that the parents pay an annual fee.
- Teacher One felt there is pressure from students and parents to use the computers regularly and that there was high expectations from the senior staff at the school in the use of the computers.
- Teacher Two also felt there is high expectations from the senior staff to make the digital classrooms a success and 'better' than a normal classroom.
- In the paying digital classrooms, there was extra pressure for the students to succeed.
- Teacher Three was well supported by the senior staff who, because of recent ICT PD, understand the benefits of a digital learning environment.
- Teacher Four received support from his teaching peers.
- Teacher Five and Six are well supported by their principals.
- All digital classrooms have positive Board of Trustees support.
- All the students are very positive about the digital classroom concept and are well motivated.

Positive aspects of the digital classroom

- Teacher One: Developing independence in students and instant access to information which speeds up the learning process. Able to cater for a wide range of abilities in the classroom and provision of extension activities.
- Teacher Two: Students are highly motivated to learn and the parents showed an interest in the students' learning.
- Teacher Three: Highly motivated students being able to develop independence through the digital classroom organisation. Instant access to information to support the learning process.
- Teacher Four: Students able to present their work digitally and an improvement in the students' presentation skills.
- Teacher Five: Students are learning how to learn and develop high motivation for learning. ICT is linked to the inquiry process of learning. A strong collaborative learning environment has developed in the classroom. Also an improvement in the students' presentation skills.
- Teacher Six: Increased motivation for the students to learn. Effective group learning using the computers. Instant access to information to support learning.

Negative aspects of Digital Classrooms

- Teacher One: Lack of structure in digital classroom environment.
- Teacher Two: Pressure exerted on digital classroom teacher by the senior management of the school. This leads to extra stress on teachers and students. Server reliability and internet crashes disrupting classroom lessons. Isolation of digital classroom teachers in the school.
- Teacher Three: Coverage of the curriculum while giving every student an equal amount of time using the classroom computers.
- Teacher Four: Lack of time to complete paper-based tasks and computer-based tasks.
- Teacher Five: Lack of time to complete learning objectives in curriculum. Lack of physical education time due to students' reluctance to leave their half-completed work on computers.

- Teacher Six: Is aware of time spent working at computers and tries to take students out for physical education as much as she can. Lack of ergonomic seating in classroom, lack of funding for correct seating and computer desks.

Improvements for a digital classroom.

- Teacher One: More ICT resources hardware/software.
- Teacher Two: More access to educational software and more collaboration between the digital classroom teachers in the school.
- Teacher Three: Permanently mounted data projector in classroom and a more flexible room layout. Frustration that there is no digital classroom model to refer to when setting up a digital classroom.
- Teacher Four: A permanently mounted data projector and more flexible layout of the pod of computers.
- Teacher Five: An upgrade to faster computers and students being able to work with their digital skills in the wider community.
- Teacher Six: An improvement in the network infrastructure and a permanently mounted data projector in the classroom.

The next chapter will outline the student survey results.

Chapter 6 Results Students

6.1 Introduction

The previous chapter outlined the views of the digital classroom teachers regarding the critical success factors in the establishment of a digital classroom.

The results presented in this chapter comprise the findings from a short written questionnaire that was completed by the students' of the digital classrooms surveyed. Classroom Two was not surveyed as the teacher was leaving the school shortly after being surveyed and did not get the time. When the questionnaires were completed by the students' the forms were posted by the teachers to the researcher. The questionnaire contained open-ended questions surveying the student views on:

- What is a digital classroom?
- What the students liked most about a digital classroom.
- What the students disliked about a digital classroom.
- If and how the digital classroom improved the students' learning.
- How learning is different in a digital classroom.
- How can digital classroom be improved?

6.2 Definition of a Digital Classroom.

The students were asked to define a digital classroom.

Teacher One's students.

A classroom with computers.	18
With digital equipment	5
Do most of your work on computers	4
For researching	3
Enhancing student learning	2
A digital teacher	1
It costs more than normal class	1
Learn software skills	1
Learn spelling etc.. on the computers	1
Lots of brainy people	1
One computer between two students	1
Special and different	1
Use whenever needed	1
We still use pen and paper	1

Table 6.1: Teacher One's students' digital classroom definition

Eighteen out of 19 students view a digital classroom as a classroom with computers. Five students also indicated that digital equipment is an important part of a digital classroom. Four students stated that a digital classroom is where students do most of their schoolwork on computers. The students' emphasis on hardware in their definition is similar to their teachers' view.

As well as the emphasis on computer hardware, three students focused on the research part of computers in the classroom while two students thought that the digital classroom was about enhancing learning.

Overall the students' of Teacher One focused on the hardware aspect and completing their work on computers. A smaller number associated digital classrooms with working and researching on computers. It is interesting that only one student focused on the teacher a 'digital teacher'.

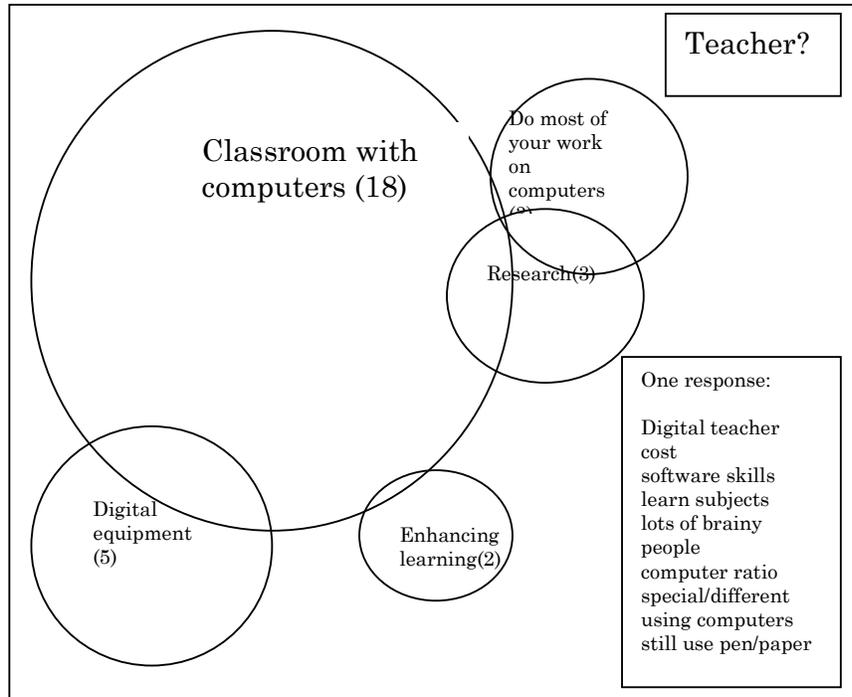


Figure 6.1: Teacher One’s students’ digital classroom definition

Teacher Two Students’: No data available in this chapter.

Normal class with 6/7 computers	9
Class with lots of computers.	8
Has movie making/games/slideshows	6
A classroom with more than 2 computers	2
A classroom with more than 3 computers in it.	1
A classroom with more than 4 computers	1
Has many sources of information	1
Has digital benefits available with computers	1
Room where you do more things on computers	1
Classroom with more computers, projector and movie making	1
Use computers often	1
With computers and you have different tasks and fun	1
Has lots of computer related activities	1
You can save your work on the computer	1
Gives you opportunity to learn in a diff way.	1
Use different technology to complete tasks.	1
Is more a privilege to learning more.	1
Room with people who need help or are good with comp	1
A learning centre	1

Table 6.2: Teacher Three’s students’ digital classroom definition

Nine of the students in Teacher Three’s class identified a digital classroom as a normal classroom with six or seven computers. A further eight students identified a digital classroom as a ‘class with lots of computers’. A majority of the students

therefore associated computer hardware and access to a digital classroom. Most of the other comments relate to what you can do with the computer. One student identified the digital classroom as a learning centre.

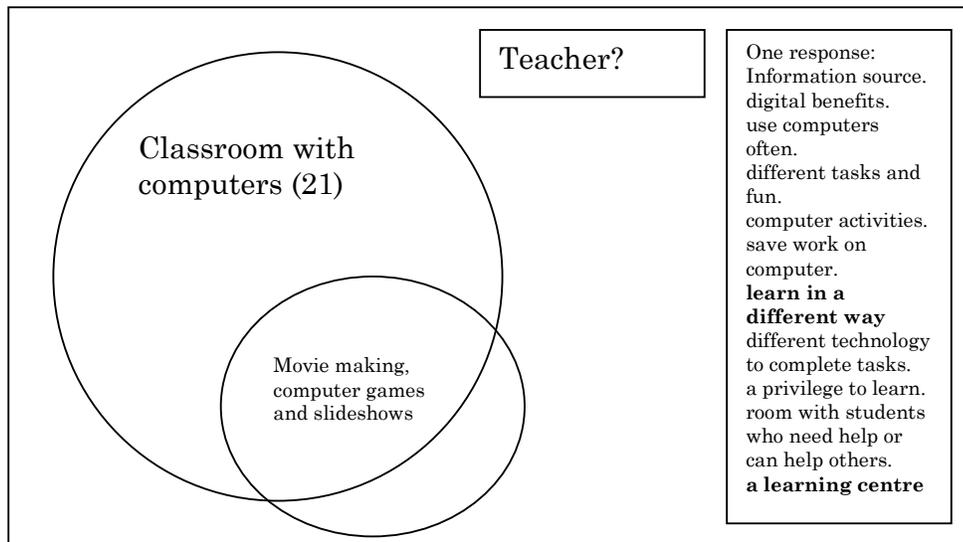


Figure 6.2 Teacher Three’s students’ digital classroom definition

Class with lots of computers	14
Class with 7 or more computers	7
Classroom with extra computers	2
You have 7 computers and you do lots of tasks on computers	1
Classroom with heaps more computers and you can use them more	1

Table 6.3: Teacher Four’s: students’ survey: digital class definition

The students in Teacher Four’s classroom associate the digital classroom concept with a large number of computers in a classroom. Four students included the ICT equipment that is present in a classroom. Computer hardware is the common factor here. One student mentioned doing tasks on the computers and one student mentioned increased access to computers. No students mentioned learning or the teacher.

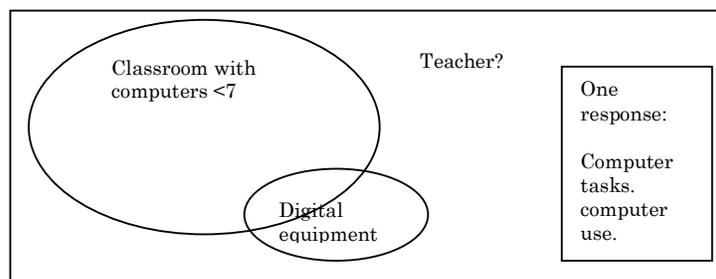


Figure 6.3: Teacher Four’s students’ digital classroom definition

Classroom where you mostly work on a computer.	16
Work on everything digital (computers, digital cameras, web cams etc)	15
Listen to digital music	14
You can create claymations with a digital/web camera.	8
You learn about computers and digital things	7
Improve your skills on computers/digital equipment	5
Playing games on the net check email in free time	3
Research on the internet instead of books	3
Learn how to research on the internet	3
Cool non grumpy teacher who gives us some freedom	3
Learn programs that would be useful for jobs in the future	2
Do things on computers, not on books	2
Have a fun day and play games in free time.	2
Lots of computer peripherals to use. (e.g. cameras)	2
Most of your writing is on computers	2
A great environment to learn where everyone is willing to learn	2
Do homework on the computer	1
Watch DVDs	1
You can go home and create movies for yourself	1
Only some subjects you have to do in a book	1
A privilege for a few students at school	1
A place where we can learn about digital objects	1
Use the computers and learn about school subjects while having fun	1
A class that you use the computers for everything except options and maths	1
Where everyone is happy because the learning environment is great	1
Learn how to use computers in different ways	1
Classroom that uses computers instead of books	1
Class-based on computers and the internet	1
Great opportunity for those who don't know about computers	1
Improves your typing skills and computer knowledge	1

Table 6.4: Teacher Five's students' digital classroom definition

Instead of describing how many computers they have in the digital classroom, Teacher Five's students talked about how they use the digital equipment. Using the cameras and making claymation movies was popular. The students also described how they learnt about the computers and digital equipment. An interesting comment was by two students, "*a great environment to learn where everyone is willing to learn*". The students also commented how they were given some freedom; an example of this is fourteen students stated that they were allowed to listen to music sometimes. The internet access was used for research and email was used for communication. Intrinsic to their comments is the presence of a different type of pedagogy used by Teacher Five.

The classroom environment has a constructivist base where the students have an opportunity to construct their own learning.

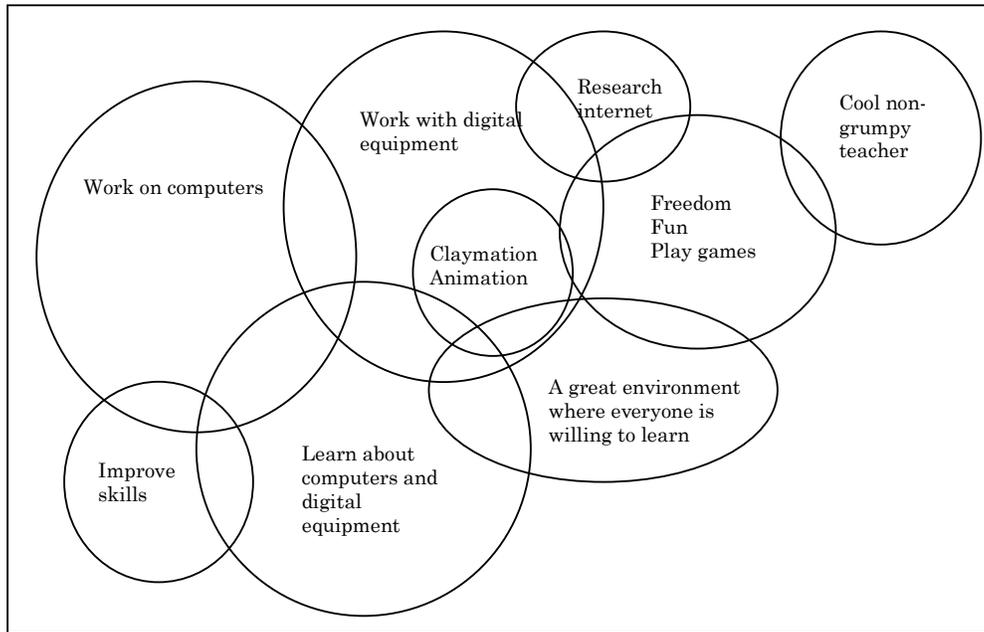


Figure 6.4 Teacher Five's students' digital classroom definition

Teacher Six students

Classroom with computers and you learn about the programs/skills	18
A computer class where you do most of your work/learn on computers	6
We work in the digital classroom for one term from senior syndicate	3
A room filled with computers where children learn how to learn about computers	2
Where you learn lots of things about computers	2
You don't work/write in your books you work/write on the computer	2
Where you learn how to type properly and fast, writing and more work	1
The computers are so we can learn more	1
I think most people in Room 12 enjoy it	1
The teacher goes to courses to learn things then tell us more things	1
Digital classrooms have more computers than the rest of the classes	1
With only 15 computers you have to wait for your turn	1
A class with computers and other equipment like scanners	1
A class where you play games on the computers	1
It is a computer room	1
A class with computers teachers and children	1
For students who don't know about the computer	1

Table 6.5 Teacher Six's students' digital classroom definition

Teacher Six's students are focused on using the computers to learn programs and improve their computers skills. They also see a digital classroom where you do most of your work on the computers and learn about computers. This is the only school where the students are cycled through the digital classroom for a term. They tend to see the digital classroom as a place to learn about computers and improve their skills. This is the only class that mentioned that the teacher goes on courses about ICT and passes the skills onto the students.

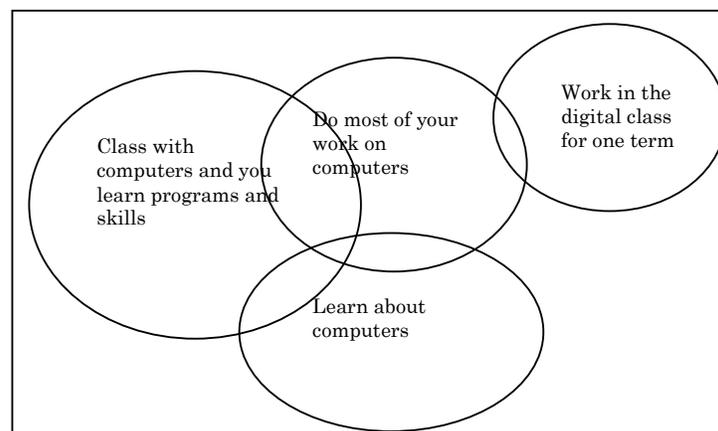


Figure 6.5 Teacher Six's students' digital classroom definition

6.3 Positive aspects of a digital classroom

The students were asked, about the positive aspects of a digital classroom.

Teacher One students

Computer access/time	8
Knowledge of computer progs/skills	7
Internet access for information	3
Research whenever you like	3
Don't have to go to ICT suite.	2
Create animations/computer effects	2
Write without spelling worries	1
Able to write and save work	1
Enhanced learning style	1
The digital camera/video	1
Ease of writing and neatness	1
Better behaved students	1
Complete project on computer	1
Learning on the computers	1
Learn better than ordinary class	1
Makes the class look brainy	1
Preparation for life using computers	1
Faster to complete school work	1

Table 6.6: Teacher One's students': positive aspects of a digital classroom.

Students in Teacher One's classroom clearly see access to computers and time using the computers as a favourite. Linked to this, the students feel that knowledge of computer programs and skills is important. Access to information and the ability to research on the internet are also important. Some students think that the learning is better in a digital class with responses such as an *enhanced learning style, learn better than an ordinary class, makes the class look brainy and ease of writing and neatness*. The comments here still reflect the attitude that the computers are an add-on to a normal class and there is no major change in teaching pedagogy.

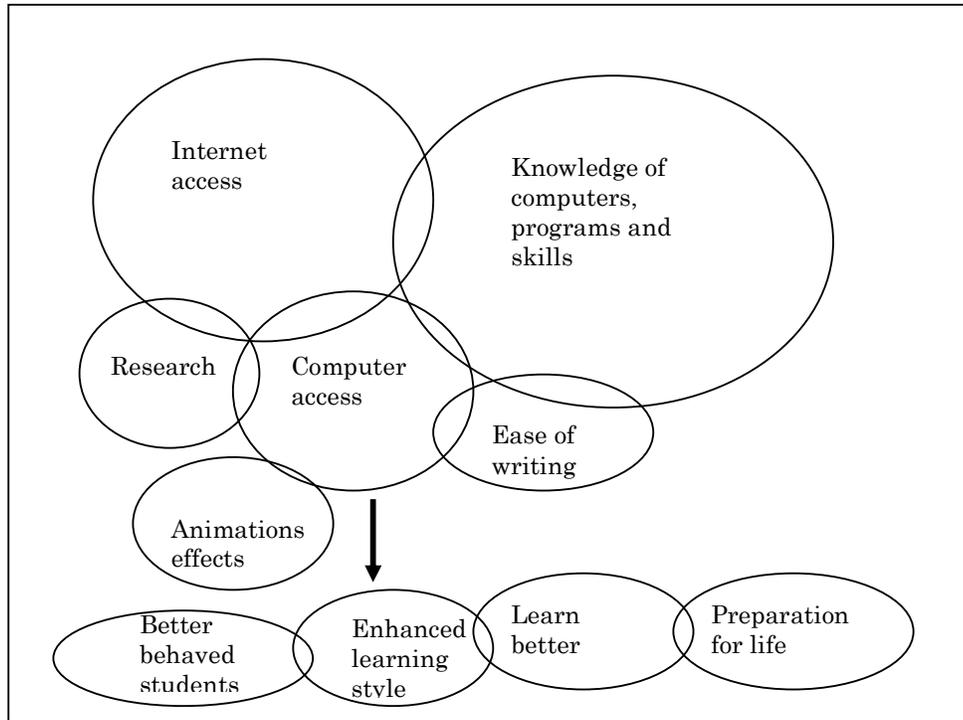


Figure 6.6: Teacher One’s students’ positive aspects of a digital classroom.

