Digital Immigrant Teachers Learning for the Information Age

Natalie Senjov Makohon
BA, DipEd, GradDip CA, BEd, MEd

Thesis submitted to fulfil the requirements of Doctor of Philosophy
2009

School of Education
Faculty of Arts, Education and Human Development

Victoria University

Abstract

This study investigated how experienced teachers learned Information and Communication Technologies (ICT) during their professional development. With the introduction of ICT, experienced teachers encountered change becoming virtually displaced persons – digital immigrants; new settlers – endeavouring to obtain digital citizenship in order to survive in the information age. In the process, these teachers moved from learning how to push buttons, to applying software, and finally to changing their practice. They learned collectively and individually, in communities and networks, like immigrants and adult learners: by *doing*, experimenting and reflecting on ICT. Unfortunately, for these teachers-as-pedagogues, their focus on pedagogical theory during the action research they conducted, was not fully investigated or embraced during the year-long study.

This study used a participant observation qualitative methodology to follow teachers in their university classroom. Interviews were conducted and documentation collected and verified by the teacher educator. The application of Kolb's, Gardner's, and Vygotsky's work allowed for the observation of these teachers within their sociocultural contexts. Kolb's work helped to understand their learning processes and Gardner's work indicated the learning abilities that these teachers valued in the new ICT environment. Meanwhile Vygotsky's work – and in particular three concepts, *uchit*, *perezhivanija*, and *mislenija* – presented a richer and more informed basis to understand immigration and change.

Finally, this research proposes that teachers learn ICT through what is termed a *hyperuchit* model, consisting of developments; action; interaction; and reflection. The recommendation is that future teacher university ICT professional learning incorporates this *hyperuchit* model.

Presentations

Parts of this study have been presented at a number of international conferences. In 2003, in Badajoz, Spain, "Teacher Immigrants" was presented at the II International Conference on Multimedia and Information and Communication Technologies (m-ICTE) called: *Advances in Technology-Based Education: Toward a Knowledge-Based Society*. The Post Graduate Studies Unit at Victoria University sponsored the application for the m-ICTE conference.

In 2004, at Melbourne University, Australia, at the AARE (Australian Association of Research in Education) International Conference called: *Doing the Public Good: Positioning Education Research*, a paper was presented: "How do Digital Immigrant Teachers (DITs) learn ICT for the Information Age?"

In 2005, the Secomb Conference and Travel Fund sponsored a paper "Understanding the Balance of Experienced Teachers" presented at AARE (Australian Association of Research in Education) international conference *Creative Dissent: Constructive Solutions* in Sydney, Australia. Additionally, in her leadership role as the Convenor of the ICT Special Interest Group for AARE, the researcher organised this presentation as part of a symposium with other academic colleagues from various Australian universities.

In 2006, two papers were presented in Australia: one at the AARE International conference *Engaging Pedagogies* in Adelaide; called "The Experienced Teacher in the Elearning Environment" and a referred paper "Experienced Teachers and Multiple Intelligences" at ASCILITE (Australasian Society for Computers in Learning in Tertiary Education), International Conference *Who's Learning? Whose Technology?* in Sydney, Australia.

The paper *"*Digital Citizenship*"* was presented in Cambridge, England, in 2007 at the *Third International Conference on Technology, Knowledge, and Society*.

The final referred paper "The Teacher Educator in Uchit" was presented at the Association for the Advancement of Computing in Education (AACE) EdMedia 2008 International Conference in Vienna, Austria.

Further to the conference presentations, on the 13/6/2006, the *"Secomb Conference and Travel Fund"* was awarded at Victoria University from the Faculty of Arts, Education and Human Development.

Acknowledgements

Many people have supported and encouraged me in my journey and I would like to thank them.

Firstly, my co-supervisors Professor Tony Kruger and Professor Brenda Cherednichenko who guided, humoured, and engaged me in the learning process. I am grateful for their generosity in reading and discussing each chapter in a way that helped me refine my earlier drafts.

Secondly, colleagues from the Faculty of Education, Arts, and Human Development, Postgraduate Studies Unit and Staff College for their collegiality and care in various ways.

Finally, the patience and encouragement of friends and family, especially Steven Senjov, my brother, who was always there; my paternal uncle, The Very Reverend Dmytro Seniw, for his prayers; my three children – Adrian, David, and Ksanya for their understanding and love; and my husband, Roman, for allowing me the time to complete this work. And above all, to my parents: $^{+}$Peter Senjov and Katerina Senjov, who were great believers in the empowerment of education and the process of *mislenija*.

Student Declaration

I, Natalie Senjov Makohon, declare that the PhD thesis entitled *Digital Immigrant Teachers learning for the Information Age* is no more than 100,000 words in length, exclusive of tables, figures, appendices, references, and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. The work presented is, to the best of my knowledge and belief, original, except as acknowledged in the text.

……..

Natalie Senjov Makohon

Table of Contents

List of figures

Glossary of ICT Terminology

Digital Language Acquisition

Computer Words	Explanation
ICT	is an abbreviation for Information and Communication Technologies and means anything relevant to information and communication over cable or aerials; including the Internet.
Internet	is networks of worldwide interconnected computers which access and transmit data and information over the worldwide networks. The networks include file transfer, online chat, electronic mail, and interlinked resources and webpages of the World Wide Web (WWW).
World Wide Web (www) or the Web	is a hypertext system that serves Web pages and transfers files over the Internet.
webpage	is an information resource suitable for the World Wide Web and is accessed through a web browser. This information is usually in HTML format, and may provide navigation to other web pages via hypertext links.
html	hypertext markup language is the format of files published on the World Wide Web to display links, texts, graphics and attached media.
hyperlink	is the connector between one piece of information in a document to another section of the same document or to another document that may be on or part of the same or different area.
browser	is the application that allows the user to search, find, view and manage information over the Internet, for example,Internet Explorer, Mozilla Firefox, or Opera.
pdf files	is a file format for document exchange over the Internet.
elearning	is a form of learning through the use of online technologies.
mlearning	is a form of learning through the use of mobile technology, such as mobile phones.
virtual learning environment (VLE)	is an environment designed to support learning and teaching. It normally works over the Internet to provide uploading of content, assessment, communication, return of students' work, peer assessment, administration of student groups, collecting and organising student grades, questionnaires, tracking tools, etc. While originally created for distance education, VLEs are now most often used to supplement the face-2-face classroom.
email	is a method of composing, sending, receiving storing and forwarding messages over the Internet.
eportfolio/electronic portfolio/digital portfolio	is a collection of reflective electronic evidence of learning records assembled and managed by a learner used for multiple purposes. In an online environment and over time, the portfolio can be maintained dynamically.The evidence can be presented in Microsoft Word, as Adobe PDF files, images, multimedia, blog entries, and hyperlinks.
digital camera	is a camera that takes still photographs or video, or both, and records images digitally.
icons	is an image, picture, a sign or representation that stands for an object in computer programs.
Computer/software programs	are instructions for a computer.
zipped file	is a data compression, to reduce file size, or store information as-is.

Laptop/notebook computer/ notebook/notepad	is a small mobile computer.
USB (universal serial bus) stick	is a data storage device with a storage capacities typically range from 64 MB to 32 GB or more.
Scanner	is a device that optically scans printed text, images, handwriting, or an object, and converts it to a digital image.
floppy disks	is a flexible ("floppy") data storage medium.
copy	Is the process of duplicating blocked text, particular files or images.
paste	Is the process of positioning text or graphics in a location, after it has been copied or removed from another location.
morphing	is the process that changes (or morphs) one image into another through a seamless transition.
edit	is the process of adding, changing, or rearranging data
cut	Is the process of reducing, cutting down or discharging information in a file.
wordprocessor	is a computer program with specifically modified typewriting facilities that deals with text based material
spreadsheet	is a computer worksheets in which numbers and text are entered in rows and columns.
breadcrumbs	represent a way of steering or moving through a website path without using the 'back' button. Their purpose is to help a user to figure out where they are within the site, and they offer links to move to previously viewed pages.
Shortcut buttons	help streamline movement within a file, instead of possibly navigating through several menu layers to get to the function.
Surfing the net	is to casually and randomly explore a series of websites in an unrehearsed manner.
graphics	are images or pictures such as symbols, drawings, diagrams, photographs and clip art
storyboard	is a series of panels roughly depicting scenes, that visually represent the content.
synchronous communication	is communication where the sender and receiver share information which is constantly being transmitted. The communication takes place in real time online between two or more people in unison.
asynchronous communication	two-way communication in which there is a time delay between a message being sent and received.
online community/ virtual community/ e-community	is a group of people that primarily interact via computer network communication media rather than face to face, for social, professional, educational or other purposes.
Web 2.0	a perceived transition of the Web from a collection of Web sites to a full-fledged computing platform serving Web applications
blogs	are short for Web logs. Blogs are publicly available web pages, with personal views and links expressing the opinions and observations of users. They are online journals where users post thoughts, comments or news in a chronological format. Updates are often frequent and done on a regular basis.
wikis	A wiki is a website that allows visitors to add, remove, edit and change content, typically without the need for registration.
Internet banking	Banking customers conduct banking transactions over the Internet

ICT Software Applications

Application/Programs	
Hyperstudio	is a multimedia authoring tool which provides a simple method to combine varied medias.
Paintshop	is a graphics editor.
Microsoft office suite	Is a desktop application for Windows and Mac with some combination of Word, Excel, PowerPoint, Access and Outlook along with various Internet and other utilities. The applications share common functions such as spell checking and graphing, and objects can be dragged and dropped between applications. Microsoft Office is the leading application suite on the market.
Microsoft Word	is a word processing program used to create, edit, format, and save documents.
Adobe Conversion	is a pdf (portable document file) converter that converts files into read only and the reader can not add information to the file.
Adobe Acrobat	Is a software program that allows you to create pdf files which can be examined and printed by anyone even if they don't have the original software used to create the file.
Photoshop	is a professional image-editing and graphics creation software.
PowerPoint	is a presentation software that creates slides, handouts, notes, and outlines, for producing slide shows that can incorporate text, graphics, video, animations, etc.
Microsoft Publisher	is a desktop publishing application from Microsoft.
Microsoft Excel	is a spreadsheet program that can perform numerical calculations and bookkeeping tasks.
Microsoft Frontpage	is a website creation and management tool to create and manage web sites.
Kidpix	is a drawing program aimed at children.
WebCt	online management system that allows educators to create web sites for courses that enhance or deliver course instruction. The system aids students in their classes by creating, managing, organizing, and housing a Web-based learning environment.

Chapter One – Change

Introduction

In the mid 1950s, the launching of Sputnik, the coming of television and satellite communications, and the beginning of information and communication technologies (ICT), were formative aspects of what has come to be called the "information age" (Castells 1996). What followed was an "exploding capacity to create, transmit, and transform information with technologies" (Romano 2003, p. 49). Internet technology has fundamentally altered the technological and economic landscape of the twenty-first century and more people have become involved in the creation, management, and transfer of information than in any previous economies. Consequently, an economy built on information rather than manufacturing and production has emerged (Romano 2003).

Government policies worldwide are constantly being reviewed and repositioned to cope with an expanding global marketplace, and the potential for enhanced social interaction and community participation (Smith 1999) through the utilisation of expanded communications technologies has been increasing. Australia is no exception, especially in the field of education, where the introduction of ICT into the educational curriculum is under way and has been encouraged by various government bodies (DEST 2001). Experienced teachers have not, however, been fully enculturated into the new environment. Like many other professionals, teachers have been forced to accept that knowledge acquisition is central to cognition and metacognition, both of which have increased in importance and value (Jochem, Van Merriënboer and Koper 2004; Bitter and Pierson 2002; Gardner 1981) in this education revolution. Such acquisition presents itself as a major challenge to be met over the next decade so as to achieve prosperity, productivity, and human capital investment (Rudd and Smith 2007).

Many teachers have embraced ICT and utilise them within their classrooms. Like other workers in governmental agencies, many teachers have realised the need to be knowledgeable, skilful,

and able in applying ICT effectively and efficiently (Anderson 2004). Some lack the confidence, skills and knowledge, but nevertheless rate their acquisition highly as a professional development need (Hargreaves, Comber and Galton 1996). Over the years, professional development based on ICT tool acquisition has engaged many, but not all, teachers. ICT learning by teachers has been a long-neglected field, and with it the reference to the pedagogical and andragogical theories in relation to learning and teaching that incorporate ICT. Still, even a finely-honed tool does not necessarily guarantee that a practitioner will improve the quality of the output, or that the end user will be more satisfied.

Background to the study

With the explosive abundance of technology, its globalisation, and the emphasis its presence places on lifelong learning (European Round Table of Industrialists 1995), teaching, like many other professions, has transcended the traditional learning environment. For example, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) entered the third millennium with a new interdisciplinary project – "Learning Without Frontiers'' – which gives the use of ICT a high priority. The European Union declared 1996 the "Year of Lifelong Learning" (Hargreaves and Evans 1997, p. 50); educational bodies in a number of developing countries, particularly Africa (Chere-Masopha and Bennett 2007), began to investigate learning and teaching developments in the new milieu. Australia has not lagged behind, and national government bodies such as the Department of Education, Science and Training (DEST) and Department of Education, Training and Youth Affairs (DETYA) as well as state governmental education departments have entered the field, advocating that ICT needs to be an integral part of learning (DEST 2000, now the Department of Education, Employment and Workplace Relations).

The Australian Government has provided a number of reports on the subject, including: "Australia's Strategic Framework for the Information Economy 2004-2006" (DCITA 2004); "Making Better Connections" (DEST 2001); "Teachers for the 21st century" (DEST 2000); "Learning for the Knowledge Society" (DEST 2000); "In Backing Australia's Ability" (DEST

1999); and "The Adelaide Declaration on National Goals for Schooling in the 21st Century" (DEST 1999). Other government initiatives include the continuing "Australian Government Quality Teacher Programme (AGQTP)" (DEST 2000) which sees ICT proficiency as one of the foundation skills for continued educational success in the knowledge society and information economy. When the issues raised in these reports are taken into consideration alongside "Higher Education at the Crossroads" (DEST 2002), and the recent speech, "A Higher Education Revolution: Creating Productive, Prosperous, Modern Austallia" (2008), by the Deputy Prime Minister, Julia Gillard – both of which are important documents to the present research project – new approaches and initiatives can be seen to be essential for ensuring better education, social inclusion, and work opportunities for Australians. Innovative approaches that can "inject diversity, choice and the highest quality" (Gillard 2008) of education through the resourcing of higher education, are required to restore educational equity for students, and foster the capacity to critically reflect on and understand the changes brought about by the information age. Further monitoring approaches, provision of courseware (the instructions), and knowledge management (the informational strategy) are needed (Rosenberg 2001) to cater for the mooted "Education Revolution" (Gillard 2008). The substantial number of older workers, including many teachers, whose career education occurred prior to the ICT revolution and who are unfamiliar with the new technologies' intricacies, must also be factored in.

The majority of practicing teachers in Austalian schools today did not receive pre-service training in computer use, yet they have experienced increasing expectations that they will incorporate computer technology into their teaching (Russell and Bradley 1997). Professional development programs (Hacker and Niederhauser 2000; Russell and Bradley 1997) have been proposed, trialled, and in some cases implemented. Yet despite this, many teachers often feel threatened by this new world; they have a high computer anxiety which is further exacerbated by comparison with the often excellent computer skills of their students (Phelps and Ellis 2002).

More than ever, understanding the mind and identifying the learning process (Kolb 1984) play paramount roles in the ever-changing communities of the twenty-first century. These two

explorations need to be robust and intelligent enough to meet future challenges in the information age. As learners work and solve problems together, their enculturation into this new age, and the reconstruction of environments appropriate to their learning, lie at the heart of transforming the collective learning process. The success of such enculturation is most important since it "play[s] a large role in shaping the development of individual minds; and individuals' thoughts and deeds serve to maintain or to alter the cultural milieu" (Wells and Claxton 2002, p. 3). However other factors are significant for the understanding of their learning itself, and include analyses of the devices used, the learning processes themselves, the necessary abilities learners must bring to the classroom, and the emotional and intellectual developments learners need to achieve specific goals in learning.

Challenge for Teacher Educators

This research is mindful of the problems facing teachers entering the new digital age and likens their experiences to the tribulations that confront immigrants who travel from the familiar homelands of their youth to reside permanently in a new homeland. Evidence will be offered in what follows to cement the aptness of this analogy and the term 'digital immigrant', will be used to metaphorically describe teachers making the transition into the new lands of the information age. It is an intellectual immigration rather than a geographical one, but the similarity of emotional experience each group undergoes provides valuable ground from which to observe and analyse such a transition.

A major challenge for teacher educators is to understand how experienced teachers are 'immigrating' to the information age and, consequently, how they individually learn and acquire the necessary information, knowledge, and skills required for teaching in the twenty-first century. According to Gardner (1994) the purpose of education is to increase understanding of content and context. The teacher educator attempted to understand the teachers' learning and teaching environment and encouraged them to do action research in their workplace. This study follows a group of digital immigrant teachers as they attempt to increase their understanding of ICT. It endeavours to understand and report on teacher learning itself, and particularly for those

teachers who have extensive teaching experience and are self-assured about the practical aspects of their practice, but who have limited ICT knowledge and skills exposure. They are "digital immigrants" (Prensky 2001) who have come later in life to the digital age, and for whom the digital world is to all intents and purposes, a foreign land.

The participants in this research are the digital immigrant teachers who grew up and entered their profession before digital technologies were commonplace in homes and schools. They frequently lack confidence or are uncomfortable in their dealings with ICT. Like many geographical immigrants, they have had to learn new and creative ways to enhance their survival in what is to them new and unfamiliar territory. They have entered the third millennium: a time and place where the acceleration of knowledge has allowed communications and the application of information to be disseminated with lightning rapidity. In order to fully participate in the new technologically rich society in which they find themselves, digital immigrant teachers must actively engage in the construction of their own authentic and purposeful learning. To aid these teachers in their learning about ICT, an understanding of the teacher learning process is imperative (Oosterheert and Vermunt 2003; Wheeler 2001), and more specifically the manner of learning when acquiring the knowledge and skills required by this new milieu.

Setting the Scene for the Study: A New Way of Learning

The research responded to the newness of the learning experienced by these teachers by recognising that no assumptions could be made about their approaches to learning. The research sought to describe the teachers' learning in general, their learning of the unfamiliar ICT domain, their use of ICT and if their developing confidence in ICT application would result in any change in their pedagogical understanding or practice.

The group of teachers participating in this study enrolled in a Bachelor of Education (Primary post-registration) course at an Australian university. Designed to allow teachers with a three-

year Diploma of Primary Teaching to complete and upgrade their qualifications to degree status, the implementation of the course was conceived as an integrated action learning project, drawing on action research principles to examine and improve classroom practice (Victoria University 2003). This study follows a cohort of sixteen teachers enrolled in the program.

The course's teacher educator emphasised action learning within the spirit of collaborative action research and reflective practice as outlined in the university handbook. The course objective was to enable three year trained teachers to complete their undergraduate degree in Education. "The course is open to full-time, part-time replacement or emergency teachers who will focus their action research on their and community-based classrooms, working on curriculum organizational and technological aspects of education." (Victoria University 2003, p. 26). The units of the course consist of action research, curriculum policy and practice, curriculum in the primary school and school experience relating to teacher's workplace experiences will be required. Consideration was given by the teacher educator to the fact that these experienced teachers were adult learners who had many years of teaching experience themselves, and so were able to incorporate their past experience and knowledge through the method of action research to reflect upon their newly-acquired experience and knowledge (McNiff January 2001).

The course constructed a way of learning that was new for the teachers in this study. Their recollections of previous university classrooms were of formal lecture theatres where, as Penelope one of the participants pointed out at the beginning of the research, they *would just sit* and *listen to some guy* (quote from the participant's comments during observation). In contrast, this newly-constructed university-learning environment applied practical action research to encourage participative and reflective practice focussing on the teachers' work through various assigned projects. And of course, ICT was introduced as teachers were learning for the information age. They were learning about ICT and its applicability in their workplaces. Their projects and course work introduced them to the use of a number of software applications including email, Internet browsers, and proprietary software programs such as HyperStudio,

PaintShop Pro, Microsoft's Office Suite, and other classroom applications. The action research projects enabled them to learn the software applications and teach their students these applications. Teachers found that learning in this environment was so different from what they experienced previously and was not restricted to the traditional university lecturer orientated approach. Instead, in this instance, a general different learning approach was observed, and teachers were learning about ICT and how to apply it in their classrooms.

This type of unexpected university learning and teaching approach and because of their lack of familiarity with ICT these committed and highly professional teachers faced a personal and professional quandary. They, in effect like many of their colleagues, were the displaced persons (Panich 1988) of the knowledge economy: they are experienced, but technologically naïve, teachers who need to be introduced to the cultural practices of the information age while they at the same time meet the enculturation pressures and challenges of learning and teaching the skills of computers (Tyner 1998). Some of these experienced teachers are simultaneously trying to overcome an unfortunate technophobia (Brosnan 1998). Because of failed attempts at the introduction of ICT into their classrooms "many have high computer anxiety and low computer self-efficacy, which is further exacerbated by the high level of computer confidence of their students" (Phelps 2003, p. 3). It is within this context of self-perceived inadequacy that they decided to undertake their journey, to immigrate, into the information age. This research attempts to map these teachers' learning experiences against the frameworks of Kolb's (1984) learning styles and modes of learning, and Gardner's (1983) multiple intelligences. However, as will be seen, these frameworks do not account for the dynamic nature of learning and teaching that was observed. New opportunities for analysis and insight were presented by Vygotsky's theoretical ideas which provide a richer and more informed basis for the interpretation of the data collected.

Focus of the Study

This study focusses on the learning of sixteen teachers who had general classroom teaching experience, but who were unfamiliar with ICT. The study observed teacher learning about ICT,

how teachers were learning with ICT and integrating it into their workplaces. The study observed teacher learning in the university classroom. David Kolb's (1984) theory of experiential learning provides an obvious model against which to investigate their modes and styles of learning as adults. It was anticipated that the application of Kolb's framework would enable the research to reveal how teachers, as adult learners in an action research environment, processed, accommodated and demonstrated their understandings of learning and the learning of particular ICT knowledge and skill.

In this environment, these experienced teacher learners exhibited diverse abilities. As a result of this observation, Howard Gardner's (1983) theory on multiple intelligences as abilities was incorporated into the study to observe how these teachers approach learning ICT. Gardner refers to abilities as multiple intelligences that students employ to attain educational goals in a learning structure. Although Gardner discusses children's learning, he makes a universal claim to learning: everyone can learn and they learn in many and diverse ways.

Initially, Laferrière's (1997) model of professional development was used to establish how digital immigrant teachers move through the different phases of learning ICT. The Victorian Department of Education's "Learning Technologies Capabilities Matrix" (1998) analytical framework – as required by the employer of most of the teachers – was used as a reference to establish the ICT skills of these teachers. However, the model and matrix became insignificant as the study progressed and the teachers extended their technical skills.

On the other hand, it became apparent that Vygotsky's (1962) concepts of social interactive learning and teaching in a cooperative and scaffolded zone of proximal development [*зона ближайшего развития*] (Vygotsky 1999) provided a more relevant approach to the data collected. Vygotsky describes the zone of proximal development (ZPD) as the "distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky 1978, p. 86). In the ZPD, under the

guidance of the teacher, individuals shape and fashion their learning environment with the prospect of becoming self-directed, lifelong learners. Although Vygostky in his work discussed mainly children's learning, his theories have also been applied to apprenticeship learning (Lave and Wenger 2003). The mention of "more capable peers" by Vygotsky himself implies a more general potential for the application of his ideas. The present study utilises these ideas in relation to adult learning environments.