Teacher Two Students: No data available

Teacher Three Students

Going on the computer and doing activities	9
You get more turns on the computer for longer	8
The fun games and activities	5
Producing work on the computer/movies/games	4
Planning our own day	3
Not doing so much handwriting	2
Going on the computer, learning and researching	2
Using the internet	2
Using the computer to type stories and projects	1
Creating playing music	1
It is fun and a new learning experience	1
Learning things in a different way	1
So many people on separate computers at once	1
My teacher	1
Except for reading and listening to teacher its fun	1
Using advanced technology	1
It is beneficial you learn more from them	1
Doing what I cant do on my computer at home	1
Completing work at home in our own time	1
The technology because it helps my learning	1

Table 6.7: Teacher Three’s students’: positive aspects of a digital classroom

Teacher Three's students enjoy activities on the computers and getting more turns on the computer. Other favourites are also associated with the computer, using the fun games and constructing movies on the computer. One unique feature of Teacher Three's room, planning their own day, was popular among three students. Learning and researching on the internet was popular with four students.

Some students felt that the learning was important in the room with comments such as: *learning things in a different way, a fun and a new learning experience, it is beneficial because you learn from them and the technology because it helps my learning*. Linked to learning, one student identified the teacher as being an important component of a digital classroom. One student felt it is important that the work could be finished at home.

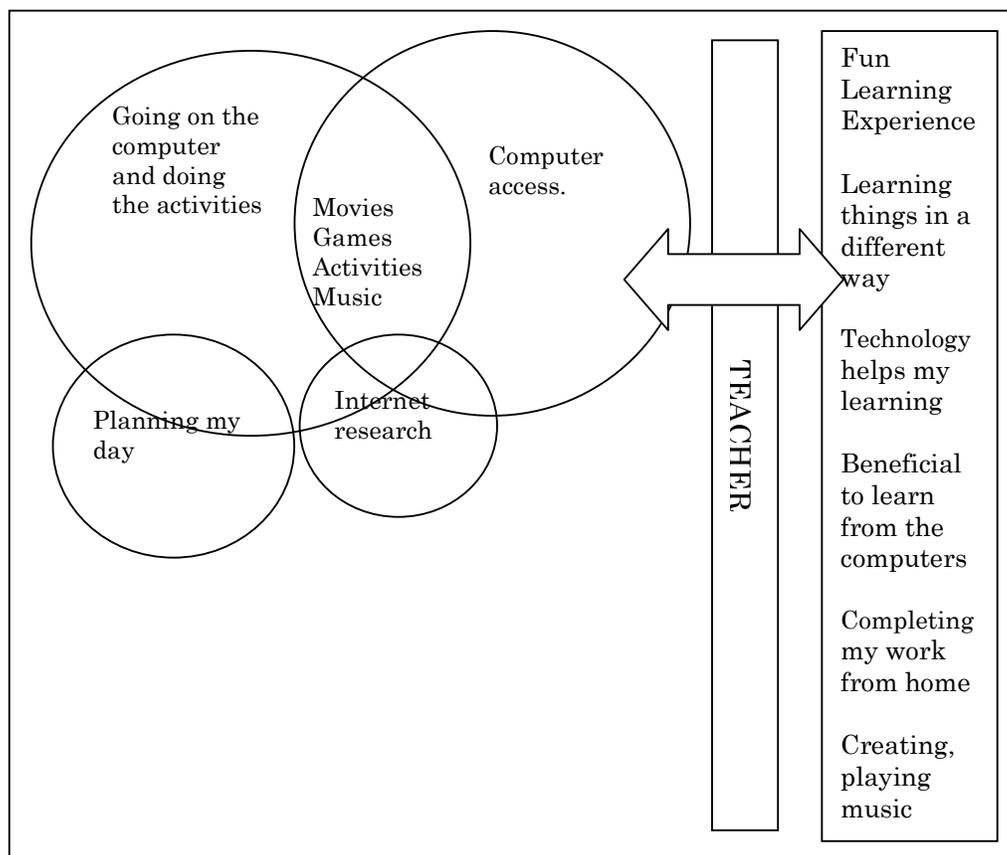


Figure 6.7: Teacher Three's students' positive aspects of a digital classroom

Teacher Four Students

There are lots of computers to use, ease of access	8
Larger group can go on the computers	3
We can play on the computers/games	3
More people can go onto the computers	2
It is easier to do hard work on the computers	2
The computers	2
You can find out a lot of interesting facts	2
You can learn different things	2
I miss out on work and get to go on the computer instead	1
You have more choices, eg publishing, painting, internet	1
Doing projects in a digital classroom	1
The digital equipment makes it easier to do things	1
With the computers you can do things that are cool	1
The computers are faster and updated	1
Do lots of extra things on the computer	1

Table 6.8: Teacher Four's students': positive aspects of a digital classroom

Thirteen students thought that ease of access to the computers is a positive aspect of being in a digital classroom. Three students thought that 'playing' on the computer with games was positive. Two students commented that it is easier to do hard work on the computers, it was helping with their learning. Research is also a reason for liking to use the computers in class: *you can find out many interesting facts and you can learn different things*. Overall computer access is a positive issue and completing fun activities on the computer is popular with the students.

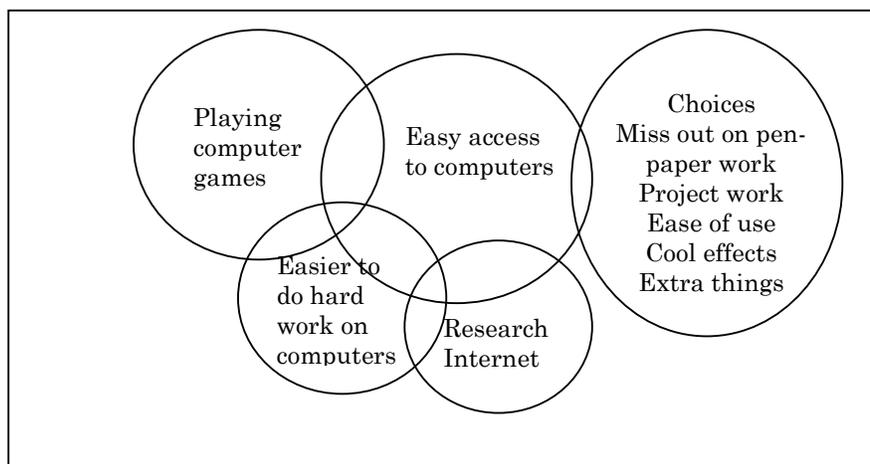


Figure 6.8 Teacher Four's students' positive aspects of a digital classroom

Teacher Five Students

Using the Digital/video cameras	11
The air conditioned classroom	10
Creating the claymation videos	6
Listening to music while working	6
Freedom to use the internet to find information	6
Work on computers and learn about computers	4
Using the computers	4
Getting homework from the internet	3
When finished our work we have free time playing games on computers	3
On a rainy day we have free time on the computers at lunch time	3
I like it that the teacher trusts us (Leaves us alone to do our work)	3
Get free time to do things we like using the technology	3
Working on the computers instead of writing in books	3
Playing games on the computers	3
Doing work on the computers because it improves my typing skills & spelling	2
Publishing on the computers	2
The good environment	2
Going onto hotmail and sending in our homework	2
Learn more about computers and how to use them	2
Use computers for most of the day	2
The learning is fun! We learn heaps everyday	2
The computer environment	1
I like working with all the technology in the digital classroom	1
Being able to stay in and finish work	1
The peer support in the class	1
Using clipart in our publishing work	1
The teacher leaves us to do our work and encourages the use of technology	1
We have a cool teacher	1
I like the fact that most of us are all really good friends!	1
Watching DVDs	1
Using the COWS (computers on wheels)	1
I love making e-books	1
Not paying to be in the digital class	1
Spelling auto-correct	1

Table 6.9 Teacher Five's students': positive aspects of a digital classroom

Teacher Five's classroom is a very positive learning community. The majority of the students indicated that they liked using the digital/video cameras to create movies and multimedia. Ten students commented on the air-conditioned classroom.

Freedom to learn is a theme that is present among the students' responses. *I like it that the teacher trusts us (Leaves us alone to do our work)*. They enjoy using the internet for research in a supportive trustworthy environment. *Freedom to use the internet to*

find information. Get free time to do things we like using technology. They enjoy working on the computers and finding out about computers.

The barriers between home and school seem to be breaking down with the students enjoying getting their homework from the class internet site and sending it to the school as an attachment in hotmail.

The students enjoy any free time to use the computers, *get free time to do things we like using technology.*

The students display a very positive attitude to learning in the classroom. *The good environment, the learning is fun, we learn heaps everyday.* A strong supportive learning environment is present, *the peer support in class, I like the fact that most of us are really good friends.*

The students appreciate that the teacher has taken the role of a facilitator, *the teacher leaves us to do our work and encourages the use of technology, I like it that the teacher trusts us and leaves us alone to do our work, we have a cool teacher.*

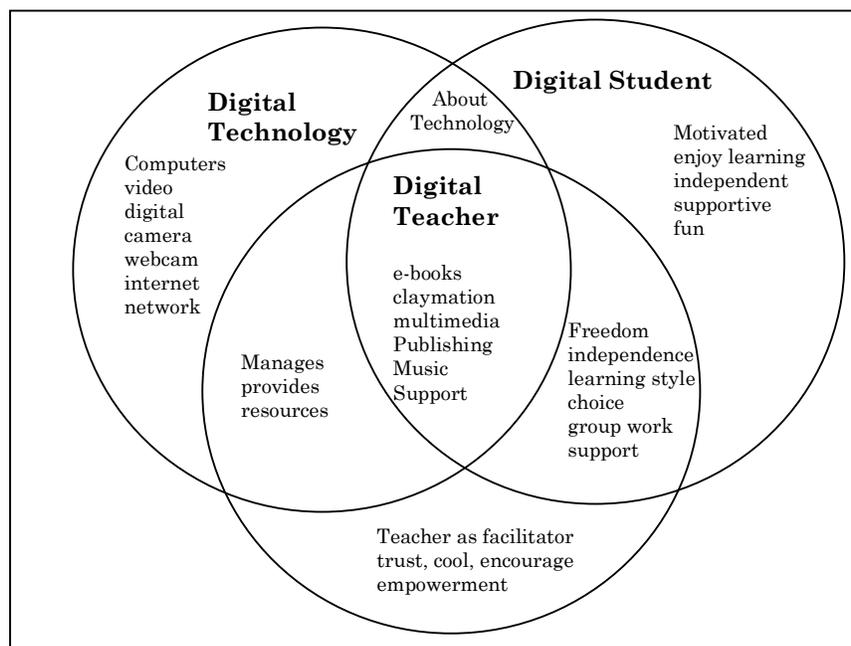


Figure 6.9 Teacher Five's students' positive aspects of a digital classroom

The three key components of Teacher Five’s classroom from the students’ point of view are the digital technology, the digital student and the teacher. How these interact together is what makes up this digital classroom. This classroom is very learner-centred and the students are independent, motivated and enjoy learning. The ICT enhances learning and engages the students. The teacher is a facilitator of learning. The classroom pedagogy is constructivist-based with the students taking responsibility for their learning. This concept will be discussed in chapter 7.

Figure 6.9 is pivotal to understanding the role and interaction of the digital student, the digital technology and the digital teacher. Where all three intersect powerful learning occurs. What has happened in traditional classrooms is that change has happened with the digital technology and the digital student but in many cases the teacher has not changed or adapted. To some extent the teacher is held back by curriculum demands (the curriculum is grounded in the non-digital era). This will be further discussed in the discussion and concluding chapters.

Teacher Six Students

Working on the computer to produce my work	11
Playing Carmen Santiago game	10
We learn about computers and new computer skills	6
Making pictures in Paint	5
Making slide shows/PowerPoint	4
You change your teacher and classroom	3
Not working in your books all the time	3
Learning how to type well	3
How to use the internet for research	2
You don’t have the same people in your class	1
Making PowerPoints	1
That my skills and knowledge about the computer has increased	1
A cool teacher because we wouldn’t be learning anything without her	1
A special class and special teaching	1
Using the computer for most of the day	1
Presenting my work on the computer	1
Using digital cameras	1
Instead of using pencils we can use computer for writing	1

Table 6.10 Teacher Six’s students’: positive aspects of a digital classroom.

Because of the digital classroom organisation in this school, (students spend one term in this class then return to their home class) the students view the positive aspects as

being able to use the computers to complete their schoolwork and learning about the computer. They value learning about computer skills which they can use when they return to their home classroom. They enjoy playing an interactive game called Carmen Santiago, constructing slide shows in PowerPoint and constructing digital pictures in paint. Using the internet for research is also important to the students. They view the computer as an alternative way to complete their school work and enjoy learning about computers.

Teacher Six students use computers extensively as part of their classroom activities. They see learning about computers as being important which will improve their computer skills. The use of computers to publish their work using a word processor or multimedia is also a positive aspect for the students. They enjoy using interactive fiction games such as Carmen Santiago where the students have to solve problems using skills such as geography facts. This will be discussed in more detail in the discussion chapter.

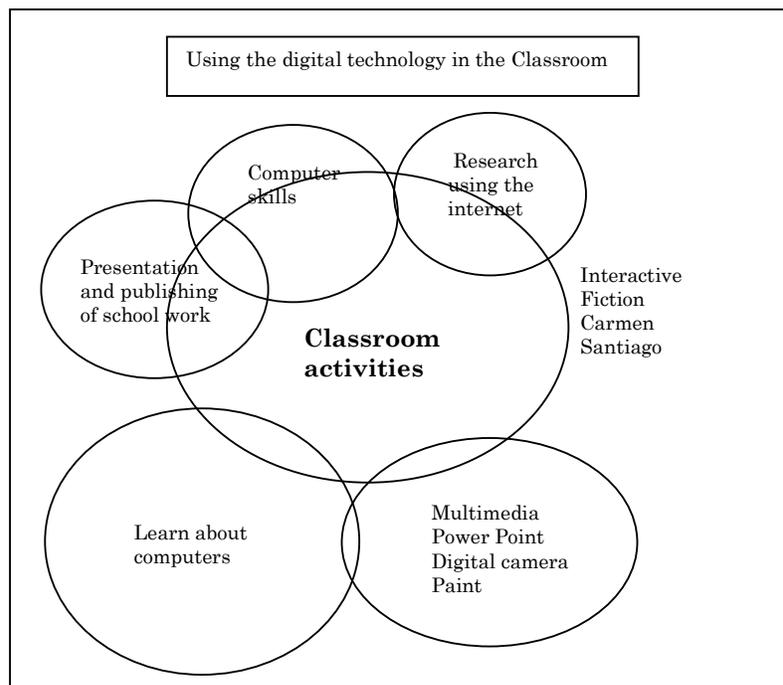


Figure 6.10 Teacher Six's students' positive aspects of a digital classroom

6.4 Negative aspects of a digital classroom

Teacher One's students

Missing out on using a computer	6
Having to share the computers	5
Computer reliability and loosing work	4
Doing less work on books	2
The classroom furniture	1
Not having desks	1
Noise in computer area	1
Misuse of the internet	1
Some people are sponsored for fee	1
Too many people in room	1
Cleaning up the big room	1

Table 6.11 Teacher One's students' negative aspects of a digital classroom

Most students in Teacher One's class are concerned about not getting access to a computer. Six thought that missing out on using a computer is a concern while five students did not like having to share the computers. It is interesting that four students were also concerned about the reliability of the computers and loosing work. Two students were not happy with the classroom furniture and not having their own desks. Also with the classroom environment, one student was concerned about the noise in the computer area. One student was concerned about the misuse of the internet. This class has an annual fee for being in the digital classroom; one student was concerned that some students are sponsored for free. One student was concerned that there were too many people in the room, while one student was concerned about the cleanup.

Teacher Three's students

Filling out the digital diary, it takes time and you forget to do it	3
Sometimes I miss out on a subject because I am on the computer	3
Interrupts some exciting things we do in class	2
Frustrates me when it freezes and you loose work	2
The humming noise from computers	1
Computers can be slow	1
Keeping up with the work on the computer	1
We have lots of homework and class work	1
There are not enough computers	1
When you have to get off the computer	1
When I print out something it is not right	1
Not finishing my school work	1
In wet lunches the same people rush to computers	1

Table 6.12 Teacher Three's students' negative aspects of a digital classroom

Teacher Three’s classroom organisation involves students completing a daily digital diary. Three students were concerned about the time it takes and they sometimes forget to do it.

Three students were also worried about missing out on a subject because they were timetabled to use the computer. Two students also thought that the computer time sometimes interrupts some exciting things they did in class.

Reliability is also an issue as it causes frustration when the computer freezes and the students can lose work. One student also complained about the computers being slow. One student was concerned about the printing process and getting the document correct.

Access is an issue – not getting on the computer and there are not enough computers to use. In the wet lunch hours the students race in to get a computer to use, and some students miss out. One student commented that because of access he/she did not get the school work completed.

Some students were not happy about the amount of schoolwork in the digital classroom and keeping up with the work on the computers.

The classroom environment was also an issue with the noise from the computers being a concern for a student.

Teacher Four’s students

Nothing	17
Because people fight over the computers	3
Is too noisy	2
If there is a storm the computers would turn off	1
Getting off the computers	1
Concern over eye health through using overuse of computers	1
Concern over electrical safety, plugs etc..	1
Cant always sit by my friends	1
You don’t go on the computers for 2-3 days sometimes	1
Writing stories on the computers	1
Too many computers	1
The computers take up room	1

Table 6.13 Teacher Four’s students’ negative aspects of a digital classroom.

Generally Teacher Four's students are very content with the digital classroom. Three students are concerned over computer access commenting that students fight over the computers. One student thought that you didn't get to go on the computers for 2-3 days while one student thought there were too many computers. One student didn't like getting off the computers. One student thought that the computer organisation meant he/she couldn't always sit by friends. Two students find the digital classroom environment too noisy.

Teacher Four's students' responses are very mixed. Two students were concerned about safety, one for eye health through looking at the monitors for a long period of time and one student was concerned about electrical safety with the cords/plugs. One student was concerned about the computers taking up too much room. Writing stories using the computers is also an issue.