Therefore, the three frameworks from Kolb (1984), Gardner (1983) and Vygotsky (1999; 1962) were chosen to guide the research and the data gathering and analysis.

This research applies a qualitative participant observation methodology to assist in the further development and understanding of the learning processes, abilities, and developments displayed by the digital immigrant teachers in a mixed mode of learning in higher education. Mixed mode delivery entails face-to-face interaction as well as online delivery. In this case the teacher educator met the teachers for a designated time during the academic year in a university classroom. The other component of the delivery occurred when the whole group transferred to online mediation: WebCt (Web Course Tools 1995). In this context, the central question which arose and led to the present research was:

> "How do digital immigrant teachers learn in the information age?"

Aim of the Study

The aim of this study is to answer the above question by generating and improving understandings of how digital immigrant teachers learn for the information age. Like all immigrants, the teachers in this study were experienced in other areas of life. However, the learning of these pre-digital practitioners had been acquired within another context. Therefore, this study aims to discover how teachers construct and acquire the necessary knowledge and skills they need to teach ICT in the knowledge economy and the information age.

The specific aims of the study were to investigate ways to:

- improve understanding of the learning of the digital immigrant teacher in the information age;
- develop a theoretical framework to support the understanding of the effect of ICT on further developments in teacher learning and ICT applications in teacher professional development education;
- construct a framework for learning applicable to the digital immigrant teacher in the information age; and
- open up the potential of lifelong learning for teachers through the use of ICT in their ongoing professional development.

Concepts and relationships

To answer the aims of this study, certain concepts and relationships need to be examined and defined. These include:

- the modes of learning and learning styles in the information age;
- the importance of multiple intelligences as abilities, in relation to experienced teachers learning in the information age;
- the importance of emotional and intellectual development in learning and teaching;
- the contribution ICT can make to the reconstruction of teacher professional development; and
- the induction of digital immigrant teachers into the potential of the information age.

Research Design

The central research question determines the aims, research design and methodology of this inquiry into experienced teachers who are learning for the information age. A qualitative research approach has been used to identify, explore, and resolve the central question, and to find meaning that has been reconstructed in a reflective, critical, sceptical, and imaginative manner. The focus of this study is the learning of experienced teachers with limited ICT exposure. The methods used to gather information about the learning were comprised of three activities: participant observation, interviews, and written documentation. At the end of the fieldwork, the teacher educator verified the analysis of data.

Analysis of the data employed methods of qualitative research analysis and concept synthesis, coupled with content analysis, to constantly compare and contextualise all the facets of reality depicted by the data. This complex approach was necessitated by the application of the extensive theoretical background, the broad framework of the study and the need to completely understand the phenomenon under examination in the broad and deep world of teacher education. The data was coded according to categories based on Kolb's learning process, Gardner's multiple intelligences as abilities and Vygotsky's terminology to reflect the 21 observations during the field work, the three interviews, teachers' journals and their online interactions.

Significance of the Research

The significance of this study lies in its generation of new knowledge about experienced-teacher learning, and in particular teachers' learning and teaching and lifelong learning in their professional development. The challenge lies in the need to understand how experienced teachers learn in the information age; a time and place which is unfamiliar to them, since their former teacher education did not prepare them for the use of ICT. However, societal expectations are that they become technoliterate and incorporate ICT into their curriculum (Ramsey 2000).

Consequently, the outcome of this study has relevance to teachers at all levels and of all disciplines, as well as being of interest to practitioners of teacher ICT professional learning. Specifically, the outcomes of this focussed study of a learner-centred model have the potential to provide useful guidelines for structural change in further teacher ICT courses at university, in departments and schools of education, both nationally and internationally. Such change would inform and support the curriculum restructuring that is constantly taking place in schools and communities as they grow to incorporate and exploit the ubiquitous ICT.

Contribution to Knowledge

This research investigates educational practice with the aim of developing new knowledge about the learning of these digital immigrant teachers. It seeks to improve the understanding of learning in a teacher ICT professional development environment. It also develops a theoretical framework for further explorations of learning and ICT for today's pre-digital, trained teachers who are required to become digital users and possessors of "digital literacy" (Gilster 1997, p. 6). There is also potential for this research to further the understanding of the learning process in teacher education more generally, as well as the integration of ICT into professional development practices in mixed-mode delivery. This study extends the potential of ICT to support experienced teachers in their lifelong learning, by enabling, and giving new meaning to, knowledge acquisition and the ways in which knowledge is generated and transmitted in the information age.

Structure of the Thesis

This thesis is structured into eight chapters. The first chapter introduces and contextualises the study. It presents the focus of the central question and the specific aims of the research.

Chapter Two explores the adult learning literature relevant to this study, in particularly that work which informs teacher professional learning. It reviews recent views on adult learning and literacy, and presents the frameworks of Kolb (1984), Gardner (1983), and Vygotsky (1999) which underpin and inform the conceptualisation of this research within the sociocultural

context of ICT. The chapter examines the epistemology underlying this study and its connections to previous knowledge and concludes that learning in the information age is changing, and so we require new forms of learning (Jochem et al. 2004; Longworth 2003; Rosenberg 2001). However, the literature is silent on how experienced teachers with limited ICT exposure actually learn. An enquiry into understanding how digital immigrant teachers learn for the information age has been instigated. Although the literature review alerts us that there are changes in learning and literacy for the information age, it also points to a gap in the literature concerning experienced teachers' learning and their immigration to the technology of the twenty-first century.

Chapter Three articulates the qualitative participant observation research utilised and the methods of collection, treatment and analysis of data. The methods incorporate participant observation in the university classroom, interviews at three points of the course – beginning, mid, and final – and teachers' written documentations with verification from their teacher educator.

Chapter Four focusses on learning styles and the modes of learning (Kolb 1984) based on descriptors which inform the process and orientation of learning for teachers. It is concerned with how teachers learn in the ICT university classroom: 'pushing ICT buttons', thinking through ways to apply software to practice, and finally, changing established practice. The chapter concludes with a discussion about the learning transformation of adult learners and the issues relating to Kolb's experiential learning model.

Chapter Five considers the learning abilities (multiple intelligences) (Gardner 1983) that these experienced teachers utilised in their ICT learning. The ICT learning environment encourages learning abilities that differ from those displayed in the traditional university classroom. The chapter explores these different abilities and the multiple ways teachers learn ICT. It evaluates the diverse learning abilities and grapples with Gardner's conclusions about diverse abilities for the information age.

Chapter Six describes by recapitulation of the findings of previous chapters, how teachers are leaving the shores of past safety and journeying into the unmarked territory of the information age. The chapter is divided into three sections. The first section is a summary according to the frameworks of Kolb's (1984) modes of learning (Appendix L) and Gardner's (1983) multiple intelligences (Appendix M). The second section examines Vygotsky's sociocultural theory of learning. While familiar concepts such as scaffolding and the Zone of Proximal Development (Vygotsky 1978; 1962) were relevant to the explanation of the learning development of the teachers participating in the research, they were not the primary connections to Vygotsky's learning model. The continuing process of struggle and accomplishment experienced by the teachers over the year prompted an exploration of Vygotsky's learning theory. Learning as a process in which struggle led to accomplishment became explicable only by reference to lesser known elements of Vygotsky's (1999) sociocultural theory: learning as a continuous process involving *perezhivanija* (*переживания*) – an anxiety or apprehension associated with a new learning experience; especially if the experience is felt keenly and often taken to heart when enduring new learning experiences and *mislenija* (*мышления*), which was translated as "thought" in 1962 from Vygotsky's 1934 original; however "thought" can also be translated as "duma". But, in the case of this research, *mislenija* has greater significance because it involves more than thought, it involves the making sense of an environment and in this situation - the learning environment (Appendix N). These insights led directly to a consideration of the underlying conditions for the learning, and the changes in learning practices, which the third section of the chapter presents as a complex interpersonal and personal working out of Vygotsky's powerful ideas about scaffolding, language, and Zone of Proximal Development (Vygotsky 1987).

Chapter Seven examines and reports on the analysis of the data in accordance with Vygotsky's (1999) theory of *uchit* (*учить*) – learning and teaching – as it appeared in this study at three learning moments: pushing buttons (P), applying software (A), and changing practice (C). Furthermore, the chapter discusses the role of learning and teaching in teacher education as

these experienced teachers with limited ICT exposure gained their 'digital citizenship' and entered the information age.

Chapter Seven also discusses the new form of learning and teaching as observed in this study, which transforms the traditional university classroom. The teachers became responsible for their own learning, educating and re-educating themselves within their Zone of Proximal Development. Together with their peers, they supported each other as they extended their learning boundaries. Additionally, the teacher educator took on a new role, helping to establish an inquiry community, where the teacher students constructed their own information and knowledge.

Chapter Eight, the final chapter of this dissertation, builds on the previous chapters, and in particular Chapter Seven, to summarise the findings. It suggests implications and makes recommendations for future ICT teacher professional learning. Additionally and more specifically, it makes suggestions for experienced teachers' ICT professional education in the information age.

Generally, the culture of teachers' learning is changing and, therefore, it is critical to understand and observe how experienced teachers learn for the information age. Tertiary education for adult learners and, in particular teacher education, should take into consideration learners' years of experience, values, and beliefs to enable the development confidence for learning in the information age (Davies 2005). Furthermore, the research confirmed that experienced teachers were self-assured about their practices, despite lacking ICT competence. This study points out the possibility for innovation and improvement of teacher professional development that its findings may prompt.

Chapter Two – Literature Review

Introduction

This chapter explores the literature that informs the research. The chapter reviews the theoretical underpinning of how people learn, drawing on the works of Kolb, Gardner, and Vygotsky. It aims to outline the current understanding, within sociocultural contexts, of the processes and developments related to teacher learning; the ways in which teachers learn and the abilities they display. It also reviews a number of topics related to this research, namely: teacher professional learning, learning and literacy in the information age, andragogy (adult learning), digital immigration, and digital citizenship.

This chapter displays the connections between teachers' learning, action research, and the work of three theorists: Kolb, Gardner, and Vygotsky. It examines action research, focussing "on change processes, participation, and reflection" (Phelps 2002, p. 4), relevant to the practical environment for teachers' learning in the university classroom of this study. Firstly, the chapter reviews the literature that justifies the research question undertaken. Then it reviews the theoretical frameworks, before discussing teacher professional learning. Finally, this chapter examines the immigration metaphor in the context of change in the information age.

Section One: Justification for Research

The research question "How Digital Immigrant Teachers Learn for the Information Age?" evolved through the observation of change in learning and teaching. The information age has brought about change (Romano 2003; Castell 1996) in most aspects of daily life and has created many challenges for people in all areas of work and life. Specific to this research, it has meant that there is pressure on schools and teachers to ensure that young people, and teachers themselves, have the knowledge and skills necessary to operate effectively in the new information age (Potomac Knowledgeway 1999, p. 1). Although some experienced teachers have found that they do not have the need for professional competency in ICT, many have

perceived a need to embrace these new technologies and have become digital immigrants (Prensky 2001a) in order to survive in the new digital environment.

The digital immigrant teachers in this research are teachers with many years of teaching experience and accumulated knowledge in their teaching areas. They are self-assured about the practical aspects of their teaching and, for many, this practical experience may be their foundation for learning (Boud et al. 1993; Kolb 1984; Dewey 1963). The accumulated years of professional work and adult learning by experienced teachers transform their experiences into knowledge (Kolb and Kolb 2003). When these teachers learn, their knowledge is attained by a number of approaches, including action based on reflection.