Teacher Five's students

We don't get to go out to Physical Education much	10
The old computers	9
It is boring doing your maths in a book when you are used to a computer	5
I would like better chairs(like in the tech computer room)	3
We just get one option	3
I like hard work, the reading activities are easy and boring	3
I would like to go to the library more often	2
Our handwriting skills might go down	1
Concerned for eye health watching a computer screen	1
Don't have much free time	1
The design room has better computers	1
Nothing	1

Table 6.14 Teacher Five's students' negative aspects of a digital classroom.

It is interesting that ten students are concerned about the lack of physical education in their class. The teacher also related that physical education time does suffer as the students get so involved in completing their tasks on the computers. Nine students are concerned about the old computers being used; this is related to the speed of the computer processor.

Five students thought that it is boring having to use a book for the maths lesson while they use the computer for the rest of their subjects. Three students are concerned

about the chairs used, they would like the proper office computer chairs like in the technology room. Three students complain about only getting one optional subject, while three students also complained about the reading activities on the computer being too easy. Two students were concerned that they were not getting to the library; I assumed that they go to the library to read books. One student was concerned about eye health through looking at a computer screen for long periods of time. One student was concerned that handwriting skills would regress.

Teacher Six's students

I like almost everything in the digital class	10
I don't like doing a computer activity with a partner	4
We don't have enough computer for everyone, so we have to share	3
We only get to stay one term	2
When I get home I don't feel like playing Sims on the computer	1
Not enough computers and you cant use them all the time	1
There is lots to do and no time to relax	1
We don't get to the subjects/activities the normal classes do (cooking)	1
Playing Carmen Sandiago and having to type fast	1
The hard work	1
I don't like working in books and writing articles on things	1
When we stay in here so long it hurts my eyes	1

Table 6.15 Teacher Six's students' negative aspects of a digital classroom.

A large majority of students (10) commented that they like almost everything in a digital classroom. Four students didn't like using the computer with a partner, a reflection of the large amount of group work in the class. In a similar vein, three students did not like having to share the computers. One student stated that there were not enough computers so you can't use them all the time. Three students expressed concerns that there was too much work to do in the classroom. Two students would have liked to stayed in the digital classroom for the whole year rather than just one term. One student felt *computered out* by the time they got home and did not feel like using the home computer. Also one student commented that their eyes started to hurt through looking at the screen for long periods of time.

6.5 Improvements to learning

The students were asked a question in the survey to comment upon whether they thought the digital classroom improved their learning.

Teacher One students

Because most jobs will involve computers	3
We still get to learn maths, spelling and handwriting	2
Improves your computer skills otherwise just the same.	1
Improving my maths	1
No, because you hear the same word over again	1
Yes, I have learnt lots both on and off the computers	1
The Year 8s help you what you don't know	1
Computers help your learning and homework	1
We learn but don't spend most of our time on computers	1
Yes, I learn skills like PowerPoint.	1
I think you learn most from your peers.	1
We learn new things	1
Computers are another learning tool	1
Everyday I have the chance to go on computer and learn new things	1
Computers increase your knowledge of computing.	1
Yes, by 2 years six months	1
Yes, we use the computers for spelling	1
Yes, you have better learning resources	1
Yes, it is easier to research	1
Improves my computers skills and normal things you learn	1

Table 6.16 Teacher One's students' learning improvements

Twelve student comments were focused on their perception that the digital classroom improves their general learning. One student was very specific stating that his/her spelling/reading age had improved by 2 years 6 months! Three students thought that the digital classroom improves their computer skills. Three students thought that their experience in a digital classroom will increase their chances of getting a better job because of their knowledge of computers. Two students commented that they still get to learn maths, spelling and handwriting, it is assumed that these subjects are done off the computer. One student commented that it improves your computer skills and otherwise it is just the same as a normal classroom. Peer support with the computers is present in the class as two students mentioned the help they get from fellow students.

The diagram shows that the students feel that the digital classroom improves their learning and their computer skills which will enhance future employment. Peer support is also a factor that the students feel is important.

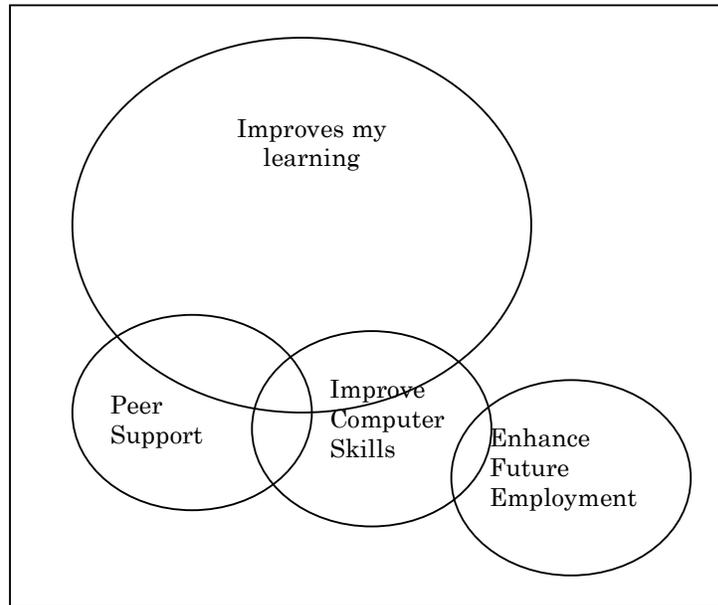


Figure 6.11 Teacher One’s students’ improvements to learning

Yes because of the internet and the work/learn/information	9
Yes I learn how to use more internet sites	2
Yes I have learnt how to make slide shows and other things	2
Yes it improves my organisational/time skills	2
Yes, we learn how to spell because of auto-spell	2
Yes by helping me work the computer	2
Sort of improves learning but some of us already know stuff	1
Yes because you can learn how to use computers for things	1
We can learn how to use a data projector	1
You get to manage your own time, have fun and learn	1
Yes I know more and more things out of the book.	1
Yes, by doing more work and learning to do digital things	1
Yes it has improved my word knowledge	1
Much the same as normal class but more fun	1
No, because it is just the same as other classrooms	1
Yes, because you learn things you may not learn in class	1
Yes more time to research when I am doing a project	1
Yes because you have more time to learn	1
More digital learning but less class time	1
Yes, improves our skills in modern technology and makes learning fun	1

Table 6.17 Teacher Three’s students’ learning improvements

Twelve students in Teacher Three’s classroom focused on the benefits of the internet resource on their learning. Six students saw gaining more computer skills more as a

advantage for their learning. Five students felt that learning more was how the digital classroom improves their learning. Four students commented that the class organisation improved their learning.

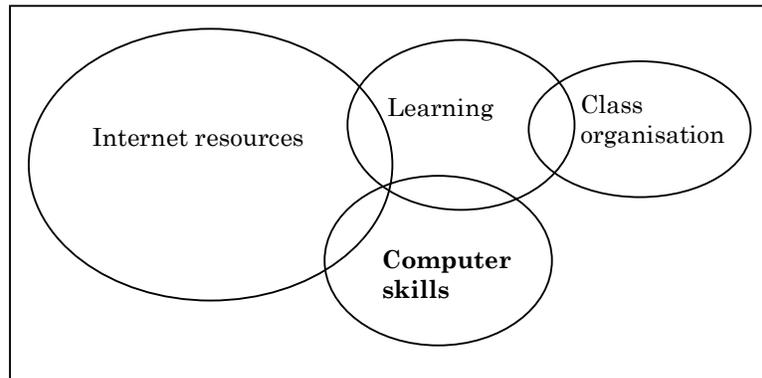


Figure 6.12 Teacher Three's students' improvements to learning

This diagram shows how internet resources/learning is important to the Teacher Three students. Figure 30 shows the importance of the internet resources that the Teacher Three students perceive is important to their learning. This is closely related to the benefits of increasing their learning coupled with an increase in computer skills that the Teacher Three students feel is important. Some students also thought that the digital classroom organisation improved their learning.

Yes, you can learn more about computers	4
Yes, the digital classroom gives me more information	4
Yes, because you can learn what new programs do	3
I am not sure	2
It does teach you stuff through the activities	2
Yes, you can look on the internet for stuff	2
Yes, more opportunities and they are good for learning	1
Not really, only if the teacher tells us new things	1
Yes, because you learn lots of things educational	1
Yes because it prepares you for using a computer later in life	1
Yes, we can get more things to help us	1
Yes we can extend our learning	1
Yes, it improves my computer skills and my work.	1
Yes you can always go on the computers	1
Sometimes the teacher teaches you things about the computer	1
Yes, I can understand the second time better.	1
You can learn more things from a computer	1
No, because there is nothing different	1
No, it is a normal class but you get learning on computers better	1
No, it will be too easy to do things we will be lazy	1

Table 6.18 Teacher Four's students' learning improvements

A majority of students, seven students thought that the information resource that computers/internet provides was important for their learning in a digital classroom. Five students thought it was important to learn about computers in a digital classroom environment, of those five, one student thought it was important to learn about computers for the future. Closely related to this seven students thought the digital classroom environment enabled them to learn about things. Six students thought that learning of computer skills and about software is important learning. Three students answered no: one student thought the teacher was the important provider of learning and one student thought that it was just a normal classroom with a pod of computers while one student thought that the technology could make you lazy.

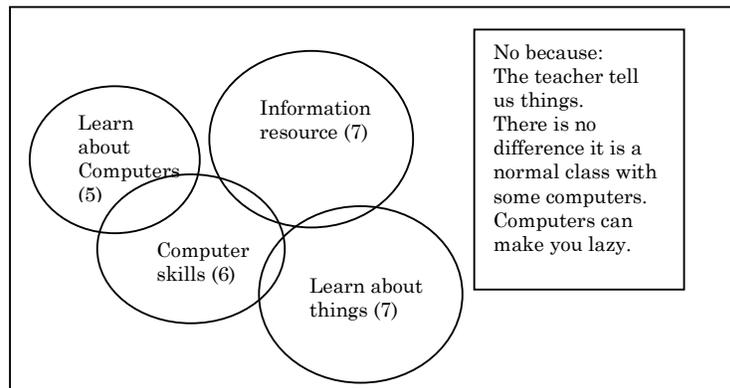


Figure 6.13 Teacher Four’s students’ improvements to learning

Improves your researching	7
Yes information on the internet	6
It is faster because you are typing on the computer	6
Yes easy access to spell-check, electronic thesaurus and dictionary	4
Yes we learn so much about computers and technology	4
Each day I am learning more about computers	4
Yes through using computers their functions and programs	3
Yes it helps your spelling	3
Yes you can improve your computer skills while you're working on the computer	3
We get faster at typing and we finish work quicker	2
There are lots of resources	2
Yes the technology will come in handy when we are older	2
We are learning about things like internet safety	1
The teacher explains how to do your work on the computer	1
It does for some people but not for others, depends on how they like to learn	1
There needs to be a balance between learning about computers and basic subjects	1
It improves our learning because we don't have to listen to the teacher all the time	1
It makes me more independent and confident in my learning	1
No because the spell check corrects your spelling	1
It makes me think more and the learning is fun	1
The digital class is the best class I have been in	1
Working on computers makes us more enthused for finish our work	1
Helps improve our knowledge	1
We don't spend all day writing in books and buying pens	1
Yes because you can get things done faster, you do more work than normal class	1
It makes us want to get on to our work because it is fun doing it on a computer	1
We improve our questioning skills	1
We are taught a range of new things	1
We don't have to go the library so often we can use the computer	1
We have heaps of fun with our peers	1
Yes it helps your reading	1

Table 6.19 Teacher Five’s students’ learning improvements

Sixteen students thought that the digital classroom improved their researching and locating information through the internet. Eleven students felt that the digital classroom allows them to improve their computer skills. Eight students commented

that typing was fast and they can complete their work quicker. Eight students felt that their spelling improved because they have access to spelling tools on the computer. Three students thought that learning about computers and technology is important. Three students also felt that the digital classroom provided them with increased motivation to learn. Two students commented that the knowledge they gain about technology will be important for them in the future. Two students also felt that the digital classroom allowed them to develop independent learning skills. Two students commented that they were developing thinking skills and questioning skills. One student felt that the digital classroom environment suited some students and not others. Another student stated that there needs to be a balance between learning on and off the computer. One student thought that the teacher was an important factor in learning. Peer support through learning and having fun was considered important by one student.

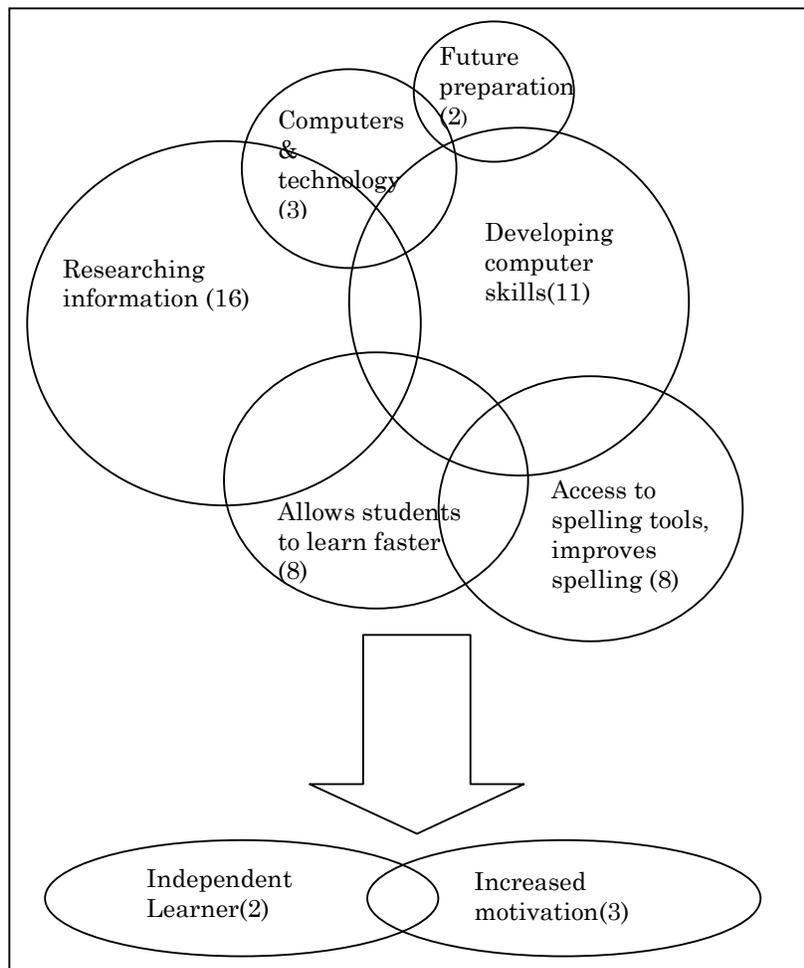


Figure 6.14 Teacher Five’s students’ improvements to learning

A combination of access to information, developing computer skills and the perceived ability to learn/work faster lead towards the development of an independent well motivated learner. The students also think that learning about computers and technology is important now and for their future careers.

Yes, you learn how to use a computer	5
Yes you can learn new and different computer programs	5
Yes, It improves my typing speed	3
It improves your computer knowledge	2
Yes, I have learnt how to do custom animation	2
Yes you get play a typing game to improve our typing skills	2
It has improved my English language on computers	2
Improves my learning so I can learn more on the computer	1
At home I have a computer and it helps and it does here	1
When you go back to your home class you can do more things on computers	1
Yes, what keyboard I need and what icons to use	1
Yes, because of all the new programs like inspiration	1
Yes because of Teacher Six's teaching skills	1
Yes because we get a good lot of time to learn new things	1
You lots of things about computers in 10 weeks	1
Yes, nearly everyday I go home and have something new to show	1
Yes you use the internet and games to learn	1
You learn how to use the internet for research	1
Yes because it is important how to use computers for life	1
We do the same work as other classes, only on computers	1

Table 6.20 Teacher Six's students' improvements to learning

Most of the students in Teacher Sixes' class think that the improvement in their computer skills is beneficial for their learning. The students also feel that it is important that they learn about computers in the digital classroom. Five students have stated that the digital classroom has improved their typing speed. It is interesting that two students have commented that their English language has improved through using computers. Two students also commented that the skills they learned at school were transferred to their home computer.

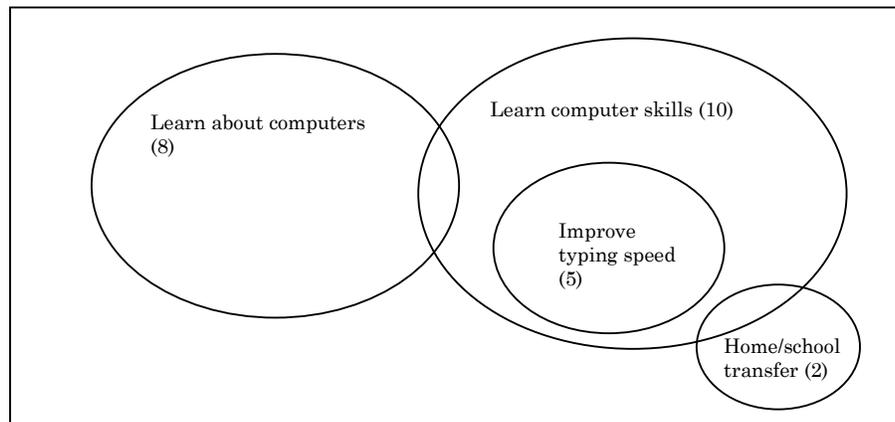


Figure 6.15 Teacher Six's students' improvements to learning

The majority of students in Teacher Six's room commented that the main benefits to their learning is that they are able to learn about computers and learn computer skills. Five students felt that the digital classroom also improved their typing speed. Two students commented that the computer skills learnt at school were able to be transferred to the home computer.

6.6 The difference in learning between a digital classroom and a normal classroom

It has more computers	6
The computers	4
You can use the computers Mon-Fri	2
You do most of your work on the computer	1
You do 80% of your work on the computers	1
Extra computers, digital knowledge and techniques	1
Less handwriting, more typing, do normal activities like maths	1
We get to publish work and use PowerPoint	1
A normal class does more work	1
You learn a lot on a computer	1
A digital classroom does not use the ICT suite	1
You do more work than a normal class on computers	1
We use the computers more in learning	1

Table 6.21 Teacher One's students': The difference in learning

The majority of students in Teacher Ones' class state that the number of computers is what differentiates the learning in a digital classroom from a normal classroom. Six students commented that they use the computers for their classroom work. Two students felt that the use of computers during the week is the difference. Only one

student mentioned that the computers in the class were used for learning. From the students' perspective the focus is on computers rather than ICT equipment.