The university handbook provided to the participants of this study (Victoria University 2003) identified the offered course as having an action research ethos, requesting practitioners to learn from experience (Dewey 1963) and by doing (Lewin 1946). During the course, participants are asked to reflect on their actions in order to improve their practice (McNiff January 2001; Kember 2000; Whitehead 1998; Dick 1997; Stringer 1996; Carr and Kemmis 1986; Dewey 1963; Lewin 1946) within real contexts (Dick 1997; McTaggart 1997). Practitioners inform and improve their practice, by reflecting on their practice, and this reflection enables them to solve particular teaching concerns based on situational evidence (McNiff 2001; Whitehead 1998; Carr and Kemmis 1986). The aim of the action research approach is to play out ideas in practice as a means of increasing knowledge about learning and teaching (Kemmis and McTaggart 1988). According to Akdere (2003) and Schön (1983) learning and teaching are improved by reinforcing, modifying, or changing perceptions. Perceptions are based on systematic observation and reflection through actions and processes that coexist and work simultaneously in solving problems and learning in practice. The processes are based on experience and practice – and reflection on that experience and practice – in a continual process whereby an understanding and development of pedagogical theory is reached.

Research Context

This research follows a group of teachers as they learn about ICT in an environment which supports an action research approach to professional learning. The expectation in the post-registration course of teacher education is that teachers undertake action learning-based inquiry which focusses on an environment that allows them to plan, reflect on, observe, and improve their practice (Kemmis and McTaggart 1988). McNiff and Whitehead (2005) recommend that improvement in practice requires action, and to obtain evidence about particular concerns, teachers should ask a number of questions. For example, Whitehead (1998, p. 1) proposes teachers ask: "How do I improve my practice?". The descriptions and explanations are for the individuals' own learning; to enable them to "create, [and] constitute their own living educational theories". These theories explain and emphasise the present action and effective reflection – what has been termed "knowing-in-action" (Schön 1983, p. 50) – in order to understand, explore, and hypothesise about the present action so to improve practice. By hypothesising, a "greater emphasis [is placed] on developing and valuing a deeper understanding of teaching and learning and [it] does so by addressing the theory-practice gap in a meaningful way" (Loughran 2007, p. 595).

Action Research for Teacher Learning

In action research, learners learn from, and reflect on, experiences in order to make sense of and improve their practice. Kurt Lewin (1946), credited with first coining the term "action research" (Checkland 1981), describes it as research into the conditions and effects of social action involving a "spiral circle of steps", comprised of planning, action, and fact finding about the action (Smith 2001). In Dick's (1997) and McTaggart's (1997) view, the spiral structure encourages change, improvement and understanding of knowledge in real context. Similarly, Kember (2000) and Whitehead (1998) view action research as a cyclical process concerned with a social practice that aims towards improvement and participation as determined by the practitioners. In the sociocultural context (Gardner 1983; Vygotsky 1962), practitioners question and re-question so they may understand and make sense of their individual practices (McNiff 2001; Kember 2000; Whitehead 1998; McTaggart 1997; Carr and Kemmis 1986).

Loughran (1996) advocates that action research involve a number of steps, in which teachers collect data, and analyse and reflect on that data, and then, by making sense of current issues through that reflection, act on and improve practice (Johnson 2005; Stringer 1996; Wadsworth 1998; Lewin 1946). Group reflection can also improve practice (McNiff 2001; Argyris and Schön 1974), especially if that reflection is based on underlying pedagogical theory. McNiff and Whitehead (2005) argue that this constitutes not only action but also research in that it is an exploration of new meaning and change in the experiences and the learning processes. Consequently, when pedagogical principles are examined there is improvement in professional learning.

Nevertheless, there are those who argue that action research is a controversial and inappropriate form of inquiry (Kock, McQueen and Scott 1997) because it does not contain the rigorous approach of established universal and permanent principles of scientific research methodology (Lincoln and Guba 1985). It is further argued that action research has neither the form nor the rigor of systematic inquiry about practice, but is fuzzy and emergent. Bogdan and Biklen (1992, p. 223) point out that action research lacks clarity and impartiality, and practitioners marshal evidence to study practices for change rather than conduct a "systematic collection of information". Hence, they say, action research relies solely on the researcher rather than on intellectual frameworks for its objectivity and procedures.

Kock et al (1997, p. 2) do argue that action research can be considered to be experimental even though the researcher does not have "a strong control over the environment being observed". While traditional research methods see "researchers enquire into other people's lives and speak about other people as data, …action researchers enquire into their own lives and speak with other people as colleagues" (McNiff 2001, p. 15). Action researchers monitor real situations to evaluate the usefulness of the practice within their context, and the impact on student learning (Huberman 1993), instead of researching an issue in the sterile world of the laboratory: the real

world becomes the laboratory where they reflect on the situation, solve problems, and generate new knowledge (McKay and Marshall 2001) in which experience becomes important.

Traditional epistemologies separate practice and practitioners, since "epistemology informs traditional kinds of theory which maintain that practice may be described and explained as an objective phenomenon" (McNiff 2001, p. 27). Conventional epistemologies view theory as an abstract body of knowledge that informs practice; a "theory-into-practice model" (McNiff 2001, p. 19). Donald Schön (1983) points out that there is a need to rethink traditional epistemologies; if we intend to pursue 'new forms of scholarship'. Thinking along the same lines, McNiff (2001) points out that the action research model, meant for continual social change, informs professional education today; and she further states, like many action researchers, that practice informs knowledge, and is situated in social and work life issues.

Despite the rebuttals, an action research approach, by clarifying and challenging everyday individual and diverse work practices, can be a valuable learning strategy. It can assist the learning and teaching of each practitioner who learns in multiple ways (Gardner 2004; 2001; 1999). Consequently, the approach occurs when teachers discover challenges in their social and work life context. Here they can observe and intervene (Kock, McQueen and Scott 2006) to make improvements and changes, and thus learn from their experiences and pass the new knowledge to their colleagues. For the kind of effective teacher professional learning observed in this study, knowledge can be seen as an entity that is not separate from practice. Rather, it is a process of evolution (McNiff 2001) with variables mandating certain opportunities, conditions, times, and processes (Hargreaves 1994). Moreover, the spirit of action research involves studying real, individual and diverse classroom contexts, so that practice may be understood, and problems and their possible solutions explored (Johnson 2005; McNiff, Lomax and Whitehead 1996).

Action research was deemed an appropriate framework for the participating teachers in this study of professional learning: they were able to rethink and relearn from their practical

experiences. The approach was an important component in the teachers' learning. Yet despite the fact that its application in this sociocultural setting allowed teachers to reflect on and improve their practices, a full examination of action research's importance is beyond the scope of this thesis. Indeed the application of Kolb's, Gardner's, and Vygotsky's frameworks proved more significant in the understanding of these experienced teachers' professional learning.

Connections

An action research approach aims to improve and change practice in a social context and not merely provide assertions. Kolb (1984), who bases his theory of experiential learning on action research in an adult learning environment (and whose framework will be examined in more depth later in this Chapter) claims that abstract concepts, which constitute theory, are formed by doing, by action and by reflection. Dewey (1910/1974), upon whose work Kolb partly based his experiential learning theory, proposes the non-didactic transmission of information, the fostering of conversations and reflection on experiences, as the pathways for solving problems through the use of suggestions, hypothesising, reasoning and testing. Dewey (1963) suggests that learning results from reflection on experience and writes that scientists and workers in other areas provide the empirical background and evidence to support theory and convictions. Thus, Dewey's approach itself works within a conceptual framework (Checkland 1981).

The process of inquiry and reflection by practising teachers undergoing a learning experience may lead to reconstruction, reconsideration, evaluation, and analysis (Biggs 2003; Loughran 1996) and so enable the discovery of new features in the action and new directions for action in the practice. Learning from experience and action research can result in a more self-reflective and self-renewing order, and this will occur when individuals perform thoughtful research on their practice.

Whilst Kolb's framework helps us to consider the impact of action research as a learning tool, it does not take into account the various learning approaches and abilities attributed to learners. This is particularly relevant as the teachers in this study are also learners, so their university

learning should have a critical framework that reports and responds to learners. Therefore, Gardner's work is helpful here, since he claims a universal application for his model of learning, and since his multiple intelligences as abilities accommodate diversity amongst learners.

Gardner (2004; 2000; 1999) stresses that individuals process and learn information in multiple ways. This processing and learning of information mirrors the ways that individuals perceive, reflect on, store and organise information. He (1993) also points out that individuals require different types of intelligences or abilities in particular cultures. Consistent with this understanding, the teachers in this study will be seen to require certain abilities to survive, thrive, and solve problems in an ICT culture.

Multiple intelligences allow the valuation of a variety of approaches to solve particular problems (Gardner 1994) and create different products using various capacities (Gardner 2000; 1983). Individuals solve problems, construct new knowledge and learn new skills within particular cultural contexts (Gardner 1993), especially when the assistance offered is congruent with the cultural settings (Gardner 1998). In this study, the learners are encouraged to solve particular diverse concerns in real life situations in order to make a contribution to their environments.

Although Kolb and Gardner present theoretical frameworks for understanding learning, learning itself may be different for these experienced teachers in this particular context. The learning environment of this study was culturally dissimilar to the traditional university environment in which teacher educators deliver the content and learners are passive recipients of information. Educational theorists recognise this form of learning and teaching in traditional didactic contexts, a practice denoted by Vygotsky (1999) as *uchit.*

Vygotsky (1999) also identifies the emotional and intellectual developments learners undergo in such an environment and labels them *perezhivanija* and *mislenija.* The emotional struggle, *perezhivanija,* represents the fears and uncertainties encountered in a new situation and can also

be translated as ‘apprehension’. This kind of emotional experience is often a consequence of uncertainty in a new situation or results from negative attitudes towards a particular phenomenon, for example, and in this case, technology. Breck (2002) refers to this fear as “mechaphobia” or the fear of machines. That is, participants fear the technology and may not necessarily relate well to particular aspects of its usage. However, once they ‘make sense’ of and understand the situation their emotional experiences change. Vygotsky (1999) names this intellectual development *mislenija* or ‘making sense’. For example, when participants are given, or comprehend, a reason to understand technology and its role, they react differently to it and their attitudes to the situation change. With this change of attitude comes a point at which they make sense of the situation. To put it succinctly, the emotional and intellectual developments participants undergo influence how they learn and make meaning of learning and teaching (*uchit*) within a given context.

Vygotsky, Kolb, and Gardner investigate learning in real sociocultural contexts to enable the solving of problems and facilitate functioning in society. Each examines learning in a different context. Kolb examines the learning process of adult learners in corporate situations. As a psychologist, Gardner probes into learning abilities in institutions. The psychologist Vygotsky, a noted teacher and lecturer, explored learning in special education (Vygodskaya 1995) within the framework of the Soviet Revolution following the First World War. These theorists all concern themselves with learning in real life contexts. Therefore, in conceptualising this research and its unfolding within a real ICT university learning context – a context in which experienced teachers with limited ICT exposure were struggling to immigrate into the information age – these three authors’ (Kolb 1984; Gardner 1983; and Vygotsky 1999; 1962) theoretical frameworks became significant.

Section Two: Conceptual Frameworks

Kolb's, Gardner's, and Vygotsky's frameworks became logical choices in understanding adult learning in the process of immigration to, and survival in, a diverse and ever-changing digital environment, by reason of their applicability in real learning contexts.

Kolb and Adult Learning

Adult learning is seen by some as "continuing education – continuing in the sense of applying systematic learning processes to the particular demands and interests of adult life" (Jarvis and Griffin 2003, p. 37). David Kolb (1984) contributes greatly to our understanding of adult learning process and writes extensively about experiential learning (Gold and Evans 1998). Experiential learning involves direct participation in the learning rather than merely reflecting about the phenomenon being learned. It involves a cycle of making sense of active experience by reflecting and theorising about that experience (Kolb 1984). In teacher professional development this learning cycle describes "the process for recording continuous professional development, through taking time to capture, record and implement learning" (Pickles 2007). Malcolm Knowles (1970) focusses on adult learning or 'andragogy', "in which adult learners are encouraged to reflect upon their experience and share their biographies of experience rather than simply accept the authority of text" (Fenwick 2001, p. 4).