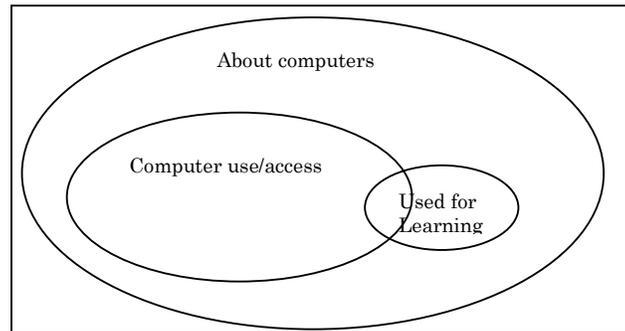


Figure 6.16 Teacher One's students' The difference in learning

I don't think the learning is different.	6
Learning is more fun than in a normal classroom	3
You get more time on the computers	3
Use computers more than a normal classroom	3
Don't have to use books for everything	2
Use a mouse or keyboard rather than writing or drawing	2
You work using a computer and do more work	1
There are more extension activities	1
You learn different programs	1
You use more advanced technology	1
Do more learning on the computers	1
More computer noise	1
More choices in a digital classroom and advantages	1
Different activities and tasks	1
The computers make school way better	1
There isn't anybody to tell you what to do	1
Learning is different: about half the time is spent on computers	1
You can plan your own day	1
You can get information off the internet for projects and fun	1
You can learn the quick fun way instead of slow boring way	1
You get more chances on computers	1
You get more opportunities/advantages in digital class	1
You go on a computer 3 times a week	1
Use computers to type up information	1
We have more activities to do	1

Table 6.22 Teacher Three's students' The difference in learning

Nine students thought that because they used computers in the digital classroom this made the learning different from a normal classroom. Six students did not feel the

learning is any different in a digital classroom. One student commented that learning is different because they use the computers. Six students thought that the digital classroom was different because they were had more extension activities and choices than a normal classroom. Five students said that learning is more fun and motivating in a digital classroom. Computer access was a reason four students gave for the difference in learning. Interesting comments by individual students include, *there isn't anyone to tell you what to do, you can plan your own day, better information access and there is more computer noise*. One student commented that the students were able to learn on the computers.

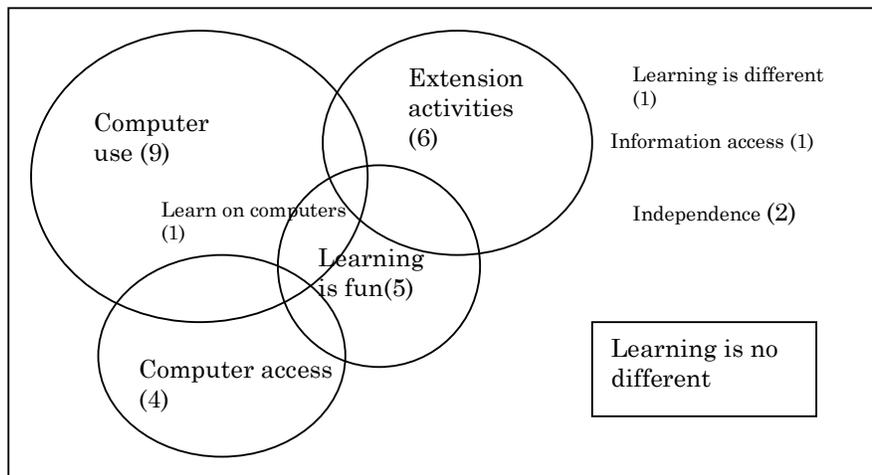


Figure 6.17 Teacher Three's students' the difference in learning

The focus for the majority of Teacher Three's students is computer access and use within the classroom that makes the difference in a digital classroom. It is interesting that six students commented that the learning was no different in a digital classroom. For those who see the computer access as being different, the students see the use of the computer to complete classroom tasks as being different as well as being able to access extension activities that is available for them through computer access. Motivation is also a major factor in using the computers in the classroom as the students perceive learning as fun.

We have more computers and more time on them	12
There are computers in a digital classrooms	3
You have more fun	2
You don't use pencils you work on a computer	2
Everyone uses a computer daily rather than weekly	1
You learn to do computer research	1
I can't understand English and the digital class uses computers	1
You learn about computers	1
You have more digital things in a digital classroom	1
Same as normal and more education	1
It is easier and more fun in a digital classroom	1
We do lots of things on the computer	1
We learn lots of computer skills with programs	1
You learn on the computer	1
You can search on the internet	1
I don't know	1
You type instead of write, it is quicker	1

Table 6.23 Teacher Four's students' the difference in learning

Seventeen students commented on the amount of computers in the classroom and the time available to use the computer. Four students thought that using the computer in the classroom and learning computer skills is what make learning in a digital classroom different. Motivation is also a factor that three students commented upon. Two students thought learning about computers is a factor. Research and access to the internet was thought to be a distinguishing factor by two students. One student thought the extension work provided by the computers was a factor. One student didn't think the learning was any different from a normal classroom.

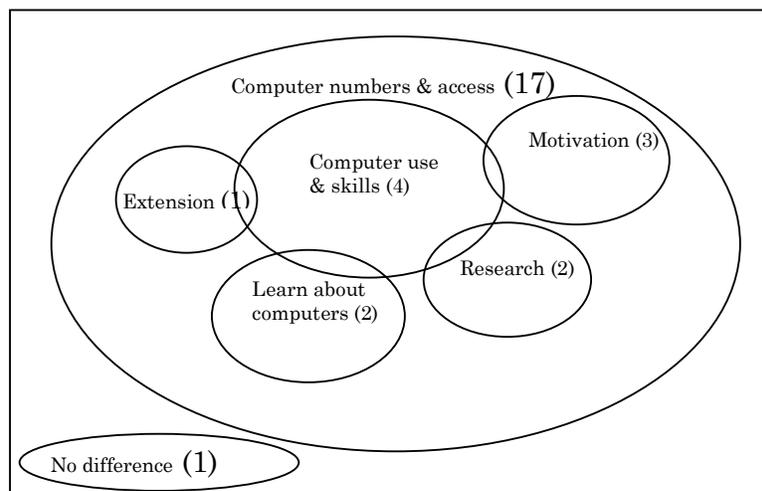


Figure 6.18 Teacher Four's students' the difference in learning

Instead of working in books we work on a computer	17
We get to go on the computers more and learn about the computer	4
No lining up to go to the library we can research on the computer	3
80% of the work we do is based on the computers which is cool and fun	3
The learning is not that much different, we just work on a computer	2
The computers make work much easier for us: eg thesaurus, dictionary	2
We hand our work in electronically	2
We have one of the coolest teachers on earth	2
We have more fun than a normal class (while we learn)	2
We are able to music while we work (at certain times)	2
The learning and research is based on the computers	2
We don't have to be told what to do the teacher sets a task and we do it for ourselves	1
We get free time during inside lunch and interval	1
Our classroom is more interesting and we learn more because our lessons are not boring	1
The class timetable is more relaxed	1
We can't lose books!	1
We learn things using different search engines on the internet and computers	1
It is different because most of the work you do is on a computer in other words digital learning	1
Everything is on the computer except maths	1
The teacher can read our writing	1
We have air conditioning	1
Everyone in the classroom has their own computer	1
We don't have to spell, the computer does it for us	1
We only need four books, maths, reading and 2 options	1
We don't get out to PE as much	1
The work is pretty much the same but different	1
We play with the digital cameras	1
We have more resources to help us learn better	1
We are gaining skills while doing our work	1
We learn how to use different digital peripherals	1

Table 6.24 Teacher five's students': the difference in learning

Teacher Five's students agree that what differentiates their classroom from a normal classroom is that most of their class work is completed on a computer. Seven students felt that the classroom provided them with a digital work environment. Seven students also felt that the digital class environment provided them with motivation to learn. Six students stated that the digital class enabled them to research effectively particularly using the internet. Five students commented that they were able to learn about computers. Two students stated that the digital class provided them with an independent learning environment; two other students also thought that the digital class environment helped them with their learning. Interestingly, two students stated that having a cool teacher in a digital classroom was important.

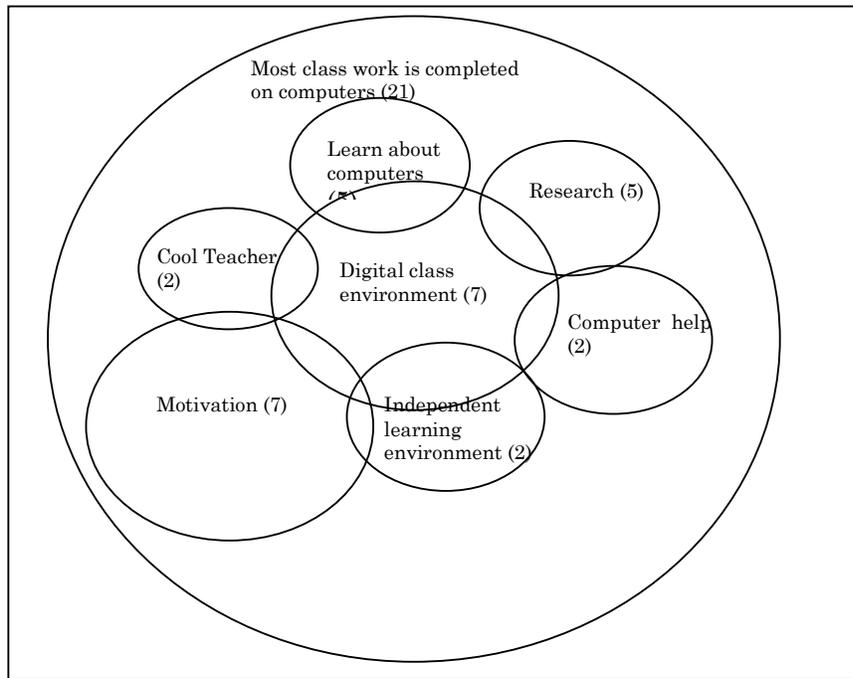


Figure 6.19 Teacher five's students' the difference in learning

In a digital classroom we do our class work on computers.	15
We learn about computers in a digital classroom	6
There are more computers in a digital classroom.	5
In a digital classroom we usually work in pairs.	3
You get to play games on the computers	2
You get to do your writing on the computers	2
Instead of writing in a book you type onto a computer	2
You do hard work in your book	1
You do more work in a digital classroom.	1
Work like language gets finished quicker	1
We can learn things in different ways	1
We learn about the internet and not things like handwriting	1
On the left is computers on the right there is desks	1
You can use the internet and get even more knowledge	1
You get used to working on a computer	1
We type more.	1
The teaching skills are very different we get to go on the computers lots	1
Because you do computers	1
You learn how to type	1
You don't always sit in a desk doing work	1
You don't do handwriting	1
You learn what to do on a computer	1

Table 6.25 Teacher Six's students' The difference in learning

The majority of Teacher Six's students see the digital classroom as a classroom where most class work is completed on computers. Eight students stated that in the digital classroom you learn about computers. Five students thought that in the digital classroom you learn about computers. Five students thought what makes the digital classroom different is the number of computers. Reflective of the classroom organisation is that three students stated that their digital classroom normally completed their work in pairs. Two students thought that in a digital classroom you could learn by playing games on the computers. Research was a factor considered important by two students. Two students also thought that in a digital classroom you typed more. One student commented that the teaching skills were different. Other interesting statements were that you don't always sit at your desk and you don't do handwriting.

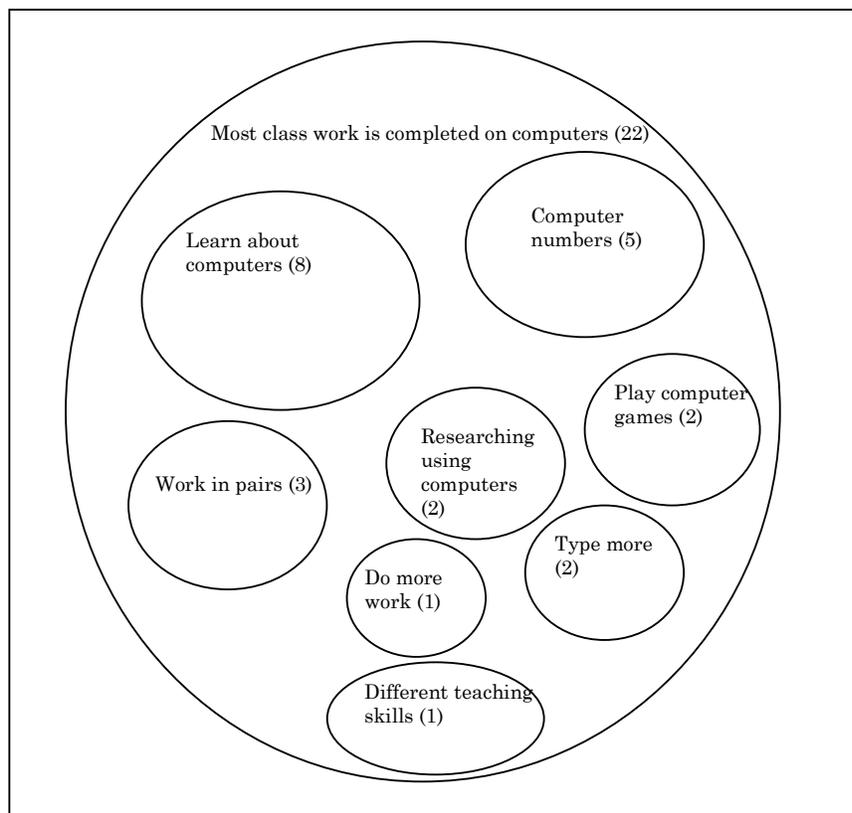


Figure 6.20 Teacher Six's students' the difference in learning

6.7 Improvements to a digital classroom

One computer per student	4
Having a teacher who knows about computers and digital	4
Getting more new computers for access	3
The same amount of computers in all digital classrooms	1
More books	1
More computer programs	1
More handwriting because we are going to get bad at it	1
More technical gear a great learning achievement	1
More technical knowledge of computing systems	1
Each student should have a laptop	1
Newer computers, upgraded, same as other rooms.	1
I don't think they can.	1

Table 6.26 Teacher One's students': improvements to digital classrooms

A majority of students thought that the digital classroom could be improved by increasing the number of computers. Four students wanted a teacher who knows about computers. Other interesting comments were more books, more programs and having more up to date technology. One student wanted more handwriting as he felt the students were going to get bad at it while one student didn't think they could be improved.

Nothing...cool as it is...	11
Having more computers	5
Everybody having a computer each	3
Making computer times longer	3
Having laptops	1
The teacher actually there to help you	1
Everyone having different tasks at one time	1
Making the computers faster	1
Doing everything on the computer	1

Table 6.27 Teacher Three's students': improvements to digital classrooms

Eleven students felt that the digital classroom concept is fine as it is. Nine students wanted more computers in the classroom so that the students could have a greater access time. Similarly, three students wanted the computer times longer. One student

wanted more help from the teacher. One student also wanted to do everything on the computer.

Doesn't need improvement	11
Having more computers	6
Every school should have digital classrooms	4
Having laptops	2
Having more programs/games	2
Free internet access	1
More cameras in the classroom	1
Digital Whiteboards	1
Not having so much digital stuff, learn without electronics	1

Table 6.28 Teacher Four's students': improvements to digital classrooms

Eleven students did not think the digital classroom needed any improvement. Eight students thought that the classroom needed more computers. Four students thought that every school should have digital classrooms. Two students thought that there should be more programs/games in the classroom. Three other students thought that there should be more electronic equipment in the classroom, while one student thought the students should learn without the electronic equipment.

Getting new computers	17
Doing Maths/Reading on the computer	6
Have more PE/ games, fresh air	4
Have more free time	4
The teacher giving out more positives	3
Having proper computer chairs	2
Having a bigger classroom because it is crowded	2
Using the computers at lunchtime	2
Upgrading CD to burners	2
Giving every student a free laptop and digital camera	2
Have more fun time in class	1
Have more laptops	1
Going to the library more often	1
Have another option out of class	1
Fix cable spaghetti on floor	1
New keyboards and a scroll button on mouse	1
Wire clips for wires to put them on walls	1

Table 6.29 Teacher Five's students': improvements to digital classrooms

The majority of Teacher Five's students feel that the computers in their classroom need to be upgraded to newer computers. Six students state that an improvement would be to do their maths/reading on the computers. Four students felt they spend too much time at the computers and would like to have more physical education time

and fresh air outside the classroom. Four students would like to have more free time while using the computers. Three students state that they would like to see the teacher giving out more positives during class time. The classroom does not have specialised computer chairs, two students would like these in the room. Two students feel the classroom is too crowded and would like a bigger room. Two students would also like to return in their lunchtime to use the computers. Two students were concerned with the wires present on the floor of the classroom and would like them secured out of the way.

Putting in more computers	16
Nothing	3
Playing more maths and typing games	3
Getting proper computer chairs	2
Having more sport time	2
Being in the Digital class for the whole year	2
Doing more subjects like the other classes	1
Doing the activities that the other classes do	1
Having one computer for every student	1
Improved by having more equipment	1
More work on the internet	1
By more funny things such as real animation	1
Getting new games	1

Table 6.30 Teacher six's students' improvements to digital classrooms

Teacher Six's students think that putting in more computers would allow for greater access to computers. Three students would like to have more time to play maths/typing games. Two students would like to have computer chairs supplied instead of the standard classroom chairs. Two students were concerned that they needed more sport time as they spend large amounts of time at the computers. Two students would like to spend the whole year in the digital classroom instead of the one term at present. Two students would also like to do the activities the normal classes do.

6.8 Chapter Summary

Survey question One: Definition of a digital classroom.

Teacher One's students

- Students thought that it is a classroom with computers or digital equipment (includes hardware and computer access)
- About researching using the internet.
- Enhancing student learning.

Teacher Three's students

- A classroom with lots of computers. (includes hardware and computer access)
- Where you are able to make movies and slide shows, play computer games.

Teacher Four's students

- Classroom with lots of computers
- A classroom with lots of ICT equipment.

Teacher Five's students

- Class where you used digital equipment.
- A great environment where everyone is free to learn.
- Students working on computers, having fun, playing games.
- Working on computers.
- Researching on computers.

Teacher Six's students

- Use computers to learn programs and improve computer skills.
- Do most of your work on computers.
- Learn about computers.

Survey Question Two: Positive aspects of a digital classroom.

Teacher One's students

- Increased computer access.
- Learning about computer programs and improving skills.
- Increased access to information.

Teacher Three's students

- Increased computer access.
- Using the computer to play games and complete class activities.
- Planning their own day.
- Learning and researching on the internet.
- Teacher who is a key component in a Digital class organisation.

Teacher Four's students

- Increased computer access.
- Playing computer games.
- Computers as an essential part of classroom learning.

Teacher Five's students

- Positive learning community.
- Students are highly motivated.
- Enjoy creating movies and multimedia.
- Freedom to learn.
- Teacher as Facilitator.

Teacher Six's students

- Focussed on learning about computers.
- Focussed on learning computing skills.
- Computers used for all classroom activities where possible.

Survey Question Three: Negative aspects of a digital classroom.

Teacher One's students

- Lack of ready access to a computer.
- Computer reliability.
- Inappropriate classroom environment for using ICT.

Teacher Three's students

- Having to complete the digital diary.
- Being rostered onto a computer and missing out on classroom activities.
- Computer reliability.
- Lack of ready access to a computer.

Teacher Four's students

- Majority of students happy with current digital classroom.
- Lack of ready access to a computer.
- Ergonomic concerns with computer chair/desk setup.
- Inappropriate classroom environment for using ICT.

Teacher Five's students

- Concerned about lack of daily physical education activities.
- The old computers used lack of processing power.
- Ergonomic concerns with computer chair/desk setup.
- Having to use books for mathematics.