Kolb (2000) states that the experiential learning cycle has its intellectual origins in Dewey where the emphasis is on continuous learning situated in experience. Dewey (1974) rejects the traditional model of education in which teachers drive education and learners are passive recipients of knowledge. In his work, Kolb captures Dewey's concept of learning through continuous experience and also incorporates Lewin's (1946) ideas concerning active adult learners who undertake action in a social setting. Kolb (1984) states that learners reflect on and evaluate the consequences of their actions. In addition to Dewey's philosophical pragmatism and Lewin's social psychology, Kolb (1984, p. 2) turns to "Piaget's cognitive-developmental

genetic epistemology … to obtain a unique perspective on learning and development", a perspective in which the interaction of the person and the environment is important.

For Kolb (1984), learning is a continuous process involving experience, reflection, interaction, and experimentation in the development of abstract concepts. He writes that "learning is the process whereby knowledge is created through the transformation of experience" (Kolb 1984, p. 38). This transformation involves the experience of the learners, rather than their merely listening to a lecture given by the teacher educator. The adult learners begin by asking "What did I observe during this experience?" and proceed to theorise based on the observed patterns, before reaching the question "What is the significance of my doing and observing, and how can I apply it to *my practice*?".

Learning and development in Kolb's framework involve a variety of learning styles and include the notion of modes of learning. Kolb argues that one learning style often dominates, and that adult learning tends to occur through the transformation of experience to knowledge (Kolb and Kolb 2003). His framework also recognises the way an individual deals with ideas and situations in everyday life. People learn by doing, and from experiences and practices, which are then transformed into knowledge (Kolb 1984). According to Kolb and Kolb (2003, p. 7):

> Experiential learning is a process of constructing knowledge that involves a creative tension among the four learning modes that is responsive to contextual demands. The process is portrayed as an idealised learning cycle or spiral in which the learner 'touches all the bases'— experiencing, reflecting, theorising and acting — in a recursive process that is responsive to the learning situation and what is being learned.

They go on to say that:

> Non-dominant modes of learning are expressed in work and personal life. Development through these stages is characterised by increasing complexity in adapting to the world and by increased integration of the dialectic conflicts between Abstract Conceptualisation (AC) and Concrete Experience (CE) and Active Experimentation (AE) and Reflective Observation (RO) (Kolb and Kolb 2003, p. 7).

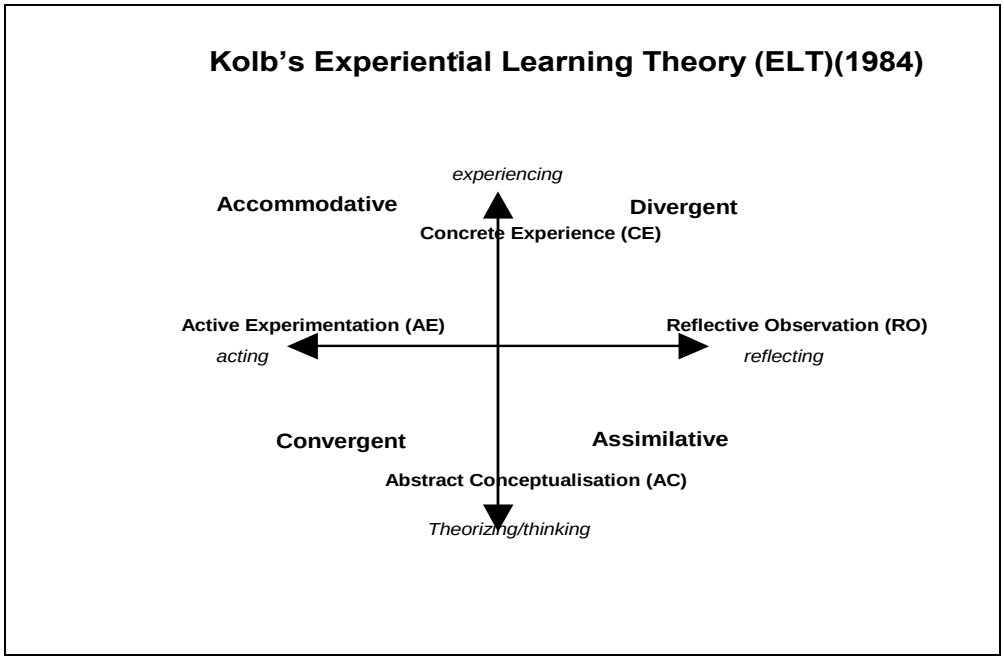

Figure 1: Kolb's Framework

Figure 1 represents Kolb's (1984) framework consisting of four learning styles: accommodative, divergent, assimilative and convergent. Each learning style is characterised by two modes of learning. An accommodative learning style consists of concrete experience and active experimentation; a divergent learning style consists of concrete experience and reflective observation; an assimilative learning style consists of reflective observation and abstract conceptualisation; convergent learning style consists of abstract conceptualisation and active experimentation (Figure 2).

	Learning Styles			
	accommodative	divergent	assimilative	convergent
Modes of Learning	Active experimentation	concrete experience	reflective observation	abstract conceptualisation
	concrete experience	reflective observation	abstract conceptualisation	active experimentation

Figure 2: Learning Styles and Modes of Learning

For Kolb, learning occurs in a cycle beginning with immediate or concrete experience. Learners then progress to reflective observation, that is, thinking about the experience and theorising about the abstract concepts connected to it. Next, learners actively participate in and experiment

with the experience. In regard to teachers, Kolb (1984) suggests that teachers are active participators who exhibit accommodative learning styles with the accompanying concrete experience and active experimentation modes of learning.

Modes of Learning

Kolb (1984, p. 69) describes each mode of learning and attributes to them specific characteristics:

> **Concrete experience** focusses on being involved in experiences and dealing with immediate human situations in a personal way... People with a concrete experience orientation enjoy and are good at relating to others... and being involved in real situations.
>
> **Reflective observation** focusses on understanding the meaning of ideas and situations by carefully observing and impartially describing them. People with a reflective orientation enjoy thinking about the meaning of situations and ideas and are good at seeing their implications.
>
> **Abstract conceptualisation** focusses on using logic, ideas and concepts…, a concern with building general theories… A person with an abstract conceptual orientation enjoys and is good at systematic planning, manipulation of abstract symbols, and quantitative analysis.
>
> **Active experimentation** focusses on actively influencing people and changing situations. People with an active experimentation orientation enjoy, and are good at, getting things accomplished. They are willing to take some risks to achieve their objectives. They also value having an impact and influence on the environment around them and like to see results.

Added to the four basic modes of learning, Kolb (1984) states that there are four ways of relating to the world which he terms: accommodative, divergent, assimilative and convergent. Their characteristics are described below (for further details, see Appendix K):

Learning Styles

After examining students' learning styles and their respective learning fields, Kolb and Goldman (1973) state that if these are matched to the learning environment, students would be more committed to their individual learning. Kolb and Fry (1975) confirm this and propose that matching environments with learning styles produces more productive learning. Kolb (Kolb et al. 1971, pp. 35-36) presents his four basic learning styles as follows:

> The convergent learning style relies primarily on the dominant learning abilities of abstract conceptualization and active experimentation ... They prefer dealing with dealing with technical tasks and problems rather than with social and interpersonal issues ...
>
> The divergent learning style has the opposite strengths of the convergent style, emphasising concrete experience and reflective observation. The greatest strength of this orientation lies in imaginative abilities and an awareness of meaning and values … The emphasis in this orientation is on adaptation by observation rather than by action …
>
> In assimilation, the dominant learning abilities are abstract conceptualization and reflective observation. The greatest strength of this orientation lies in inductive reasoning, in the ability to create theoretical models, and in assimilating disparate observations into an integrated explanation … this orientation is less focused on people and more concerned with ideas and abstract concepts. Ideas, however, are judged less in this orientation by their practical value …
>
> The accommodative learning style has the opposite strength of assimilation, emphasizing concrete experience and active experimentation. The greatest strength of this orientation lies in doing things, in carrying out plans and tasks, and in getting involved in new experiences…

It is worth reiterating that although Kolb writes extensively for the corporate world and not specifically for education, he does contextualise learning in society (Kolb et al. 1995). As Tennant (1988, p. 105) remarks: "as a rule of thumb the model provides an excellent framework for planning teaching and learning activities and it can be usefully employed as a guide for understanding learning difficulties, vocational counselling, academic advising and so on". In supporting the application of his theory of learning, Kolb (1971) developed an inventory in which learners rate their own learning style by designating a mark on the mandala (Figure 1). However, studies like Newstead's (1992) indicate that the reliability of Kolb's Learning Styles Inventory (LSI) is low and the underlying factor structure is not in agreement with what is predicted. Therefore, while this study found value in Kolb's formulation of learning modes, his LSI was not used in this study.

Although his works have generally been well received, critics of Kolb's theory point out that his work pays insufficient attention to the process of reflection. But his work is useful in planning activities and checking effective engagement (Boud et al. 1993). Although Kolb (1984) developed the experiential learning cycle for the corporate world, Zuber-Skerritt (1988, p. 4) supports its use for teacher professional development, because "this kind of self professional development is directly relevant to the teachers' needs; and as one academic put it, it is active, productive and creative in practice".

Jarvis (1987, p. 119) argues that learning styles are for ideal learners, and that in reality, "very few people are ideal learners". He points out that "some significant conceptual and methodological difficulties in the literature on learning styles are yet to be resolved" (p.120). For instance, Jarvis (1987) and Brookfield (1986) point out that Kolb's concept of preferred learning style is a comfortable way of learning, and that learners need some exposure to non-preferred learning styles to feel some kind of disorientation or challenge in their learning. For example, Powell and Reiff (1993) found that pre-service teacher education students' challenge was coping with technology, and that they expressed a negative attitude to computers, even while exhibiting a reflective learning mode and successfully completing their computer

subjects. Brudnell and Carpenter (1990) also found that learning styles may assist teachers in identifying students' less favourable attitudes to Computer-Aided Instruction (CAI) but asserted that this knowledge did not improve students' learning processes in the culture of the ICT environment. Tennant (1997) and Jarvis (1987) go on to point out that Kolb's cycle does not take into account cultural experiences and conditions, and they assert that its empirical support is weak. Rogers (1996) includes purpose, intention, goals and choices in his variation of the Kolb's model, and proposes at least three modes of learning instead of Kolb's two modes (Rogers 1996, p. 110). Generally though, the above authors value the concept of Kolb's experiential learning cycle for planning and thinking, while simultaneously acknowledging its limitations.

Gardner and Multiple Ways of Learning

Other factors besides attitude can influence learning. For example, different ways of learning or certain abilities can be more valuable in, or suitable to, different environments. The ability of individuals to learn in multiple ways is central to Gardner's theory (1983), and as a psychologist he studies "the mind from as many different perspectives as possible" (Larsen 2002, p. 9). He expands the parameters of intelligent behaviour to include a diversity of human abilities and the concept of learning in many ways. Gardner's work on multiple intelligences, as abilities, is an important tool in understanding the different ways teachers learn ICT.

Multiple Intelligences

Gardner's theory of multiple intelligences (1983) states that problems are solved in multiple ways in particular cultural settings. Originally, he recognised seven intelligences in his study of intelligence.