Teacher Six's students

- Majority of students are happy with current digital classroom.
- Did not like the large amount of group work on the computers.
- Lack of ready access to a computer.

Survey question Four: Comments about learning in a digital classroom.

Teacher One's students

- Preparation for future careers.
- Computers are used as a tool for learning.
- Improves their learning.
- Digital classroom improves computer skills.
- Peer support available in a digital classroom.

Teacher Three's students

- Internet resources help their learning.
- Digital classroom improves computer skills.
- Improves their learning.

Teacher Four's students

- Improved access to information resources.
- Able to learn about computers and improve computer skills.
- Digital classroom environment enables students to learn.

Teacher Five's students

- Improves researching and the inquiry process.
- Improves computer skills.
- Students learn faster.
- Access to ICT tools to enhance learning.
- Digital classroom environment leads to independent learning.
- Increased motivation to learn.

Teacher Six's students

- Improves computers skills.
- Learn about computers.

Survey Question Five: The difference in learning between a digital classroom and a normal classroom.

Teacher One's students

- Digital classroom is about computers.
- Improved access to classroom computers.
- Computers are used as part of learning.

Teacher Three's students

- Computers are used as part of learning.
- Improved access to classroom computers.
- Extension activities are available with classroom computers.
- Learning is fun.

Teacher Four's students

- More computers in a digital classroom.
- Improved access to classroom computers.
- Learn about computer skills.
- Computers are used as part of learning.
- Increased motivation to learn in a digital classroom.
- Computers are used for research.

Teacher Five's students

- Most classroom work is completed on computers.
- Learn about computers.
- Computers are used for research.
- Digital classroom environment is a positive learning environment.
- Increased motivation in a digital classroom.
- An independent learning environment in a digital classroom.

Teacher Six's students

- Most classroom work is completed on computers.
- Learn about computers.

- More computers in a digital classroom.
- Class organisation is different.
- Computers are used for research and games.

Survey question Six: Ways in which a digital classroom could be improved.

Teacher One's students

- One computer per student.
- Having a teacher who knows about computers.
- Newer computers.
- Improved hardware and software in the classroom.

Teacher Three's students

- Majority of students were happy with digital classroom setup.
- Other issues include.
 - More computers.
 - One computer per student.
 - More time using the computers.

Teacher Four's students

- Majority of students were happy with digital classroom setup.
- Other issues include.
 - More computers.
 - More digital classrooms in schools.
 - Making laptops/games available for student use.

Teacher Five's students

- Newer computers.
- Mathematics/Reading on the computers.
- More physical education/games in the fresh air.
- More free time in class using the computers.
- More positives from the teacher.
- Improving the size, equipment available in the digital classroom.

Teacher Six's students

- More computers in classroom.
- More Maths/Typing games available.
- Improved chairs.
- More sport time.
- Being in a digital classroom for a whole year instead of just a term.

In the next chapter the results will be discussed in detail with reference to the literature.

Chapter 7 Discussion

7.1 Introduction

The previous chapter covered the digital classroom students' views on the main research questions of this thesis. The results were displayed in table and diagram form and discussed briefly. The teacher and student results are discussed in more detail in the discussion chapter.

This chapter synthesises the findings of the study together with the research questions and examines the implications of the study. The findings will also be compared to the research literature. The critical success factors in the implementation of a digital classroom will be explored. The chapter describes how the findings are used to develop and propose a model of development of a digital classroom. The chapter concludes with a definition and model for a digital classroom.

Research Questions	
Teacher Questions	Student Questions
What is a digital classroom?	What is a digital classroom?
What resources are needed for a digital classroom?	What I like most about the digital classroom is ...
What professional development in ICT is provided for teachers in a digital classroom.	Do you feel that the digital classroom improves your learning? Why or why not?
How is the digital classroom organised? (seating, grouping, daily activities etc.)	What I don't like about digital classroom is ...
What changes in teaching style (pedagogy) are needed in a digital classroom?	Does the digital classroom improve your learning?
What funding and support are provided in a digital classroom?	How is the learning in a digital classroom different from a normal classroom?
What are the teachers' perceptions of the attitudes of the major stakeholders in a digital classroom?	How could digital classrooms be improved?
What are the positive aspects of a digital classroom environment regarding learning?	
What are the negative aspects of a digital classroom environment regarding learning?	
What do you think can be improved upon in your digital classroom?	

Table 7.1 Research questions

7.2 Definition of a digital classroom

As outlined in the literature review there is no common accepted definition of a digital classroom in New Zealand. Both the teachers and the students were asked to define a digital classroom. Every teacher had a slightly different definition of a digital classroom. The majority of the teachers focused on the 'digital' when defining a digital classroom. All the teachers except Teacher Five defined a digital classroom as being about computer access, numbers of computers, completing work in digital form and having the computers available in the classroom. Little mention was made of any changes to teaching pedagogy. Teacher Five stated that, "It's not about computers really. It's about the pedagogy of teaching." Becker (2000) stated that, "The way that a teacher uses computers gives an indication of her/his underlying pedagogical philosophy." Teacher Five had an aim of developing the inquiry process and producing life-long learners. The difference in teaching pedagogy will be explored as the research questions are discussed.

All the teachers were focused on using ICT to improve learning by extending students or integrating ICT into classroom lessons.

Teacher One

Teacher One primarily saw the digital classroom as a classroom where students had ready access to digital equipment and this could be used to enhance student learning. No mention was made of a change in pedagogy.

Teacher One's students

Teacher One's students also saw the digital classroom as a classroom with computers and digital equipment. They were focused on hardware and completing their work on computers.

Conclusion

Both the teacher and students agree on what a digital classroom is – a classroom where students have access to digital equipment and the students are able to complete their classroom work on the digital equipment. There is little mention of a change in teaching style/pedagogy although both the teacher and the students mentioned that the

digital classroom enhances learning. There is very little difference between the teacher's and the students' definition. They both concentrate on the hardware/software available and replacing the pen and paper with the computer and the mouse.

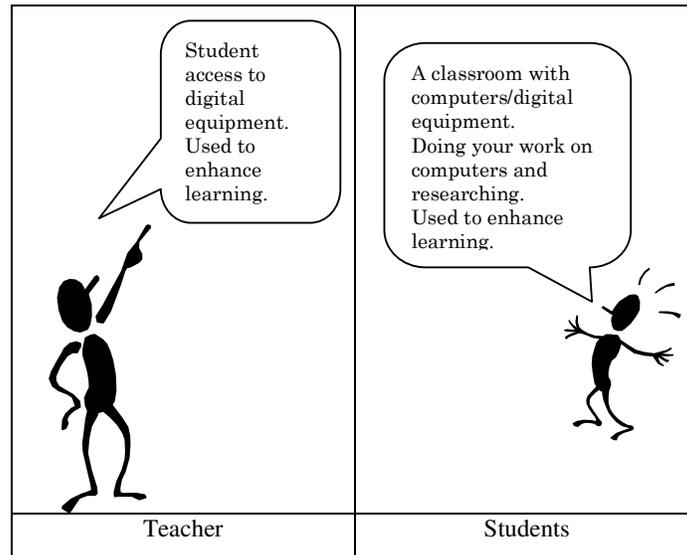


Figure 7.1 Teacher One/Student comparison

Teacher Two

Teacher two saw a digital classroom as an opportunity where students could use digital equipment in their learning. Teacher two saw the digital classroom as an opportunity to extend students. No data is available from the Teacher two students.

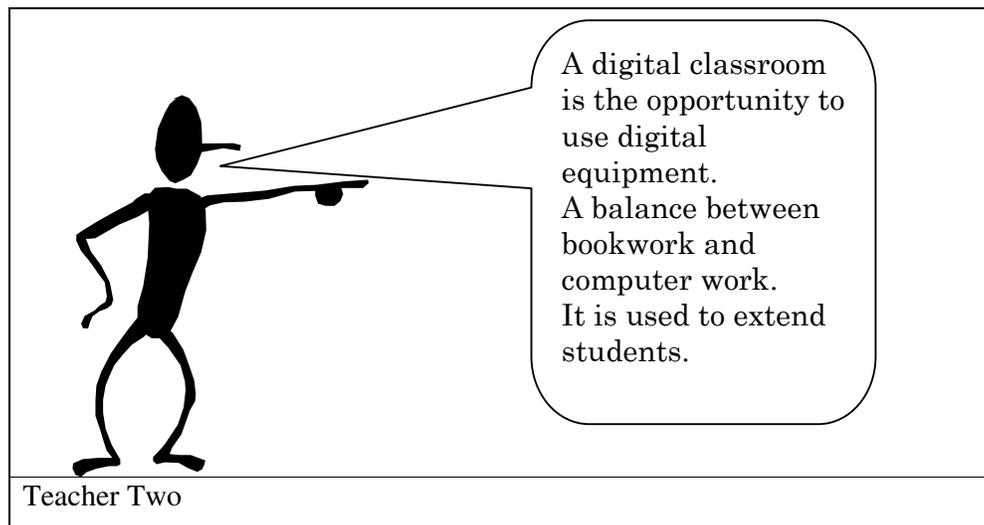


Figure 7.2 Teacher Two

Conclusion

Teacher Two was focused on providing the students with an opportunity to use digital equipment for learning. He also sees the digital equipment as an opportunity to improve learning in the classroom. Motivation to learn is seen as an important factor. As Teacher Two's students did not complete the survey there is no comparison available.

Teacher Three

Teacher Three saw a digital classroom as being a place where there was an improved ratio of computers to students and where students could use the digital equipment to enhance their learning. Again no mention was made of a change in teaching pedagogy although during the interview Teacher Three had introduced an innovative structure to her teaching organisation where the students were given a choice to organise their day. This student-centred approach could be used with or without digital equipment.

Teacher Three's students

The majority of students identified a digital classroom as a classroom with lots of computers. Six students stated that you are able to make movies, slide shows and play computer games in a digital classroom. Two students identified that you are able to learn in a different way and the classroom was a learning centre.

Conclusion

Both Teacher Three and the students identify a digital classroom as a classroom with computers where the students have ready access to the computers. The students tend to be more specific regarding computer use (movie-making, computer games) and some have identified that they learn in a different way using technology.

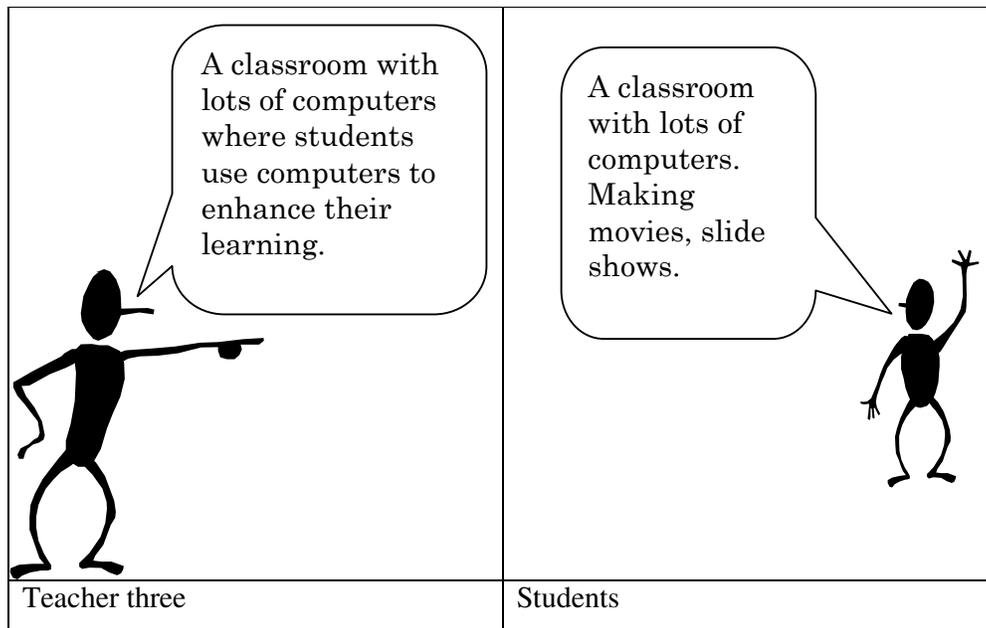


Figure 7.3 Teacher Three/Students comparison

Teacher Four

Teacher Four thought that having a digital classroom meant that he did not have to go to the computer suite to use the computers and that it enabled him to integrate ICT into classroom lessons more readily.

Teacher Four's students

All of teacher four's students thought that the digital classroom is a classroom with computers and no mention is made of pedagogy.

Conclusion

Both Teacher four and the students are focused on a classroom with large numbers of computers. The main difference is that the teacher states that ICT is integrated into lessons and the students state that they do lots of tasks on computers. The computers are used in the same way that they would in a single-cell classroom, very little has changed regarding teaching organisation and the definition given by the teacher and the students reflects this.

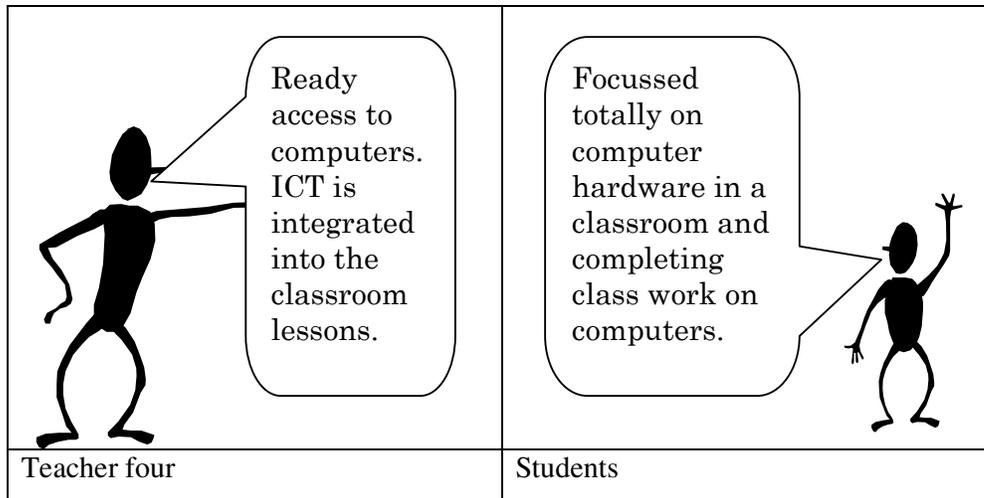


Figure 7.4 Teacher Four/Students comparison

Teacher Five

Teacher Five's focus was entirely on the pedagogy of teaching. She discussed the inquiry process and developing life long learners in her classroom. Changes have been made to the teaching style first, and then the ICT has been organised to enhance the learning with the goal being independent learners.

Teacher Five's students

Teacher Five's students' focus is different to the other classrooms. They describe what they do on the computers, working on the computers, researching, improving their skills. Most importantly they describe their classrooms as a great environment where everyone is willing to learn. Freedom, fun, playing games are words that are used to describe their digital classroom.

Conclusion

Both Teacher Five and Teacher Five's students focused on the digital classroom environment rather than on hardware/software in the other classrooms surveyed. Teacher Five's classroom displays the characteristics of an engaged classroom as outlined by (McKenzie, 1999a). Here the students are engaged in authentic learning, learning by inquiry using collaborative groups. This will be further analysed in the pedagogy section of this chapter.

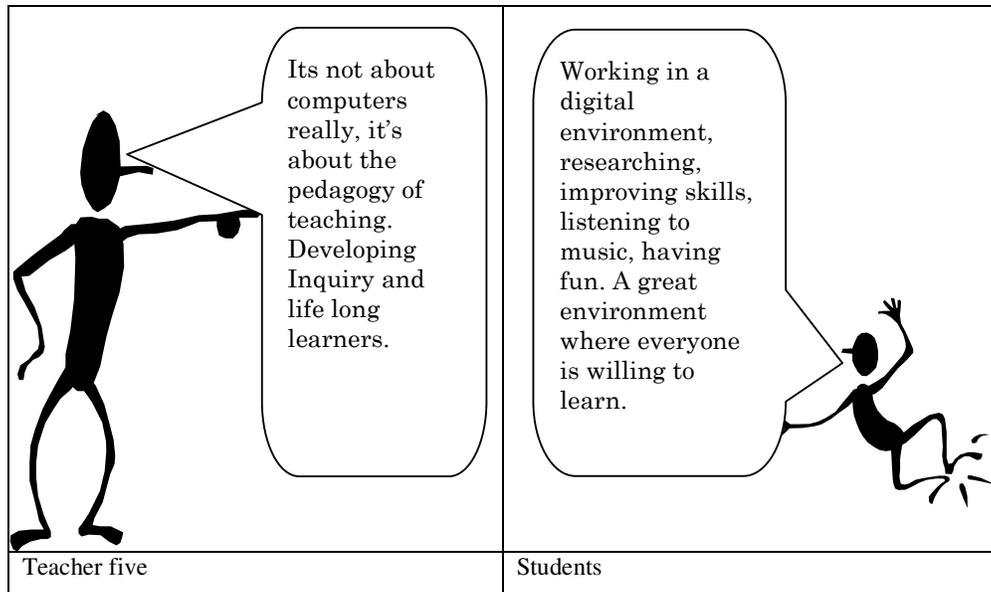


Figure 7.5 Teacher Five/Students comparison

Teacher Six

Teacher Six focused on the number of computers in the classroom available for the students to use. The students used the digital equipment for presentation of their class work. The students were in the classroom for a term to acquire ICT skills that would help them in their general classroom work.

Teacher Six's students

Teacher Six's students focused their comments on learning about computers rather than with computers. Because of the school organisation they were placed in the digital classroom for one term and their comments were focused around learning skills and completing their work on the computers.

Conclusion

In Teacher Six's definition the computer took the place of the pencil/book. The computers were used as a tool to present the students work. The students saw the digital classroom as a place to learn about computers and improving their computer skills.

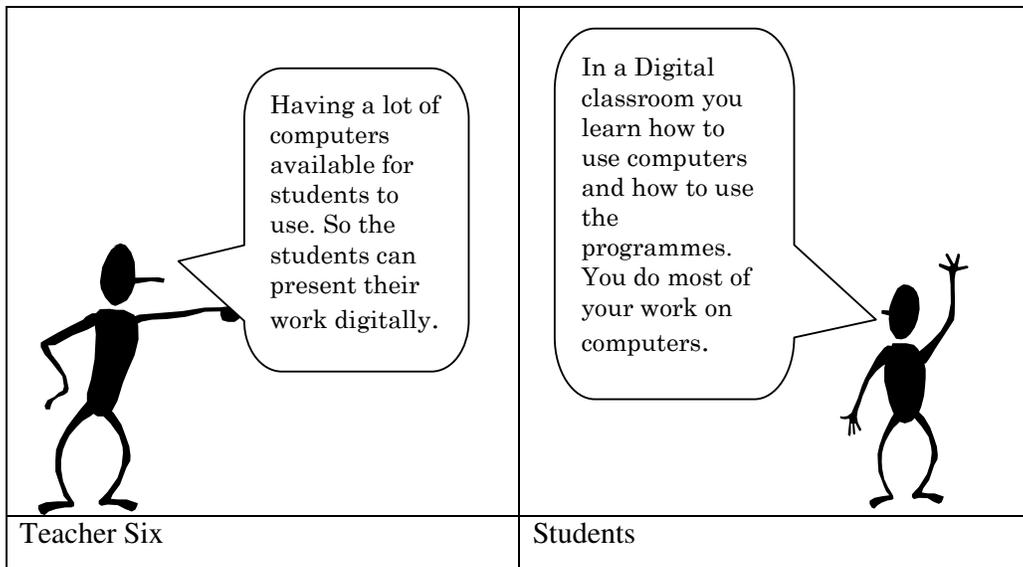


Figure 7.6 Definition of a digital classroom Teacher Six/students

Digital classroom definition

A digital classroom is a learning environment where the goal is to develop independent learners using the inquiry process. Learning is facilitated using authentic collaborative tasks where students participate in active learning integrating ICT where appropriate. Learning is interactive and learner-centred using rich multimedia with self, peer and teacher feedback.

This contrasts with my first definition where I concentrated on hardware/internet/networking and made a comment on working collaboratively using ICT for the majority of their work in the classroom. The previous definition was too technocentric and limited. All the teachers other than teacher five concentrated on the digital part, focusing on learning with/about the technology. The ICT was integrated into the classroom programme without a major change in pedagogy. For the definition to be effective the classroom/pedagogy part is important, then the appropriate ICT tool can be selected (if appropriate) to achieve the learning goals.

This definition has been strongly influenced by Teacher Five’s definition of a digital classroom. Technology is not an end in itself, the goal is to facilitate the development of engaged learners who are:

- “Responsible for their own learning
 - Energised by learning
 - Strategic
 - Collaborative”
- (McKenzie, 1999a, p.2)

A digital classroom could include the following elements adapted from (Means & Golan, 1998, cited in Lai, 2005, p.15)

Integration	Curriculum integrated into existing curriculum, cross- disciplinary, problem solving, metacognitive and global
Engaging	Self-motivated, independent thinking, creative and self-esteem
Real-world	Driven by real-world issues, problems and information.
Extended	Allow students the time necessary to study specific subject matter in depth.
Student-centred	Allow students to choose topics, research methods, and resources, and to design their own products and presentations
Teachers	Facilitate student learning
Collaborative	Require cooperation among students on project tasks
Multimedia-based	Products and presentations integrate multiple media, not just computing technologies
Assessment	Feedback to student work and final products and presentations is provided through self, peer, and teacher assessments based on curriculum standards and project goals

Table 7.2 Digital classroom elements

7.3 Resources

All the classrooms were well resourced ranging from a pod of seven computers to 28 computers. All classrooms were networked and had access to a broadband internet connection.

Generally all the classrooms were well equipped. Jamie McKenzie talks about toolishness, schools equipping students with technology for no reason or giving students the wrong tool for the task. (McKenzie, 2001)



Figure 7.7 Toolishness is Foolishness (McKenzie, 2001)

Teachers in three out of the four schools appear to be technocentric, focusing on the technology itself (putting the hardware/software considerations ahead of learning). It is interesting that all of the teachers except Teacher Five focused on the technology when defining a digital classroom. This is under the assumption that exposure to technology leads to an improvement in learning. But my literature review has shown that there is no clear link between exposure to a digital learning environment and an improvement in learning. Some studies such as the study conducted by the UK's Royal Economic Society found no ground for the correlation between IT use and education (Orlowski, 2005).

Network reliability is a problem if all lessons are reliant on the network. This means the teacher needs to have a second plan available should the network crash or the internet is unavailable or very slow. This has a disruptive effect on class lessons. Only one classroom had the flexibility of a wireless network and wireless capable laptops which meant that the students were not confined to a workstation.

Inadequate technical support can lead to network starvation where teachers and students become frustrated with the reliability and speed of the network. This leads to teachers not using the networking capability in their teaching (McKenzie, 1999a). There is a strong link between the successful use of a constructivist pedagogy using technology and readily available technical support (Means & Olson, 1995, cited in

Lai, 2001). Network reliability is very necessary if students are going to use ICT for a large part of their day in the classroom. Teachers in the interviews commented how disruptive network failures could be on their prepared lessons especially when it involves the internet.

All the digital classrooms had ready access to digital/video cameras which were used when appropriate. No classrooms had a permanent data projector, Teachers Three and Four had shared access to one. However it was time-consuming to set up and could be easily knocked in the classroom environment. Teachers One and Two could book a data projector well in advance; however with a constructivist program operating having a data projector readily available when needed would be very desirable.

Groups of computers produce a lot of heat and only one classroom was equipped with air conditioning. The comfort of air conditioning was noted by Teacher Three's students. (see Table 6.9 p. 129)

At the time of the survey no classrooms had access to a Learning Management System (for example Moodle or Blackboard), although Teacher Five had a website set up with homework resources and class information that some students could access from home.

7.4 Professional development

All the surveyed teachers had attended a wide range of professional development (PD). Some of the PD lacked focus and was not strategically planned. The interviews showed that there was little evidence of strategic planning and the PD was largely skills-based. PD ranged from none in Teacher Two's case to a significant provision in the case of Teacher Six who was provided with a scholarship. Teacher Three's school had previously invested in school wide PD in ICT where a large group of teachers had completed the Graduate Diploma of Information Technology qualification. Teacher Three was in this group of teachers. This meant that a large proportion of the staff had both skills and pedagogy PD in ICT. Teacher four who was also based at Teacher Three's school had received little PD in ICT as he was new to the school.

“Specifically, teachers who reported spending more than a day (9 hours or more) in PD [related to ICT] were more likely to report feeling well prepared or very well prepared to use computers or the internet than those who reported spending a day or less (fewer than 9 hours) in such activities.” (Smerdon et al., 2000, pp. 83-84).

Teacher Two commented that he had no PD related to ICT and was did not feel well supported by his school.

Some of the teachers lacked current PD in the pedagogy related to the successful integration of ICT into the classroom. There was no overall plan and the PD was very adhoc.

Regarding PD each school needs to plan their learning goals of the digital classroom. What type of pedagogy is best suited to the digital classroom environment? The school needs to then modify the classrooms and install ICT equipment that best suits their needs. The ICT equipment should not come before the pedagogy. Each teacher then needs to attend PD courses that will give them an understanding of the best type of pedagogy that is suited to their digital classroom. Once the teaching philosophy/theory has been established then the teaching programmes and classroom routines can be established with the students. While the digital program is running then the teachers need to reflect regularly on their teaching practice and how it can be improved. Peer support is vital also.

School One

Teacher One had optional PD in ICT which was coordinated by the Deputy Principal. This was predominately skills-based where the emphasis was on learning software. This was very adhoc and was not responsive to the needs of the individual teachers. There needs to be a survey or interviews with the individual teachers to work out a overall PD plan.

There seems to be little coordination or planning in providing PD for the teachers in School One. The senior management controlled the professional development direction. There is also little collaboration between the teachers of the digital classrooms. There is little formal pedagogy PD where alternative styles of teaching are explored suitable for integrating ICT into the classroom. Teacher Two reported

that he has had no PD in ICT and he was operating in isolation in the school. Teacher One in the same school reported that he was able to choose suitable courses from a course booklet and then discuss the suitability of the course with the DP who would book the course. The teacher stated that most of the courses were skills-based.

School Two

School Two had developed ICT as being part of the school culture. The school had the ongoing support of a full-time ICT specialist teacher who taught students ICT skills which could support the class curriculum. The students were withdrawn from regular lessons on a rostered basis and taught skills that supported their in class work. Apart from the group of teachers who enrolled in the Graduate Diploma of Information Technology in Education programme most of the PD was related to ICT skills. Teacher Three had previously extensive PD in ICT while Teacher Four was relatively new to the school and had yet to access the ICT PD. It would seem sensible to fast track some PD in ICT pedagogy for a teacher that was new to the digital classroom environment. The school had also made ICT part of the performance agreement which was reviewed annually.

School Three

This school had been part of an ICTPD (Information Communication Technology Professional Development) cluster for three years, although the teacher commented that while it was a valuable experience she felt the PD was not always ICT-based. The teacher did not expand upon this point. A strength in School Three is the collaboration between the teachers with regards to ICT. Teacher Five had also attended ICT conferences. The teacher also spoke about the close support from the principal of the school regarding PD related to the development of the digital classroom concept. The relationship between the school management and the digital classroom teachers is an important factor in the success of the digital classroom.

School Four

Teacher Six had extensive PD in ICT as a result of the school support with a scholarship and personal financial support to attend ICT PD courses. The teacher has also had an opportunity to visit other schools and observe best practice. The teacher

had attended a mix of skills and pedagogy-based courses. This would not have been possible without the support from the school.

Conclusion

Lai (2005) commented that ICT teacher education programmes usually are concerned with the acquisition of technical skills rather than examining the pedagogy that ICT demands and how best to integrate ICT into the curriculum. This has been confirmed in the results from my research. Moursund and Blielefeldt (1999) also have found that most teachers do not model the use of ICT in their own teaching even though many use ICT at home. Cuban (2001) also commented that most teachers used ICT only occasionally for word processing and this did not impact on the classroom pedagogy. Cuban found that eight out of ten teachers had a computer at home, but they failed to make the link between learning and technology although they believed computers could improve learning and teaching. While it is outside of the scope of this research to observe the individual teachers in the classrooms, it would be interesting to document and analyse the teaching pedagogy present in the digital classrooms.

Teacher PD should put more emphasis on how ICT pedagogy rather than isolated pockets of skills training which has been observed in some schools in this study. School Two has endeavoured to develop an ICT culture in the school by planning ICT PD to all staff which has resulted in a group of teachers with a sound pedagogical base. However, new teachers to the school also need to be upskilled and so the PD needs to be ongoing. School Two has used an outside PD provider to provide a balance of ICT skills and pedagogy PD to staff as part of the Graduate Diploma of Information Technology in Education qualification. School Three has been part of an ICTPD cluster. From the teacher's perspective this has had mixed results. The teacher commented that the PD was not always focused on ICT development. School Four had put considerable PD resources into the digital classroom teacher. This has not had a flow on effect to the other teachers in this school and has been concentrated on improving the digital classroom only. When the teacher leaves the school, there will be no-one with sufficient skills and experience to continue the concept.

7.5 Classroom Organisation and Pedagogy

The discussion below will indicate how the organization of the digital classrooms supports or hinders the achievement of a learner-centred (constructivist) classroom. Learning theory has demonstrated that more effective learning occurs when students construct their own learning which can be enhanced by the use of ICT.

The current generation of students are constantly surrounded by digital technology and the constructivist learning theories are more appropriate to their learning needs than the instructivist theories. The constructivist pedagogy facilitates the development of a learner centred rich learning environment that meets the current learners' needs.

The discussion of learning theory in chapter 2 has shown that the constructivist learning theory allows technology to be used to its potential in the classroom. This leads to the development of independent learners who used ICT to construct their own concepts. Students learn how to learn in a rich environment. The classrooms are learner-centred as opposed to teacher-centred. Constructivism also allows students to work in small groups to maximize their learning using ICT. The discussion below will indicate how the digital classrooms in this study support or hinder the achievement of a learner-centred (constructivist) classroom.

All of the digital classrooms use a traditional classroom that have been physically adapted for the digital classroom concept. This means that some compromises have to be made as the classrooms were designed for the traditional teaching environment where the students sit in their desks with the teacher out the front. Despite the presence of the computers the physical environment still supports the instructivist pedagogy. All the teachers organized their daily teaching in different ways. This section will discuss the way each teacher has organized their day in the classroom.

Teacher One: The teacher has a mix of traditional classroom-directed teacher pedagogy and constructivist pedagogy in his classroom. The students work in groups and have a turn on the computers. For the core subjects the students are taught in the traditional manner and when the computers are used it is in a behaviourist way for concepts such as maths skills or spelling. During topic studies the children are given

more freedom and use the computers for research and to present their work. Here the computers are used in a more constructivist way. (See Figure 5.2 p.72)

Teacher Two: The makeup of Teacher Two's classroom is constructivist. The computers are used for motivation; the students are set tasks or problems to solve using the technology. The presentation is also in digital form. The students work in groups or individually. The students are also given more freedom and are allowed to take risks. Unfortunately Teacher Two's students did not complete the survey so I am unable to verify the Teacher's comments. The teacher is a facilitator, guiding the students learning and giving the students more responsibility. The technology is a strong motivational factor in the classroom.

Teacher Three: Teacher Three operates a constructivist-based classroom. The students plan their own day and utilise the ICT equipment to construct their own learning experiences. Ownership of their learning is developed during the planning process. The students work individually or in groups on such as completing an online maths challenge or completing a presentation using PowerPoint. The computers are used to enhance the planned classroom activities; their use is integrated with the class lessons. There was no mention of inquiry-based learning or problem-solving activities. The students use the computers around four times a week for a 45-minute period. The teacher has used a constructivist pedagogy in her classroom to give her students some freedom and autonomy in their learning. The computers are used to supplement learning.

Teacher Four: The teacher operates a traditional teacher-directed approach to learning. The teacher directs the student learning in the class and the students are rostered on regularly to use the computers. All the use of the computers is by individuals and the students use behaviourist-type programmes; for example, a quiz or a maths game are used to reinforce topics that are taught in class. The teacher sees the computers as being motivational particularly for the boys. The students have little choice or freedom when using the computers as they are rostered on individually. The computers are used also as an information resource or a tutor when using behaviourist drill-and-practice programmes. The computers are also used for research.

Teacher Five: Teacher Five's classroom pedagogy has taken one step further than the other cases. Teacher Five's classroom is a strong example of a constructivist learning environment. The teacher has taken a facilitator role and has setup a student-centred learning environment. See figure 6.9, p. 130 for an outline of how the technology, the digital teacher and the digital student interact in the digital classroom environment. The emphasis here is not on the technology but on the student and the inquiry process. The learners have the freedom to organize their own learning and to select use of technology to facilitate learning where appropriate. A digital learning environment has been established in the classroom but at the heart of all learning is the student, not the technology. This was illustrated in Teacher Five's definition of a digital classroom when she said, "It's not about computers really. It's about the pedagogy of teaching." It could be argued that Teacher Five's classroom also is an example of connectivism. Students are challenged to become life-long learners, extensive use is made of digital networking and grouping. ICT is used by students for solving problems and collaborating in a digital environment.

Teacher Six: Teacher Six was constrained by the school class setup in that she only taught the students for one term. They came to the digital classroom to experience digital learning and to some extent the students learnt about ICT rather learning facilitated by ICT. Brown differentiates between learning with information technology, learning in information technology and learning about information technology (Brown, 1995). In Teacher Six's class the students were learning in and about information technology. This because the students were only in the digital classroom for one term and the aim was to expose the students as much as possible to ICT. In the student survey the majority of the students stated that they thought a digital classroom is a place where you learn about the computer programs and skills. A constructivist approach was used extensively in the classroom where the teacher was a facilitator and there was a strong group/peer learning environment. There are also elements of connectivism in Teacher Six's classroom when she talks about the organised chaos of her classroom, with individuals and groups working independently of the facilitator with many things happening at once, all being facilitated by the uses of technology.

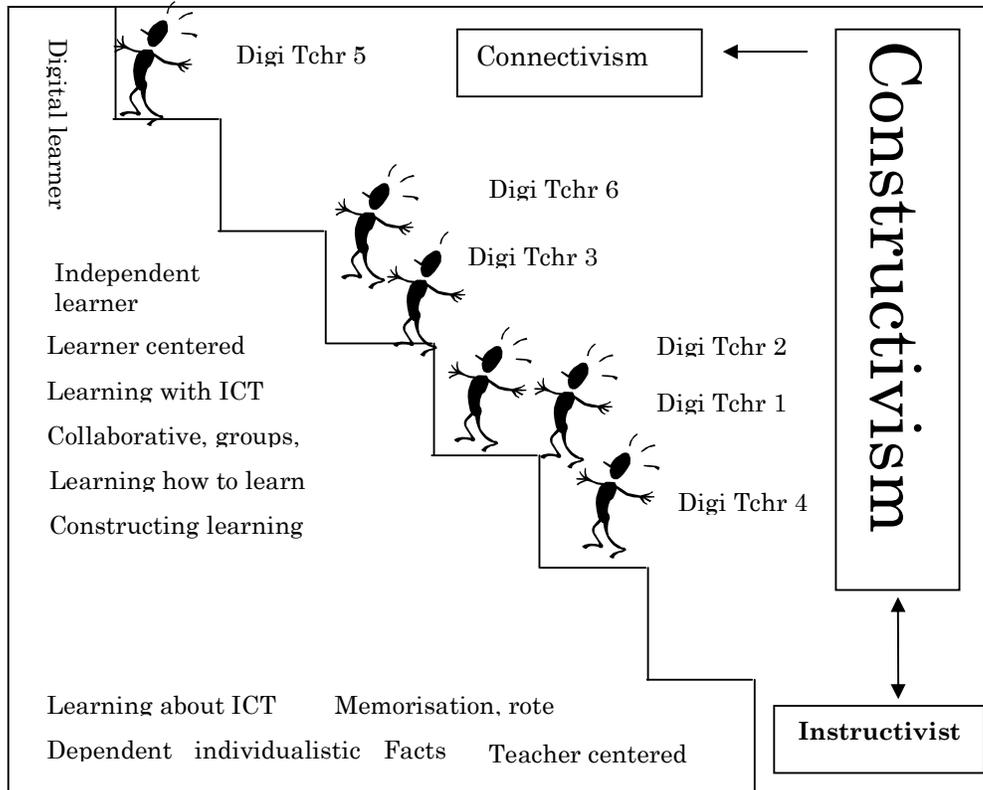


Figure 7.8 The pedagogy continuum

7.6 Funding and support

All the schools required extra funding to support the digital classroom model. Each school has used a different method of funding the digital classroom. School One has chosen to charge the parents a fee as well as use Ministry of Education money for the equipment and infrastructure required. Both teachers in School One stated that they were not supported well regarding extra resources required for a digital classroom. Teacher One commented that you need to go through the DP to ask for a resource where as Teacher Two said there was no money for extra software or equipment for his digital classroom. Any extra programs were freeware from the internet.

School Two was well resourced from the school operating budget and the Telecom Educational fund through the parents’/supporters’ phone accounts. A specialist ICT teacher who worked out of the school computer suite was also funded by the school. A computer technician is also employed by the school. There was no extra charge on parents of students in digital classrooms.

School Three funded the digital classroom through Board of Trustees funding from the Ministry of Education. A computer technician was also funded to setup and maintain the school network. Teacher Five commented that through using recycled computer equipment and citrix networking technology the ratio of computers to students was low. Some students also chose to bring their own laptops to school. This was optional. No extra charge was levied on the students.

School Four funded the digital classroom through the Board of Trustees funds. The teacher worked to a budget and sourced the ICT equipment with the support of the principal. There is no extra charge for the students.