These postulated intelligences can be defined as follows:

> **verbal intelligence** is the ability to use with clarity the core operations of language. People with linguistic intelligence have a sensitivity to the meaning of words and are proficient in conveying information.

logical intelligence is the ability to handle chains of reasoning and recognise patterns and orders as in a science. People with this intelligence use abstract symbols/formulas, outlining, graphic organisers, numeric sequences, calculation, deciphering codes, and problem solving to achieve goals.

musical intelligence is the ability to appreciate musical patterns, compose musical tones, pitches and rhythms, and perform musically.

kinesthetic intelligence is the ability to use "one's whole body or parts of the body (like the hands…) to solve problems" (Gardner 1999, p. 42) and "experiment in an active way" (Gardner 2000, p. 196) and handle objects adroitly. People with kinesthetic intelligence use activities that involve physical manipulation of devices and actions to achieve goals. In ICT, the physical action involves control of fingers sensitive to movement to manipulate devices; such as, computer keyboards, a mouse or other mobile devices. Gardner does not specify the devices of technology; but by moving a mouse by hand or actually using the keyboard to key information, the operator is using hand and fingers to solve problems and write on the screen. Additionally, Grow (1990) argues that the act of writing is different enough from the act of sitting at a computer to be regarded as kinesthetic activity in which he states that in writing "a high degree of fine motor control" is often found. In 1998, Dickson (p. 1) commented that "computers rely mostly on eye-hand coordination for their operation … key boarding and the use of the mouse or touch screen. This kinesthetic activity reinforces learning and makes the student an active participant in the learning process."

visual intelligence is the ability to perceive the world accurately and to act to re-create or transform aspects of that world. A person with visual intelligence uses activities that involve art, pictures, sculpture, drawings, doodling, mind mapping, patterns/designs, colour schemes, active imagination, imagery, and block building to achieve goals.

interpersonal intelligence is the ability to understand people and relationships. These learners think by bouncing ideas off each other. They use activities that involve group projects, division of labour, sensing others' motives, receiving/giving feedback, and collaboration skills to achieve goals.

intrapersonal intelligence is the ability to access one's emotional life as a means to understand oneself and others and is exhibited by individuals with accurate views of themselves. These learners use activities that involve emotional processing, silent reflection methods, thinking strategies, concentration skills, higher order reasoning, centering practices, and meta-cognitive techniques to achieve their goals.

Gardner believes that there are many other intelligences depending on the realms of a particular context (Gardner 2004). He argues (1999) that several multiple intelligences, namely the logical, intrapersonal, and kinesthetic intelligences are simultaneously employed to solve the challenges of learning in any given technology context.

Gardner (1983) does not clarify the operation and application of each intelligence to a particular goal, but merely identifies and describes them. He admits that there is an element of subjective judgment in identifying the particular intelligence utilised, and that this judgement is prey to situational criteria (White 2000). Central to Gardner's definition is recognition of Piaget's influence of developmental theory in which the learner's intellectual abilities develop and an "end-state" (Gardner 1993) results. He also follows Chomsky's linguistic structural development from simple linguistic abilities to sophisticated expressions (Gardner 1983). The learner begins with simple expressions and progresses to complex structures of language.

Development of Multiple Intelligences

During the course of his exploration into the different ways of learning and the different abilities employed in learning, Gardner – like Piaget (1970) who for many years worked with Binet but became more interested in reasoning processes than in performing intelligence tests – examined and was dissatisfied with Binet's definition of intelligence (1904). In response to a governmental request to create an intelligence test, Binet developed a set of items that tested attributes, ranging from sensory discrimination to vocabulary knowledge, for 'at risk' elementary schoolchildren. These tests became the norm and were "administered quite widely, thanks to the efforts of Lewis Terman at Stanford University" (Gardner 1991, p 2). Like Kolb

(1984), Gardner (1983) was influenced by Piaget's thoughts on experience, reasoning processes, and human knowledge, where intelligence is seen not as an innate internal quality but rather as a product of interaction between a person and their environment. This results in his development of a theory of multiple intelligences.

Gardner proposes that humans come to an understanding of a topic using multiple ways of knowing (Gardner 2000). On a number of occasions (2004; 2001; 1999; 2000) he points out that human beings can learn in multiple ways, but that "regrettably. …formal schooling often neglects these multiple ways of knowing" (Gardner 2000, p. 32) and merely utilises two forms of intelligences: the linguistic and the mathematical/logical. He also points out that educational culture, with the ascendancy of ICT, will shift traditional intelligences and permit individualised education with "active hands on learning" and "explicit step by step thinking" (Gardner 1999, pp. 44-43) through the use, by students of the future, of what he terms logical, intrapersonal, and kinesthetic intelligences. As a consequence, he says, educators will have to rethink and shift their educational goals and not concentrate solely on a single intelligence.

For Gardner, education has two goals: "[to] help students to become certain kinds of adults and [to] help students understand the major ways of thinking that have developed in the discipline" (Gardner 2000, p. 34). It is the latter observation that is of prime relevance to this study. One of the "major ways of thinking" for students of the future, that is, for digital natives (Prensky 2001a), is to further value the "explicit step by step thinking" (Gardner 1999, p. 43) of logical ability. However, it is not solely this single intelligence that is relevant to the students of the future; but, as Veenema and Gardner (1996, p. 75) propose educational goals should open up a different educational process, especially for those students "who do not stand out in the traditionally canonical intelligences of language and logic" to begin acquiring the "major ways of thinking" to attain educational goals. Multiple intellgiences ought to be valued and not solely the two traditional intelligences.

Gardner gives examples of approaches for learners to attain educational goals in the digital environment. Through the use of synchronous and non-synchronous media, and the employment of cartoons, graphics, and different scenarios educators can create simulations of human dilemmas and so enable the utilisation of interpersonal, intrapersonal, logical, and kinesthetic intelligences. An example would be the use of the Internet to assist students of history in making sense of documentation which they can then relate to events in today's newspaper. For example, if a cohort of the students were studying immigration they could scan the web for information about the first arrivals in Australian and the conditions of their immigration. Once they have the relevant information, they could compare these conditions to present day conditions for contemporary immigrants. Another feature of web is that Cyber-communication can make the "materials vivid, easy to access, and fun to play with – and they readily address the multiple ways of knowing that humans possess" (Gardner 2000, p. 35).

Gardner (2000) considers intelligence as primarily concerned with the understanding of the content of learning. It is an ability to be used to reach an educational goal (Gardner 1993; Hoerr 2000). It is not a certain type of curriculum nor a "mode of assessment; rather it is a way of thinking about what transpires in any intellectual activity" (Gardner 1993, p. 227). Knowing and understanding the content of a curriculum involves having the necessary information and knowing when to use it to reach an educational goal that is valued in a particular culture.

Gardner's Method

In his method, Gardner (1983) explores the way in which particular cultures value individuals, and the way that individuals create different products or serve their cultures in various capacities. Knowing and understanding the content of learning within a given domain involves having the necessary information and knowledge of when to use it; and possessing such knowledge brings acceptance. That is, after solving problems or fashioning products in a novel way, individuals are in turn accepted and valued by knowledgeable individuals within their discipline (Gardner 1983), and are then accepted into the domain. Walters and Gardner (1998, p. 78), in their Catalyst Projects, find that "novices [do] not make a sustained entry into the

domain when they work[…] on their own". However, if the task is inviting and they have considerable help, the novices complete the task within the cultural setting. This observation is relevant to the present study, since the teachers are themselves novices or new settlers attempting to immigrate into the cultural setting of the ICT environment. Gardner relates the importance of interpersonal abilities and the importance of assistance from more capable and knowledgeable individuals. Vygotsky (1987) too, writes about the importance of more capable individuals who assist novices, apprentices, and children in their struggles to solve problems. Gardner and Vygotsky agree that the operation of problem solving within a cultural context has to be acknowledged by the given culture for its core operation to be valid and significant within that culture's particular context.

Some critics have viewed Gardner's list of multiple intelligences as problematic and Gardner (1993) himself points out that he has been criticised for his definitions. Morgan (1992) says that the multiple intelligences theory resembles a list of learning styles. Kornhaber and Gardner (2006) counter that some overlaps could occur but that Gardner's multiple intelligences are to be seen as tools or abilities, and that learning styles are used for the learning of processes (Kolb 1984). Morgan (1996) describes each of Gardner's intelligences as abilities; as sensitivities and skills that support the many factors of intelligence which have traditionally proven beneficial to schools and teachers.

Other critics, such as Eysenck (1998) and Sternberg (1985), view Gardner's definitions as problematic because his problem solving approach is adhoc, not scientifically-based and not grounded in empirical research (Waterhouse 2006; Smith 2002). Kaufman (2006), a traditionalist intelligence researcher, sees Gardner's definitions as non-substantial, since they do not have any form of testability. Gardner (1995) defends his definition and points to the numerous laboratory and field data that contributed to its development. Yet, regardless of the questions and issues surrounding Howard Gardner's notion of multiple intelligences, his definition has been valuably utilised within education to help educators to reflect on the learning of their students and, importantly for this research, on their own practice (Smith 2002).

Through his investigations and observations Gardner concludes that humans exhibit a number of abilities when functioning in society within a given cultural situation. Humans need different learning abilities in particular cultural contexts in order to solve the challenges of learning within that specific cultural environment. Recently, Gardner (2004, p. 141) writes of education that "any topic of significance can be represented mentally in a number of different ways" and says that for him, entry into the topic includes the same sequential order that he advocated in 1983. The sequence of intelligences is important to Gardner's work (1983, p. 31) and he begins it with logical and verbal intelligences because they "are particularly important in the kinds of schools that we have today — ones that feature listening to lectures, reading, writing, and calculating". These activities and these "kinds of schools" are also the environment in which Vygotsky's *uchit* occurs.

Gardner and Veenema (1996, p. 70) regard abilities as multiple intelligences "and these intelligences constitute the ways in which individuals take in information, retain, and manipulate that information and demonstrate their understanding (misunderstanding) to themselves and others". Learning on the individual level should be structured in a manner that allows students the opportunity to "exhibit their understandings by means of media and representations that makes sense to them" (Gardner and Veenema 1996, p. 70).

Beyond Kolb and Gardner

Although Kolb's (1984) and Gardner's (1983) concepts identify and illuminate learning processes and learning abilities, it will be shown that they did not assist with the specific understanding of the observed developments and changes in immigration to the new world of ICT as observed by this research. That is, Kolb's and Gardner's frameworks do not sufficiently describe nor answer the original question of how digital immigrant teachers learn for the information age. To fully understand the meaning of experienced teacher ICT professional learning therefore, it is necessary to consider another framework that examines, and enables a closer alignment between, adult professional learning, action research, and the dynamics of

practice. Vygotsky's work (1999; 1962) considers all of these elements, and so it is deemed important for this study to explore their meaning and origins carefully. Although Hanfmann and Vakar originally translated Vygotsky's work in 1962, on returning to the original Russian (*Мышление и Речь* 1999; which the researcher read in the original) it emerges that three important concepts had been overlooked. These are: *perezhivanija*, *mislenija*, and *uchit* (Vygotsky 1999) and all are highly significant to understanding the nature of the learners in this study.

Kolb, Gardner and Vygotsky approach learning from a different perspective. Kolb identifies learning through modes of learning and their processes, while Gardner illuminates certain human abilities and different ways of learning. Vygotsky (1978) on the other hand develops a sociocultural theory, where learning within a sociocultural context occurs along two planes: the intermental plan and the intramental plane. According to Resnick (1996) Vygotsky emphasises the collective and social roles in learning; she gives primacy to the collective and social role, while ignoring the individual role. The learner's enculturation is important in a social setting, and education must promote social rather than individual consciousness (Wertsch 1985). Therefore the individual is not seen as autonomous from the social group and the collective is larger than the individual.

The next section discusses Vygotsky's concepts in relation to sociocultural theory and this study. Emotional (*perezhivanija)* and intellectual (*mislenija*) developments and the concepts of learning and teaching (*uchit*) became relevant to this study.