In all six digital classrooms considerable funding has been used to provide hardware and software resources. This has enabled many of the barriers of ICT use to be overcome in some digital classrooms. Lai, Pratt & Trewern (2002), cited in Lai,(2005), p.11 have identified the following list as barriers to effective use of ICT in the classroom:

- cost of equipment
- cost of technical support
- other costs of use
- teacher knowledge of equipment
- teacher understanding about value of use
- board of trustees understanding about value of use
- availability of equipment
- availability of resource kits/learning activities
- back-up support once equipment is in use
- software/licensing
- knowledge necessary of technical planning
- knowledge necessary to integrate technology
- cost of internet use

Cost and resourcing are major factors for all teachers using ICT in the classroom. By analysing the teacher responses to the resourcing question it appears that those

teachers who have a good relationship with the management of the school were able to communicate their equipment needs and resource their digital classrooms to their satisfaction. Other teachers, particularly Teacher Two, was totally frustrated and sourced extra software from freeware on the internet. Teachers Five and Six had good support from their management in their schools and were very well resourced. The Ministry of Education Microsoft agreement has ensured access to Microsoft software for schools.

An important factor from Lai's (2005 P.11) list is the Board of Trustees' understanding about the use of ICT in the classroom. Boards of Trustees' are very supportive of the digital classroom concept. One factor missing from this list is the support from the principal and senior management in the school.

In School One, Teachers One and Two felt that there was a large amount of pressure from the senior management for the digital classrooms to be successful. Teacher Two also felt the digital classroom was a marketing and public relations concept for the school, and hence there was a pressure to make the digital classroom successful. Also because the parents were paying a fee for the students to attend the digital classroom there was also extra pressure from the parents for the students to do well.

Teacher Three and Four in School Two were well supported by the senior management. Recently both the senior management and staff had studied towards a Diploma of Information Technology in Education together and a supportive ICT culture was present in the school. The management had an understanding of ICT pedagogy and were supportive both financially and with PD. Teacher Four was new to the school had not been part of the school wide PD.

The principal of School Three had a strong interest in ICT and was very supportive of the digital classroom. A second digital classroom had been planned due to the success of Teacher Five's classroom. Not only had the support been provided for hardware and software equipment, but the Board of Trustees had supported considerable modification of the classroom to cater for the digital learning equipment and the installation of air-conditioning to improve comfort levels for the students.

School Four also had considerable support from the senior management. The principal had worked closely with Teacher Five in the setting up and the on-going running of the digital class. The teacher and principal were in regular close communication regarding the ICT needs of the classroom.

Conclusions

The funding must be adequate to fund the equipment needed for a digital classroom environment. Lack of resourcing will lead to frustration on behalf of the teacher and students as the equipment fails or is unreliable. It is important that the digital classroom teacher plan ahead for equipment that is necessary for a digital classroom and not purchase equipment on a whim.

To resource a digital classroom the school must provide a flexible learning environment to support a constructivist/ connectivist pedagogy. Ideally wireless laptops, with one between three students a good ratio. The wireless laptops allow the students to work in a group or individual learning event anywhere within the classroom. This flexibility is a must for effective group work. There must be ongoing technical support for teachers for the hardware and school network. Broadband internet is necessary if full use is to be made of the new Web 2.0 tools such as wikis, blogs and personal learning spaces which are going to become important learning environments for students.

Digital classrooms must have full support from the school administration and be adequately resourced. A roof-mounted data-projector is necessary for the teacher or student to use on demand. Peripheral ICT devices such as cameras and microscopes should be readily available. Computers need to be well serviced and fast technical support allows classroom disruptions to be kept at a minimum.

7.07 Positive aspects of the digital classrooms

All the teachers were very positive about the digital classroom. Table 7.4, p.174 shows that motivation to learn, the development of independent learners and access to information via the internet is perceived as a positive aspect by the majority of the teachers.

Table 7.5, p.175 shows that the students saw computer access as being an important positive factor of being in a digital classroom. This factor links in with the motivation factor identified by the teachers. Students like working on computers in class and it is perceived as being different to researching a book or handwriting a report.

The ability to access the internet was also seen as an important factor. Students liked the speed of accessing information and the wide range of information available on the internet. Research is another common factor identified by the students. The research process used by the students is beyond the scope of this research, it would be interesting to analyse the research process the students use. There is a difference in merely copying and pasting from the web pages to using the internet as a resource in an inquiry approach where knowledge is being produced.

Motivation is seen as a key part of learning. No-one can force a student to learn. McKinnon, Nolan and Sinclair (2000) found in their study of students' attitudes towards computer use that, even though the students became immersed in a digital learning environment utilising digital tools for learning, their attitude towards computers became less positive. They concluded that there is no substitute for a quality learning programmes irrespective of technology. From the literature review many studies have demonstrated that the deployment of ICTs in education have made little or no effect on learning (Becker, 2001; Cuban, 2001; Lai, Pratt, & Trewern, 2001), despite the increase in motivation on the part of the learner. When the students in this study were asked about the positive aspects of a digital classroom the majority of students stated that access to computers was important (see table 7.5, p186) and using computer activities/games.. Some of their comments were very technocentric rather than focused on learning. An exception was the students in Teacher Five's class who focused on the development on a learning community, and the elements of an independent, motivated learner (see figure 6.9, p130).

It was interesting that inquiry-based learning was only mentioned by two teachers, Teacher Five and Teacher Six. The inquiry process is an excellent way to integrate the use of ICT in the classroom. During the inquiry process the students formulate investigative questions then they obtain and process factual information to answer their question. They construct knowledge that reflects an answer to the

question/problem. In a classroom this is normally carried out in groups. Research was also a positive aspect identified by student. (see Table 6.19, p.141) They also discussed group-based learning and collaboration as being important as this is a reflection of the classroom organisation where groups of students work on the computers. A paradox is that the majority of the teachers/digital classrooms seem to be concerned with busy work (replacing pen and paper) using the computers. The students indicate that the most popular 'likes' about a digital classroom are; access to computers, computer knowledge/programs/skills, computer games and activities. Bigum (2003, p. 22.) states that "this kind of digital busy work has characterised two decades of classroom computer use". Another example of this digital busy work was from Teacher 1 when he gets the students to use PowerPoint to deliver responses to books. Another example is Teacher 4 where during reading time the students complete a quiz on the computer. Webquests are used for research, Bigum (2003) comments that this is where the teacher provides a challenge and a set of online resources where the students can find the answers. This is basically a technological hide-and-seek exercise. Most of the digital classes use PowerPoint as a presentation tool. From what I have observed in schools the students become focused on the special effects rather than the content of their presentation.

Attributes	Tchr 1	Tchr 2	Tchr 3	Tchr 4	Tchr 5	Tchr 6	Total
Motivation	√	√	√		√	√	5
Independent Learning	√		√		√	√	4
Access to information (internet)	√	√	√		√	√	5
Speeds up learning process	√						1
Cater to wide range of abilities	√						1
Individualised Learning	√						1
Parent Support		√					1
Low absenteeism in class		√					1
Less behaviour problems			√				1
Preparation for life			√	√			2
Time management skills			√				1
Presentation using multimedia				√			1
Development of literacy			√				1
Learning to learn environment					√		1
Access to digital tools when needed			√		√		2
Alternative presentation for students				√	√		2
Digital environment suits some students				√	√		2
Gender differences catered for					√		1
Collaboration					√		1
Group work					√	√	2
Inquiry learning					√	√	2
Development of high order thinking skills						√	1

Table 7.4 Teacher comments on positive aspects of digital classrooms

The teachers are still thinking in the old paradigm: we have this new technology, what do we do with it in our present/old context? Teacher Five is the only teacher who has made major changes to adapt her pedagogy to make use of the digital classroom environment.

Motivation, the development of independent learners and access to information on the internet are seen as positive aspects of a digital classroom by teachers. Teachers tend to associate motivation with learning. The students are very motivated to use computers. What is needed is a study to measure the learning by students in a digital classroom. However this is fraught with difficulty. What do you measure and how. What do you compare the results against?

I am surprised that only one teacher mentioned the development of higher order learning and only two teachers mentioned the inquiry learning process. With the correct pedagogy these skills can be developed in a digital classroom environment.

Attribute	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Number	
Access to computers	√	No data available	√	√	√	√	5	
Research	√		√	√	√	√	5	
Internet Access	√		√		√	√	4	
Computer games/activities			√	√	√	√	4	
Computer Knowledge/programs/skills	√				√	√	3	
Presentation on the computer					√	√	2	
Working in groups on the computer					√		1	
Learning different things					√		1	
Using digital/video cameras						√	1	
Working in an air-conditioned classroom						√	1	
Creating claymations/animations	√					√	2	
Listening to music						√	1	
Learning is fun						√	1	
Learning about computers					√		1	
Drawing/painting on the computers							√	1
Not working in books						√	√	2
Planning your own day				√				1
It is easier to do hard work					√			1
Freedom to use the computers						√		1
Teacher trusts us on the computers						√		1
Learning to type						√	1	

Table 7.5 Students comments on the positive aspects of digital classrooms

The students saw access to computers and the ability to research as the most positive aspect of a digital classroom. Internet access is also related to research. Students were also very motivated by being able to play computer games in the classroom.

7.08 Negative aspects of a digital classroom

	Tchr 1	Tchr 2	Tchr 3	Tchr 4	Tchr 5	Tchr 6	Total
Lack of time for physical education					√	√	2
Unreliable internet access		√	√				2
Change in Teacher Management Style	√						1
Initial student attitude towards computers	√						1
Teacher pressure to perform from senior management		√					1
Outside visitors to view digital classroom		√					1
Pressure on digital students to perform		√					1
Pressure from parents who contribute financially to digital classroom		√					1
Server reliability: network crashes		√					1
Students missing out on core subjects			√				1
Lack of time for students to complete paper-based tasks				√			1
Time to complete lesson learning objectives					√		1
Parent concern over lack of handwriting					√		1
Funding for equipment						√	1
Lack of ergonomic furniture						√	1

Table 7.6 Summary of negative aspects of digital classrooms (Teachers)

The teachers have individual concerns regarding the negative aspects of digital classrooms. Most of the concerns arise out of traditional classroom expectations of schooling. Teacher One found the change in teaching style hard to get used to after teaching in a traditional classroom. Teacher Two voiced concerns over the pressure he felt from senior management in the school who had high expectations of the digital classroom and wanted the concept to work. In Teacher Two's case the fact that the students were paying a yearly levy to be in the digital classroom also meant that extra pressure was being exerted, either by the management or the parents. Teacher Two was also concerned that many prepared lessons were spoilt by network crashes or internet connection crashes. He then had to have a backup lesson ready.

Teacher Three had concerns mostly over the timetabling in that while a group of students were on a pod of computers they could be missing out on core subject lessons. Teacher Three said the internet occasionally crashed most due to atmospheric conditions effecting their satellite connection.

Teacher Four was concerned that the students would miss out on paper-based activities while on the computers; he still felt the paper-based work was important in his classroom and was not totally comfortable with the digital format.

Both Teacher Five and her students were concerned about the lack of physical activity in their classroom and because of the intensity of the student focus on a digital project they would not go out for their timetabled activity. In order to achieve a balanced education it could be argued that physical activity is important and the students should not spend large amounts of time operating a computer. Because of her teaching style Teacher Five is quite flexible in her approach and if a lesson is going really well she tends to let it run into the next timetabled lesson. This can have implications for equal coverage of the curriculum. In some ways operating a digital classroom in a typical New Zealand school is like fitting a square peg in a round hole as the schools infrastructure is not designed for digital classrooms. The curriculum is very content focused (since 1994 the curriculum has been revised so that it is more open and less structured). Bigum (2003) argues that the use of computing and communications technologies (CCTs) has remained in an immature state since the 1980s. This is because schools are inherently very conservative organisations and that when a new CCT emerges the school finds an educational thing to do with the technology without thinking about the pedagogical implications. For example often the computer is seen as a word processor (presentation tool) in the classroom where as it should be totally integrated and used as a tool in the inquiry process. This is seen in some of the negative responses to digital classrooms; it is a response to the infrastructure that has arisen out of the traditional teaching approach of the last hundred years. An example of this is concern over inadequate curriculum coverage. Bigum (2003) also talks about schools should be shifting away from thinking about students as consumers of information and towards thinking about them as producers of knowledge. It could be argued that the digital classrooms with the exception of Teacher Five are concerned with being consumers of information.

For the teachers, unreliable internet access is important as it disrupts lessons that have been planned and surprisingly lack of physical education opportunities for students.

The lack of physical education stems from the reluctance of students to leave the computers during a classroom activity.

Attribute	Tchr 1	Tchr 2	Tchr 3	Tchr 4	Tchr 5	Tchr 6
Missing out on using a computer	√	No data available				
Having to share the computers/work with partner	√					
Computer reliability/loosing work	√					
Having to fill out a digital diary			√			
Missing out on class activities if I am on a computer			√			
Nothing				√		
People fight over the computers				√		
We don't go out to physical education much						√
The old computers						√
Having to write in the maths books						√
The uncomfortable chairs						√

Table 7.7 Summary of negative aspects of digital classrooms (Students)

The students concerns were mostly concerned with access to computers. Students seem to have a need in a digital classroom to have a computer each. Computer reliability was also an issue. It is very frustrating for students and teachers to loose work that has been created on the computer. Teachers need to ensure that students save their work regularly. For the amount of time students spend sitting on unsuitable chairs and desks the wrong size it is surprising more students have not complained about uncomfortable classroom furniture. Teacher Six's class was also concerned about the unsuitable chairs that they use. Using old computers is very frustrating for students as programmes require more processing power and run very slowly if there is a mismatch between the software and hardware requirements. Overall students were satisfied with the digital classroom and there were few negative comments.

Improvement	Tchr 1	Tchr 2	Tchr 3	Tchr 4	Tchr 5	Tchr 6
Updated computers	√				√	
CD-writers	√					
Permanently mounted digital projector	√		√	√		√
More scanners	√					
Educational software		√				
Working digital teacher syndicate		√				
Flexible room layout			√	√		
Research/reflection time			√			
Digital Teacher Sharing group			√			
Contact with local community to share ICT skills					√	
Improved network infrastructure		√				√
New computer seating						√
Video editing software/computer						√

Table 7.9 Improvements to the digital classroom (Teachers)

	Tchr 1	Tchr 2	Tchr 3	Tchr 4	Tchr 5	Tchr 6	
More computers	√	No data available	√	√		√	
One computer per student	√		√				
Computer literate teacher	√						
More time on computers			√				
Digital classrooms in every school					√		
Class laptops			√	√			
New computers						√	
Maths/Reading on computers						√	
Physical Education/fresh air						√	
More free time						√	
Nothing				√	√		√
Playing more computer games							√
Computer chairs							√

Table 7.10 Improvements to the digital classroom (Students)

Both the teachers and students are focused on improving the quantity and quality of the computers within the digital classroom. Here the focus is on the technology not the pedagogy which has been a common theme throughout both the teacher and student comments.

D'Ignazio (1995a, p. 69) discussed the 'Technology Administrator's Field of Dreams: Build it and they will come'. "The notion behind this strategy is that technology is so inherently good and important that if we just acquire the boxes, build the infrastructure, or get internet accounts for all the teachers and students, they are just going to love it. And teaching and learning will never be the same again." In the survey results both teachers and students seem fixated on acquiring newer and faster technology with little mention from the teachers about PD or better ways to use the technology. The students were also concerned with keeping up with the latest technology. To some extent the digital classroom concept, like the teachers; definition, is concerned with the digital technology rather than the pedagogy used to maximise learning.

Although it is outside the scope of this thesis some schools may be introducing digital classrooms to be seen on the cutting edge of technology and education. D'Ingazio (1995b) discusses the notion that schools are stuck on a technology treadmill chasing after the elusive dream of acquiring the latest technologies, a hopeless chase as the technologies keep changing and mutating unpredictably.

Selwyn's (2004, p. 11) solution is for government/schools to develop "appropriate political expectations of what computers can and cannot be used for in education and shaping how computers are integrated into schools from a bottom-up rather than a top-down perspective." From this thesis research Teacher Five's approach is a good example of a bottom-up approach to integrating ICT into education, whereas the majority of the other classrooms illustrate the top-down approach.

7.09 Digital Classroom model

A digital classroom is a learning environment where the goal is to develop independent learners using the inquiry process. Learning is facilitated using authentic collaborative tasks where students participate in active learning integrating ICT where appropriate. Learning is interactive and learner-centred using rich multimedia with self, peer and teacher feedback.

The development of a digital classroom is in a transition phase. The problem is that the classrooms are being developed in traditional classrooms run by traditional teachers using an out-dated curriculum. Because the digital classroom model is in a transition phase I have designed the model appropriately.

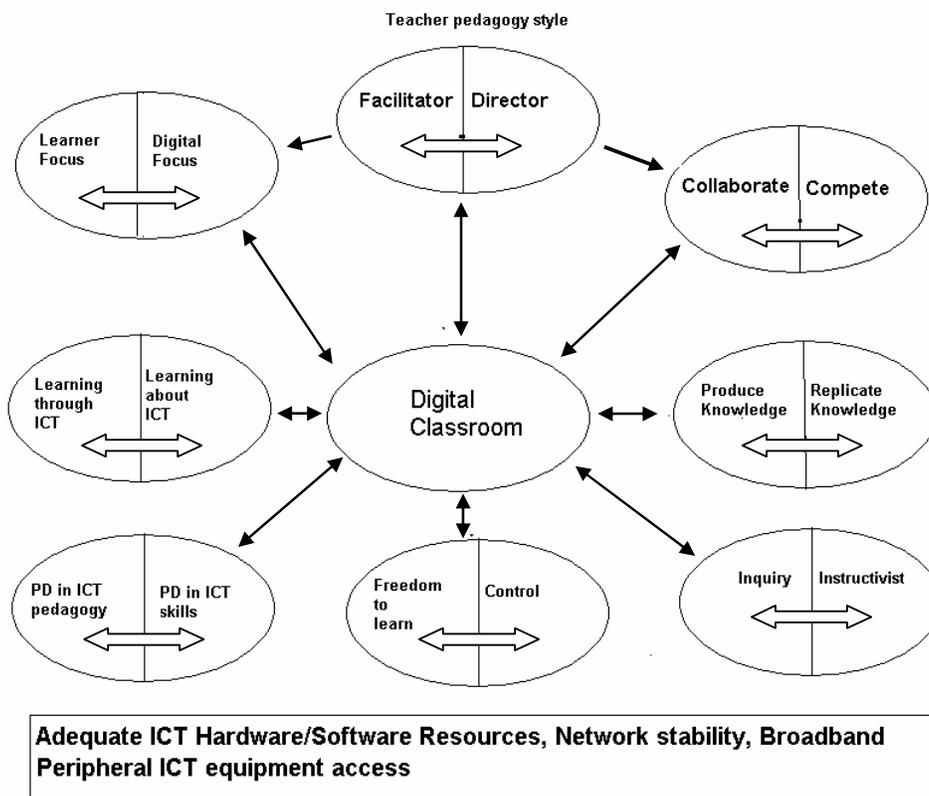


Figure 7.9 Digital classroom model

The model shows that each digital classroom concept is in a transition phase from a teacher-directed traditional model to a constructivist model where the teacher takes on the facilitator role. Each digital classroom surveyed fits into the model depending upon where the teacher and the digital classroom concept fits into the continuum. Note in this model I have inserted a bar containing adequate ICT hardware/software resourcing it is very difficult to quantify these resources, what has emerged from my research is the importance of the teacher and the pedagogy used in the classroom, not the computers. The equipment does need to be reliable and stable and peripheral ICT resources needs to be available on demand. The ICT equipment does need to be flexible, wireless laptops are preferable for the digital classroom environment. As stated in my definition ICT will be used for teaching and learning where appropriate. What has emerged is the importance of the teacher and the pedagogy used. This determines the effectiveness of learning in a digital classroom environment, not the ICT hardware/software.