Vygotsky and Sociocultural Theory

In his short life (1896-1934), Vygotsky "was attracted by everything that contributed to the development of culture and education" (Vygodskaya 1995, p. 5) within a sociocultural context. Vygotsky's theory is characterised by three general themes: development from the simple to the complex; attention to the higher mental functions; and the interpersonal and intrapersonal

interaction of learning (Vygotsky 1987; 1962). And Vygotsky, like Kolb and Gardner, is interested in the learning process within both cultural and social contexts.

Vygotsky maintains that the higher mental functions – of which learning is one – have their origins in social interaction which leads to making sense (*mislenija; мышления*, Vygotsky 1999) of learning in what he terms a learner's Zone of Proximal Development (ZPD). *Mislenija* is the 'making of sense' which arises from interpersonal and intrapersonal interactions within a ZPD (Vygotsky 1999; 1987). Vygotsky (1978, p. 86) describes the ZPD as "the distance between actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers". He advocates that learning entails both challenge and assistance. This notion of potential development is analogous to Krashen's (1982, p. 21) observation that "[we] acquire,… only when we understand language that contains structure that is 'a little beyond' where we are now". Vygotsky also concerns himself with the sociocultural environment of learning. Krashen, too, is cognisant of this and even anticipates Vygotsky's terminology when saying that we "also use context, our knowledge of the world, our extra-linguistic information to help us understand language directed at us … we acquire by 'going for meaning', and as a result, we acquire structure" (Krashen 1982, p. 21). Learning and teaching in this way can be seen as relying on the connections between the people and context, and on the mediation of the cultural devices within a social environment.

Vygotsky (1999) views the learning and teaching process (*uchit*) within a social context; as an interactive experience that translates from a simple to a complex involvement for learners, who in time internalise their knowledge acquisition. He argues that like thought and language (Vygotsky 1962), *uchit* does not exist on its own but denotes an interactivity between both learning and teaching that takes place within the Zone of Proximal Development. Indeed for Vygotsky, learning and teaching are not two separate entities. He bases this concept "more on the European traditions (e.g. The Netherlands, Belgium, Germany and Scandinavia), ...focusing

on the relationship between learning and teaching such that one does not exist as separate and distinct from the other" (Loughran 2006, p. 2).

In contrast to this "European tradition" and to Vygotsky's (1962) view on learning and teaching, traditional didactic educational approaches like those inherited from England and practised in Australian universities, encourage learners to absorb "ready-made [concepts] through a process of understanding and assimilation" (p. 82), rather than to develop and formulate true concepts in a non-spontaneous context. Hence Vygotsky's *uchit* concept is distinctive, in that he maintains learners make meaning of the content through a "communication social contact" Vygotsky (1962, p. 18) provided by the cultural knowledge within the sociohistorical context (Lave and Wenger 2003).

Vygotsky explores not only the intellectual and sociocultural aspects of teaching and learning, but also the emotional/affective tendency in speech, thought, and learning. He labels this tendency *perezhivanija (переживания,* 1999) and it is a concept which until recently was largely unknown outside the former Soviet Union. *Perezhivanija* describes the ways learners "perceive, experience, and process the emotional aspects of social interaction" (Mahn and John-Steiner 2002, p. 3). It encompasses the interpersonal and intrapersonal dynamics of Gardner (1983) that assist learners in understanding and making sense (*mislenija*) (Vygotsky 1999) of their new knowledge.

The particular social environment of this study was the university classroom in which teachers were attending to their professional learning through action research. It was an environment that had changed culturally from similar environments in the predigital era. In an attempt to understand this culturally changed environment, the next section investigates teacher professional learning, literacy and adult learning. These three topics are intrinsically related to teachers' learning, teaching and survival skills which support their immigration into the changing twenty-first century environment.

Section Three: Teacher Professional Learning

Within the traditional teacher professional learning environment of the university, the teacher educator plays a critical role as the disseminator of knowledge, and the recruiter and preparer of teachers for the school environment (Schwille, Dembélé and Schubert 2007). However, in the university classroom of this study other forms of learning in teacher education became evident. These offered many positive opportunities for teachers to reflect on their practices and to learn, both individually and collectively, by reconstructing and reorganising their experiences in order to add value to their work (McNiff 2001). According to McKenzie (1998) teachers add value and strengthen their learning as they grow, survive, and learn from experience and they do so by asking questions, describing events, and sharing knowledge. Ramsden (1992, p. 167) has further proposed that teachers should incorporate "dialogue, structured goals, and activity" in learning.

Similarly, Loughran (2006, p. 28) explains that by employing dialogue, teachers "dissect and analyse the assumptions, practices and structures that together form the basis of … the construction and use of knowledge". Brookfield (2006, p. 255) refers to this analysis as a working philosophy of practice in which teachers establish "a set of values, beliefs, insights and convictions about the essential forms and fundamental purposes of teaching". Teachers begin to organise their vision of what they are trying to do and endeavour to understand the importance of what they are doing. Therefore, they are not only doing, but also individually learning. Vygotsky (1962) stresses that learning is not an individual activity since there is the need to learn from "masters" (Lave and Wenger 2003, p. 56). He explains that these masters already possess technical mastery of their topic and that they teach apprentices, who in turn become masters and transfer their knowledge to younger apprentices (Lave and Wenger 2003, p. 56). This is in contrast to, for example, Fullan (1990) and Bennett (1987) who examine teachers as individual learners. They propose that technical mastery, reflective practice, research and collaboration are integrated in teacher professional learning.

(It should be noted here that the use of Vygotsky's 'master' is a gender-neutral term carrying neither authoritarian nor paternalistic connotations. What is denoted by this term is a superiority of skills; a technical mastery of the various aspects of teaching and learning of a particular topic. Vygotsky wrote from and reflected his own social and historical milieu, and the unfortunate undertones that the word 'master' may have carried should not be transferred to the current use of his terminology.)

Rather than relying solely on the learning processes of the individual, Hargreaves (1994; 2003) and Cohen (2004) advocate that, in order to evaluate learning and teaching problems, learning should take place in collaborative communities that practise collective research. Brookfield (1995) also supports the idea of communities in which practitioners explore questions or problems, take action, and then reflect on the action. Such communities aggregate and identify activities that will engage participants in developing and sharing practices in a facilitative environment (Mayes and de Freitas 2007).

Within a community of practitioners, Brookfield (1986, p. 10) asserts that "praxis is placed at the heart of effective facilitation. Learners and facilitators are involved in a continual process of activity, reflection upon activity, collaborative analysis of activity, new activity, further reflection and collaborative analysis, and so on". Ramsden (1992) suggests that such reflective practice is an essential component of all professional endeavours. Sparks and Loucks-Horsley (1990) and Fullan (1997) emphasise the need for informal support structures and the cultivation of a reflective learning culture: one which incorporates networked collaborative communities that support learning domains, and encourage reflective practice (Brookfield 2005; Jonassen, Peck and Wilson 1999).

Besides individual and community processes, teachers require certain capacities in order that they may experiment, explore, and make meaning of change. Fullan (1997) specifies a number of such capacities – collaboration, inquiry, mastery, and vision building – which he regards as prerequisites for individual teachers to become aware of change and to make meaning of the

change. The capacities can be achieved through a continual individual learning process which entails written commitment, the ability to modify ideas, the observation of each other's classes, and the reporting and discussion of issues and approaches. Huberman (1993) suggests that change requires time to in order that the individual may make meaning of it, and argues that change takes approximately two or more years to be realised. Generally, the above authors claim that if the prerequisites of available time, capacities, and support through communities and networks are met, there will be personal and social growth for teachers.

Joyce et al. (1989), like Huberman (1993), note that successful teacher professional learning is tightly connected with the accomplishment of school improvement and effective innovations. McNiff (2000, p. 36), through her research reports that "personal learning has influenced the quality of educational experiences for students, and has also impacted on wider institutional contexts". Sparks and Loucks-Horsley (1990) and Fullan (1997) suggest that teacher professional learning is not often practised well in schools or that it is not connected to the relevant underlying pedagogical theory. While all these issues are relevant in professional learning, researchers in ICT learning propose other models for professional development.

ICT Learning Models in Teacher Professional Learning

Several ICT professional development models have been devised to assist teachers in acquiring ICT competencies and skills. However, these have resulted in the encouragement of "technophiles" to dominate the ICT professional learning domain. For example, Laferrière (1997) recommends a six-phase model of teacher professional development aimed at technology integration and content proficiency within an education system. Teachers are to: develop an awareness of the network phenomenon; master the internet and intranet resources; see new possibilities for learning and teaching; establish new classroom management routines; direct project-based learning; and create knowledge-building communities. Cohen and Chinni (1999) also identify a six-stage model of ICT progression (Cohen 2000). Other models and matrices (Learning Technologies Teacher Capabilities Matrix, Department of Education, Victoria, 1998) have been devised that are concerned with benchmarking against minimal levels of abilities and

knowledge (ACODE 2006). As a result of these developments, some of the models have been used for quality assurance and accountability (Sachs 2003).

Beynon and Mackay (1991) recommend paradigms for core technology competencies and skills, but do not attempt to proceed beyond the technical emphasis on how to use the technology. Knuth, Amenta-Shin, and Ciesemier (1999) propose some competency in computer and non-computer hardware, but they see competencies in software applications, multimedia presentation, and network tools as essential to the paradigm. These are all 'technoliterate' requirements and play a secondary role in teacher development, and as McLaughlin and Marsh (1978) stress they have a transient effect since they do not approach the underlying pedagogical ideas assimilated in learning. Although these approaches have been employed as benchmarks, they have not provided the necessary pedagogical theory in relation to learning and teaching incorporating ICT.

In contrast to the paradigms and models for promoting changes involving ICT, the work of O'Rourke (2003, p. 286) contemplates the dimensions of "educational change in relation to teacher professional learning and ICT… These dimensions [go] beyond technical skilling to develop a critical view of ICT". Although, the work examines the process of change and the required support for change in a facilitative and collaborative school environment, it does not examine how experienced teachers *learn* ICT within a formal university environment.

Within the university setting, Laurillard (2006, pp. 76-77) advocates "a cybernetic/adaptive model … through an apprenticeship programme [note the similarity to Vygotsky's concept of apprenticeship] to the idea of 'the reflective practitioner' working within a 'community of practice'". McConnell (2006) further outlines the idea of community and cooperative learning through a sustaining network e-learning paradigm, in which cooperation and collaboration are encouraged. The latter paradigm is similar to action research where learning can be concerned with social practice and participation (Whitehead 1998; Kember 2000). However, whether this paradigm improves and changes practice needs further investigation.

Somekh and Davis (1996) advocate that teachers adopt action research to improve their practices by working along side students in the classroom, to support technical and higher level computer skills (Somekh and Davis 1996). Other researchers focus on ICT professional development for experienced teachers through courses initiated by employing authorities. Examples include: in the United Kingdom, the New Opportunities Funds (NOF) planned to invite and link commercial companies with universities and local authorities to provide ICT training to teachers in schools from 1999 to 2003 and "80 percent of the UK's 450,000 teachers [completed] the New Opportunities Funds (NOF) programme on Information and Communication Technology" (Mirandanet 2004, page. 1). About the same time in Australia, individual states and their education departments provided ICT professional development also in the school environment: the New South Wales Education Department's Technology in Learning and Teaching (TILT); the Victorian Education Department's the Computing Across the Primary Curriculum (CAPC); and the Queensland Education Department's "formation of online 'communities of practice'" (Pearson 2003, p. 51). The key priorities of the Australian initiatives were to ensure that experienced teachers acquired the technical competencies and capabilities of the respective software programs. Pearson (2003, p. 53), in his review, notes the prevalence of "recent initiatives to learning about and with ICT in Australia". Whilst in the UK the priority was to "cover classroom applications of ICT, not basic skills; online learning was emphasised, to introduce teachers to the National Grid for Learning (NGL)" (Mirandanet 2004, page. 1). On the whole, 'technophiles' have attempted to ensure teachers acquire adequate ICT competencies and skills. However, these approaches have not included examination of the pedagogical theory applicable to ICT learning, nor have they adapted to change.