7.10 Summary

In this chapter the results have been discussed and related to the literature. A definition of a digital classroom has been formulated and a model of the developing digital classroom has been outlined.

- Teachers focused on the digital aspect of a digital classroom with the exception of Teacher five
- A new digital classroom definition was constructed which reflects the aims of a constructivist-based ICT environment

A digital classroom is a learning environment where the goal is to develop independent learners using the inquiry process. Learning is facilitated using authentic collaborative tasks where students participate in active learning integrating ICT where appropriate. Learning is interactive and learner-centred using rich multimedia with self, peer and teacher feedback.

- The attributes of a modern engaged learner were outlined
 - Engaged with learning.
 - Collaborative.
 - Responsible for own learning.

- Use authentic tasks.
- Self-directed learner.
- Engaged with inquiry learning.
- Adequate resourcing for a digital classroom was discussed
 - Network reliability is important.
 - Broadband internet is needed.
 - Generally all the classrooms were well equipped.
 - No classrooms made any use of a learning management system.
- PD in the use of ICT in teaching/learning is vital
 - A suitable pedagogy should be investigated first then plans made to incorporate the pedagogy into the digital classroom environment.
 - Teachers attended mostly skills-based PD courses.
 - Teacher five had thought carefully about the appropriate pedagogy and planned the implementation into the classroom.
 - Most teachers were concerned about skill development and how to integrate isolated ICT skills into the classroom.
 - The amount and direction of PD varied considerably between teachers, even within the same school.
 - PD lacked focus and was not strategically planned.
 - Support from the administration in the school is vital.
- The two main learning theories that support ICT in learning are:
 - Directed instruction/cognition.
 - Behaviourism is used with ICT in schools and leads to low-level dependent learners.
 - Constructivism
 - There are many forms of constructivism which lead to the development of self-directed independent learners.
 - Teacher Five's digital classroom is a good example of a constructivist learning environment where technology is used to develop self-directed independent learners and where the learner comes first, not the technology.
 - To be effective in a digital classroom environment the teacher needs to take on the facilitators role (guide on the side).

- Teachers were all at different stages along the constructivist continuum.
 - Connectivism is an emerging theory that will have more relevance as the digital classroom concept develops.
- Digital classrooms must have full support from the school administration and be adequately resourced.
- Classroom equipment must be well serviced and reliable.
- Networks must be stable and broadband connection reliable.
- Motivation, the development of independent learners and access to information on the internet are seen as positive aspects of a digital classroom by teachers.
- The students see access to computers and the ability to research as the most positive aspect of a digital classroom.
- Negative aspects from teachers.
 - Most of the concerns arise out of traditional classroom expectations of schooling.
 - The change process.
- Negative aspects from students.
 - The students concerns are mostly concerned with access to computers.
- Improvements to digital classrooms. Both the teachers and students are focused on improving the quantity and quality of the computers within the digital classroom.
- The digital classroom concept is in a transition phase from a teacher directed traditional model to a constructivist model where the teacher takes on the facilitator role.
- What has emerged is the importance of the teacher and the pedagogy used. This determines the effectiveness of learning in a digital classroom environment, not the ICT hardware/software.

Chapter 8 Conclusion

8.1 Introduction

In this concluding chapter I will summarise the results of my research and suggest further directions for the digital classroom concept. The limitations of this research will also be outlined.

8.2 Digital classroom definition

From a teachers' perspective a digital classroom was defined by five of the six teachers as a classroom with ICT equipment and a ratio of computers to students with the emphasis on the technology. Teacher Five stated that it was about the pedagogy of teaching. A change in teaching style using the inquiry process for learning and the development of life long learners. The ICT equipment was to support the learning.

The majority of students also saw the digital classroom as a classroom with computers. The students were focused on learning about the computers. Teacher Five's students commented about using technology for their research. The establishment of a constructivist learning environment. Teacher Five's digital classroom environment has strongly influenced my definition of a digital classroom.

A digital classroom is a learning environment where the goal is to develop independent learners using the inquiry process. Learning is facilitated using authentic collaborative tasks where students participate in active learning integrating ICT where appropriate. Learning is interactive and learner-centred using rich multimedia with self, peer and teacher feedback.

Here the goal is the development of independent learners who are able to use the inquiry process to problem-solve. A collaborative learning environment is established which is facilitated by ICT, both within the classroom, nationally and globally. The constructivist pedagogy enables the teacher to take a facilitator role and the students to take an active role in their learning. As the emerging connectivist pedagogy develops it will be more suitable for guiding more effective teaching using ICT because it takes into account new 'digital' learning styles of the Net Generation.

Because the digital classroom concept is in a transition phase I have designed a digital classroom model that places individual digital classroom along a continuum for each of the main concepts.

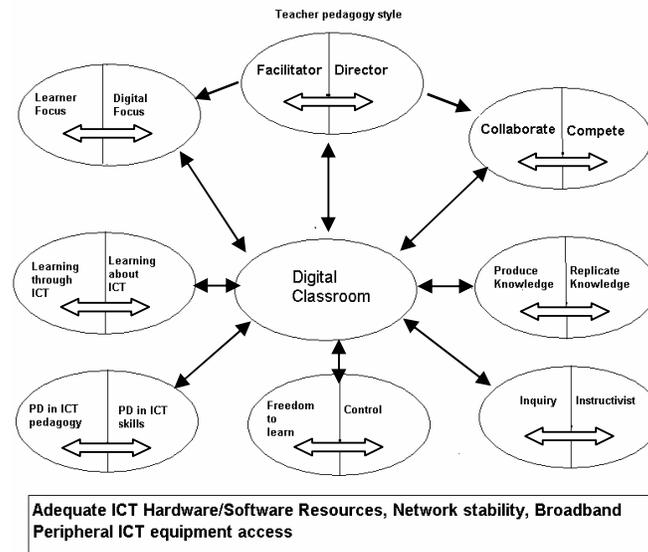


Figure 8.1 Digital classroom model

In each element that makes up a digital classroom there is a continuum. Each classroom in the research fits along the continuum. The teacher has the most important role in facilitating the learning in a digital classroom. The focus must be on higher order thinking not the speed and number of computers. The classroom must be learner-centred leading to the development of independent learners. For many teachers it is a major step to move from a director’s role in a classroom to a facilitating role. It is vital for teachers to take PD in the different types of pedagogy that are appropriate to use with digital learners. Research has shown that teachers do not use ICT well in their classrooms (Cuban, 2001).

8.3 Critical Success Factors

The example of Teacher Five’s classroom is a good example of a classroom that has moved along the continuum towards a classroom where the students show the characteristics of learners utilising the potential of a digital learning environment. A constructivist pedagogy is present where the students are fully involved in the classroom activities where they are able to construct their own knowledge. The

constructivist pedagogy has implications for the teacher for changes in lesson preparation, classroom management and assessment. The students collaborate on learning tasks and learn through ICT not about ICT. Teacher Five's students' comments show that they have some freedom to learn and are moving towards independence. Inquiry is a major focus and the students are on the way to becoming knowledge producers, not just knowledge replicators. Above all, the focus of the classroom is on learning, not technology. The ICT must be reliable, stable and use a broadband internet connection. Access to peripheral ICT equipment needs to be on a just-in-time basis. The ICT should be transparent in a learner focused classroom.

There is a lack of current research on the concept of digital classrooms and further research is needed as the concept develops. There is currently much talk about the mismatch of the learning styles of today's students and the traditional classroom concept (Prensky, 2001). Further research is also needed to investigate the pedagogy that is being used in the digital classrooms. The main aim of digital classrooms is to improve learning. Research into the learning style and achievement of students is also needed as considerable financial investment is being made by schools. Action research by digital classroom teachers will also inform educationalists about the digital classroom concept. This will enable reflection by teachers and allow some analysis of the digital classroom concept.

All the classrooms were well equipped with ICT equipment. A fast stable network is essential for the digital classroom environment. The network needs to be well maintained to minimize network crashes which disrupt the flow of the digital classroom learning activities. Adequate server storage is essential for digital portfolios. Secure wireless access points are also needed for every digital classroom. Teacher Five stated that the wireless laptops were ideal in the digital classroom environment as they allowed the students flexible access to the network and could be easily moved for group work or access from the library. A permanently fixed data projector was considered to be essential by all the teachers although no classes had a permanent data projector at the time of the survey. Access to a range of ICT peripheral devices at a just-in-time basis is also essential. All students had access to a network drive to save their files.

Access to PD varied considerably among the digital classroom teachers. Two teachers had completed a Graduate Diploma and had access to some pedagogy development. This needs to be ongoing and current. One teacher had no PD in ICT. The other teachers' PD was primarily ICT skills-based. McKenzie (2003 P.4) noted that "knowledge of content must be balanced with a solid grounding in effective teaching strategies, especially when we hope teachers will dramatically shift the performance of students who have been failing or struggling". More PD is needed so teachers make the most appropriate choice of pedagogy when using ICT to enhance learning. All the classrooms were at a stage along the constructivism continuum with Teacher Five's classroom reflecting a strong constructivist pedagogy. This was reinforced by the comments from Teacher Five's students. School Three had developed a strong culture of ICT PD amongst the staff this leads to peer support and the sharing of ideas. The literature review has illustrated research where ICT has failed to make an impact on learning, McKenzie (2003) discusses that a lack of pedagogy PD has led to the failure of ICT to make an impact on classroom learning. The teacher is a key component in the development of a constructivist classroom where ICT is used to create a rich learning environment.

All the digital classrooms use traditional classrooms that have been modified to varying degrees. Teacher Five's classroom had been significantly modified to give more room, the other classrooms had the furniture re-arranged for the computers and cabling. Students are generally rostered onto the computers during specific times each day while the teachers teach the remaining students. Rostering is a directed activity that controlling teachers use to manage students; in a constructivist learning environment the students should use ICT when the need arises. All the teachers endeavoured to use ICT to enhance learning using a constructivist pedagogy. Integration is sometimes merely substituting a word processor for a pencil. Each teacher is at a different step along the constructivist pedagogy continuum. (See Figure 7.8 The pedagogy continuum p. 179) Teacher five is at the furthest point along the continuum compared to the other teachers. This has been endorsed by the student comments. At the heart of Teacher Five's classroom environment is the student not the technology. Students have the freedom to learn and select the use of technology to facilitate their learning where appropriate.

McKenzie believes teachers should keep in mind the following points when planning lessons utilising ICT for students.

- “Needs Assessment (what learning is needed?)
- Professional Growth (how can I improve my teaching?)
- Classroom Culture (how do I cultivate the class culture for learning?)
- Strategy (how do I teach to maximize results?)
- Resource Management (how do I make do with what we have?)
- Problem Solving (what could go wrong and how do I cope?)
- Orchestration (how do I orchestrate all the different aspects of pedagogy?)”

(McKenzie, 2003, p. 6)

Each school funded the digital classrooms in different ways. School One charged the parents an annual fee and used Ministry of Education funding. School Two was resourced from the Ministry of Education and the Telecom school fund. School Three and Four was funded through the Ministry of Education funding with no charge for students. It was up to each school to manage the funding of ICT equipment in the school. The source of the funding appears to have little relevance on the performance of the digital classrooms other than an expectation from the parents in School One on the teachers to fully utilise the ICT equipment in their teaching.

It is vital that the teachers are well supported by the management of the schools. In the majority of cases the digital classroom teachers felt well supported by management. This was necessary in all cases in the setup of the digital classroom within the schools. An exception is Teacher two who did not feel well supported by management or his syndicate. Parents and Board of Trustees were very supportive of the digital classroom concept in all cases.

Motivation, the development of independent learners and access to the internet for information were seen as positive factors by the digital classroom teachers. This was also confirmed by the student survey. Although motivation was identified as a major factor by the teachers research has failed to link this with student achievement (Becker, 2001; Cuban, 2001; Lai, Pratt, & Trewern, 2001). The students enjoyed accessing the computers, being able to present their work on

computers and playing games. Teachers Five and Six mentioned that ICT was used in the inquiry process. The inquiry process has much potential for utilising ICT in learning and this is the focus of many Information Communication Technology Professional Development (ICTPD) clusters working with New Zealand Schools. There is much scope in the future for teachers to develop inquiry infused constructivist-based activities in the digital classrooms.

Unreliable internet connections and lack of physical education activity were the main negative factors identified by the teachers. One teacher identified the change in teacher style being a challenging factor. Many classrooms did not have ergonomic chairs and tables, one teacher was concerned about this. In the school where the parents paid for their students to be in a digital classroom the teacher felt there was pressure from parents and management for the students to succeed. Reliability of the network and internet connection was experienced by the teachers in School One and a backup plan was necessary. Two teachers were concerned about the lack of physical education time for the students it was difficult dragging the students off the computer when a physical lesson was scheduled. Students of Teacher Five were concerned about the lack of physical education. Teachers should keep in mind that they need to offer a balanced curriculum.

A permanently mounted classroom projector was an improvement indicated by four teachers, this would allow the teacher and students to demonstrate computer skills and for the presentation of tasks. Care is needed here so the teacher does not become a sage on the stage rather than a guide on the side. A more flexible classroom layout and updated computer equipment was asked for by two teachers. Regarding improvements to the digital classroom both teachers and students seek improvements to the technology rather than pedagogy.

The digital classroom concept is in an early stage of development and most teachers/students are focused on the technology side rather than the pedagogy. Teacher Five is an exception and an analysis of her classroom shows a rich multimedia environment where the students used ICT to support their learning. The traditional classroom is based on the industrialised model of teaching where the students sit in rows and move through the educational system together. This

system is still the most predominate model used in the New Zealand education. The Net Generation of students are very internet savy who are constantly interacting with technology, cellphone, email and internet. If managed well the digital classroom concept could meet the needs of this generation of learners. My research has shown some variation between the six classrooms studied and the classrooms were at different stages along the constructivist continuum. Education is traditionally conservative and the digital classroom concept is turning heads. The digital classroom is certainly motivating for both the teachers and students. The key to its future success relies on the pedagogy the teacher uses within the classroom.

None of the classrooms used any learning management systems such as Blackboard, KnowledgeNet or Moodle. In the future the use of learning management systems will be vital in the next stage of the digital classroom concept. This will allow the students to create digital portfolios and be part of a 24/7 digital learning community. This will also bridge the gap between the school and the home. The new Web 2.0 tools such as wikis, blogs and personal learning spaces (e.g. MySpace) will be used by students as part of their daily learning activities. This will allow students to collaborate with students all over the world. The interactive whiteboard (IWB) is a recent technology that if managed well will contribute to digital classrooms in a positive way. Like any technology the IWB needs to be matched with the appropriate pedagogy to be successful in a digital classroom. Technology will continue to develop at Moore's Law pace and this will continue to be used by digital classroom teachers. The main barrier will be the skills of the teacher, more specifically the pedagogical skill of the teacher to move into the facilitator role. While PD in pedagogy continues to take a back seat to purchasing technology, effective pedagogy change in using technology effectively for learning will be slow. Digital classrooms will continue to develop in small clusters and because of the conservatism of the education system it will be many years before digital classrooms are part of mainstream education.

8.4 Research limitations

The limitations of this research are that the research is spread over six classrooms. No one classroom was studied in detail. As a follow-up it would be interesting to

sit in a digital classroom and observe the learning behaviour of the students interacting with the technology and a more detailed analysis of the teaching pedagogy used. It would also be interesting to visit the same classrooms five years later in 2008 and compare the teaching style and critical success factors. Research analysing the learning that occurs in a digital classroom is needed. The difficulties are who do you compare the learning against and what learning do you measure?

8.5 Conclusion

Digital classrooms are about students participating and having some control over their own learning in a digital environment. The students need to become knowledge producers. “Literacy in the 21st century is all about participation: the ability to critically consume and create knowledge for the betterment of ourselves, our families, and our communities” (Carvin, 2006, p. 6).

The key to the success of digital classrooms lies with the teachers. An effective pedagogy must be developed that combines the power of the new digital tools available in a rich multimedia learning environment with the learning style of the M Generation learner. With constructivism and connectivism we have a good base. Digital classrooms have the potential to merge the new learning styles of today’s students with the power of the new emerging digital tools to produce a new generation of independent literate problem solving students.

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Appendices

9.1 Consent form



Digital Classroom Project

Consent Form

The purpose of the study is to investigate the critical success factors for the implementation of a digital classroom in New Zealand. The research is being done by Malcolm Roberts from UNITEC New Zealand, and will be supervised by *Carmel McNaught*.

Name of Participant:.....

I have seen the Information Sheet dated *April 2004* for people taking part in the Digital Classroom Project. I have had the opportunity to read the contents of the information sheet and to discuss the project with the Digital Classroom team and I am satisfied with the explanations I have been given. I understand that taking part in this project is voluntary (my choice) and that I may withdraw from the project at any time up to final draft stage.

I understand that I can withdraw from the project if, for any reason, I want this.

I understand that my participation in this project is confidential and that no material that could identify me will be used in any reports on this project. I have had enough time to consider whether I want to take part. I know whom to contact if I have any questions or concerns about the project.

The **principal researcher** for this project is
Malcolm Roberts

Signature.....participant
.....(date)

Project explained by.....

Signature.....(date)

The participant should retain a copy of this consent form.

This study has been approved by the UNITEC Research Ethics Committee from April 2004 to December 2005. If you have any complaints or reservations about the ethical conduct of this research,

you may contact the Committee through the Secretary (ph: 09 815-4321 ext 8041). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

9.2 Research information form for participants



INFORMATION SHEET

Digital Classroom Research Project

About this research

You are invited to take part in a research project to investigate the critical success factors for the implementation of a digital classroom in New Zealand. The Researcher is Malcolm Roberts. This project is being supervised by Carmel McNaught

You have the right to not participate, or withdraw from this research survey at any time to final draft stage. This can be done by phoning *Malcolm*, or by telling him when he contacts you that you do not want to participate.

The teacher interview will take about 45 minutes to complete, and the pupil questionnaire, 20 minutes.

Information and concerns

If you want further information about the project you can write, fax or email
Malcolm Roberts
Hauraki Road
RD 4 Thames
07 8675317

Confidentiality

Confidentiality and your anonymity will be protected in the following ways:

- All computer records will only be accessible by passwords held only by the researchers.
- The completed questionnaires and interview transcripts will be seen *only* by the researcher. *Unitec* will only receive summaries and reports in which all personally identifying features are removed.

Finally, we would like to thank you for your valuable contribution to this research.

This study has been approved by the UNITEC Research Ethics Committee from April 2004 to December 2005. If you have any complaints or reservations about the ethical conduct of this research, you may contact the Committee through the Secretary (ph: 09 815-4321 ext 8041). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

9.3 ICT equipment survey

Digital Classroom ICT equipment.

Room No:

Number of students:

School No:

Equipment

Number

Equipment	Number
Computers	
Scanner	
Digital Camera	
Video Camera	
Microphone	
Fax	
Polycom Audio Conference	
Telephone	
Web cam	
Other equipment	

Is the classroom networked Yes/No

Network type: Ethernet/ Wireless

Internet connection type: Dialup or Broadband