Yet attitudes to professional learning are changing and, as evidenced by the Victorian Government's Blueprint (2003), teachers are increasingly asked to question and challenge concepts of teaching and learning, and to facilitate the adoption of student-centred approaches in their classrooms. Authorities are understanding that teachers need to be included in the interactions about teaching and learning and, in particular, in discussions about the acceptance

of new technologies, so that they can articulate their experiences and knowledge and ask reflective questions regarding their concerns (Davies 2005). There is also a growing recognition that learning communities encourage reflection and discussion, and that they assist in transforming and adapting learning to the rapid changes experienced in present-day society (Ramsden 1992; Brookfield 1986). So, according to McLaughlin and Marsh (1978), there is awareness that reflection and discussions on professional learning which incorporate pedagogical theory relating to ICT learning issues are essential, and are to be preferred to solely learning ICT skill-specific mechanics.

Beauchamp (2004) discusses the ICT teacher learning transition and the need to gradually incorporate ICT into teaching practice as teachers increase their ICT confidence to interact more readily with the technology. "Although [he states] it is ironic that children should be providing staff with free inservice training (INSERT), there remains an issue for teachers if children are learning to use the resources at quicker rate than staff" (p. 337). Therefore there is a growing realisation that teacher ICT professional learning needs to change, and in a way that promotes "attitude, values, and beliefs that develop confidence for ongoing learning" (Phelps, Graham and Kerr 2004, p. 2). Further, learning in the ICT domain needs to incorporate pedagogy to enable practising teachers to more fully understand their own practice and their students' learning in relation to ICT. For deliverers of teacher professional learning, it is essential that they understand adult learning theory or andragogy, as this will enable them to link learning processes and abilities within a social context, as well as to understand the emotional and intellectual developments that teachers experience as they learn and become literate users of ICT.

Andragogy

Andragogy as adult learning was conceptualised by Alexander Kapp, a German teacher, in 1833. Although Kapp formulated this concept, Malcolm Knowles (1973) popularised it and subsequently became intrinsically linked with the concept (Smith 1999; 1996). According to Knowles, adult learners should be treated as individuals having years of experience and who

expect to be active participators who influence their own learning. Knowles (1978) stresses adult learners are self-directed and self-reliant. Kolb (1984, p. 6) demands "that the relevance and application of ideas be demonstrated and tested against their [the adult learners'] own accumulated experience and wisdom". In fact, adult learners – those over the age of 25 years (West and Hore 1989) – *expect* a plan and structure in their learning and teaching, one that ideally would be negotiated in response to their personal and professional needs.

Davies (2005, p. 22) argues that adult learners are interested in the "why, what, and how" of learning and are concerned with appropriate pathways that are aligned with their life goals and internal priorities so as to motivate them to learn and solve problems. Knowles (1980, p. 44) asserts that adult learners "experience a need to learn in order to cope more satisfyingly with real-life tasks or problems".

In their real life tasks, adult learners accumulate a wealth of information, values, beliefs, and opinions. They tend to refer new knowledge and information to previously learned information and experiences. This processing and transfer of learning is central to understanding how individuals develop important competencies (Broudy 1977; Papert 1980; Singley and Anderson 1989; Mayer 1992; Knowles 1998; Bransford et al. 1999). By developing and transferring competencies, learners become more aware of themselves and actively monitor their own learning strategies and resources (Zimmerman and Schunk 2001), as well as their understanding of the process.

Thus, in this process adults acquire knowledge and information by interaction and facilitation that encourage self-direction (Fidishun 2006) and by experiential learning (Kolb 1984). Such an approach is essential for adults who wish to make choices and construct their learning (Brookfield 2006) at "all levels, which is a fundamental requirement of lifelong earning in the knowledge economy" (Flew 2002, p. 50).

Adult Learners and Globalisation

"Learner earners" are those adult learners who, in response to the growing global economy, are often mobile (Bjarnason 2004), highly-motivated, and transient in the employment they undertake. They include "serving members of the armed forces, or business people traveling the globe, [or] individuals, who study at home after their workdays ends ... [They continue their professional learning often because their] professional bodies increasingly require their member practitioners to keep abreast of new methods and approaches" (Bjarnason 2004, p. 144). The expanding casualisation of the workforce has meant that teachers, as 'learner earners', have also been increasingly required to keep their professional practice abreast of ICT developments and have been driven by the expectation that ICT be incorporated into their classrooms. University educators have been under particularly increasing pressures to incorporate ICT into their teaching and to adapt to globalisation (Bowles and Veltmeyer 2007).

Globalisation in the contemporary world implies a transcendence of borders, be they cultural, economic, or national, and is facilitated electronically and instantaneously (King 2004) by the rising importance of digital communications. Globalisation as a concept spans "cultural, technological, informational, environmental, and political transformation" (Jones 2006, p. 2). It is a multi-faceted process, which involves technology, people, economy, and knowledge across borders (UNESCO 2004). It also requires knowledge of the digitalised processes that distribute information beyond the boundaries of traditional university education (D'Antoni 2007).

Within the sphere of education, 'learner earners' (Bjarnason 2004) are required to be upskilled, and are encouraged to actively participate and "enable … competitiveness in a global knowledge-based economy" (King 2004, p. 57). Teachers and teacher educators have become increasingly aware of the growing importance of the globalised form of education. For university educators, the globalised world, and its reliance on ICT, encourages a rethinking of education in universities (Laurillard 2006); a shift to methods where adult learning is anti-didactic and more student-centered (Mason 1998).

Literacy and Learning in the Information Age

Learning for the "net generation" has changed (Tapscott 1998), and the concept of literacy has expanded (Kajder 2007) beyond the dictionary definition of the ability to read and write (Turner 1989), to include the use of new technologies (Bertram 2003) which incorporate a significant diversity of literacies (Snyder 2005; Kalantzis, Cope and Harvey 2003; Gee 2002; Bawden and Robinson 2002; Bawden 2001). In 1996 for instance, the New London Group introduced the concept of 'Multiliteracies'. Here, linguistic as well as cultural designs in multimodal forms are represented in dynamic relation to visuals, sounds, gestures, and spaces (Cope and Kalantzis 2000). Cope and Kalantzis (1998) further argue that in the information age new technologies encourage new relationships between visual information and text, as well as bring new ways of retrieving and absorbing information. In other words, there is a fundamental difference between traditional print literacy and the new digital literacy. Gilster (1997, p. 6) who popularised the term 'digital literacy' defines it as the ability to use and understand information in multiple electronic formats from a wide variety of sources via computers. Aviram and Eshet-Alkalai (2006, p. 1) state that digital literacy "is usually conceived of as a combination of technical-procedural, cognitive, and emotional-social skills … [that have] been conceived as a 'survival skill', a key that helps users execute complex digital tasks effectively".

In addition to expanding the definitions of literacy, the introduction of ICT has also expanded the definitions of learning (Gordon 2001; Breck 2002; Garrison and Anderson 2003; Laurillard 2006; Corbeil and Valdes-Corbeil 2007). For example, Cohen (1998) and Salmon (2001) inform us that twenty-first century learners utilise new forms of representation, new cognitive skills, and new perceptions to construct meaning in the new world in which they find themselves. Research by Greeno and Hall (1997) and Salmon (2001) reveals that learning now requires different mental skills and capacities. For example, students use the process of inquiry to apply the activities to working, thinking and socializing outside the classroom rather than simply giving an answer, especially in science and mathematics. Students use simulation models to demonstrate their understanding of activities; they use tables, graphs, databases, words and equations to quantify information and change values in the simulation model. Therefore, student

communication is in multiple forms of representation. Kalantzis and Cope (2005, p. 3) introduce the concept of "Learning By Design" at sites in Australia "to meet the needs of the knowledge society in a globalised world", for "learners who are increasingly immersed in digital and global lifestyles". They note that learners often design their learning around new identities, affinity groups, and networks, all based on deeply interrelated knowledge and skills (Gee 2002). Beetham and Sharpe (2007, pp. 7-8) coined the phrase "design for learning" which they see as "the process by which teachers – and others involved in the support of learning – arrive at a plan or structure or design for a learning situation ...designed with a specific pedagogic intention". In so doing, they pose a crucial question for educators in the information age to ask of themselves: "How can I choose from, use, adapt, and integrate [the technology that] … is available to me to provide a coherent experience for my learners?" (Beetham and Sharpe 2007, p. 8)

New concepts, definitions, and designs are essential to the introduction of effective learning and teaching in the global era, and so certain strategies need to be developed to implement such learning; strategies which personalise and broaden knowledge and skills, and aim at the empowerment of ICT learners (Elder and Paul 1994) in the information age. According to Gee (2002) and Bowles (2004), this empowerment process reinvents learning, and a new learning culture and ownership is developed. Harasim, Hiltz, Teles, and Turoff (1995) and Anderson (2004) point out that strategies need to be employed in this new learning to aid the learner to cope with new experiences: with the option of time-shifting, place-shifting, and simulation that offer extended learning throughout the work life of the learner, and which expand learning beyond the limitations of the classroom and into 'cyberlearning' (Rosenberg 2001; Bowles 2004). According to Fidishun (2006, p. 3), cyberlearning is part of this new learning, and moves learners towards self-direction "by giving them short, directed, concrete online tasks". However, self-directed learning is only one approach to learning and others should be considered.

Harasim et al. (1995), Jonassen (1994), Leibernam and Grolnick (1996), and Warchauser (1997) alert us to other approaches in cyberlearning. They see great potential for collaborative learning since learners are enabled to experience many new facets of communication, such as: 'many-to-

many' communication; place and time independence; Computer Mediated Communication (CMC); and multimedia interaction. Laurillard (1997) argues for educational media to be used in a range of ways in order to encourage discussions, interaction, and reflection. She argues that such communications in an e-learning environment enable collaborative learning. Tang (1998) agrees, and points out that learners actively construct their knowledge through collaborative learning, and by participating in progressive discourses. Cyberlearning allows learners to support each other through their collaboration and sharing.

Yet we need to be aware that the teacher educator's role changes in the e-learning environment (Laurillard 2002) to one where learning is active "in a social context [and] in the Vygotskian tradition" (Laurillard 2006, p. 73). As we have noted, in the Vygotskian tradition the master teaches apprentices who then pass their knowledge and skills to less knowledgeable individuals. Harasim et al. (1995) point out that, with the introduction of educational media, the teacher educator's role changes to one of facilitation rather than direct instruction. Likewise, Feenberg (1999; 1993; 1989) identifies the teacher's facilitation role in e-learning as one of moderating so as to contextualise the learning. This allows the teacher educator to monitor and advise on the learning process and to oversee the weaving of discussions. Additionally teachers may act as problem solvers in the e-learning context and, by adopting a role where they are no longer the didactic instructor, encourage an environment where learning becomes more learner-centered.

The learner-centered approach has been practised in schools since the 1960s when progressive ideas were being incorporated into education. Lewin's (1946), Dewey's (1963), Piaget's (1970) and Knowles' (1978) theories, to name just a few, all emphasise learner-centered approaches in various forms. Jarvis, Holford, and Griffin (1998) inform us that by the mid-1970s student-centered education and lifelong learning were part of the establishment and taken for granted. However in higher education, the approach has not been as strongly evident as in pre-tertiary schools. Since the introduction of ICT and globalisation, there has been a rethinking of university learning and teaching approaches (Laurillard 1997).

So no single definition, concept, approach, or design has been undertaken to ensure that all of a learner's needs may be met. However, the use of an array of materials in a variety of ways can ensure different means of learning and encourage environments in which learners may develop strategies to acquire and construct their own ICT literacy and learning. In an attempt to understand the participants' learning in this context, the next section traces the cultural changes and digital immigration.

Section Four: Changing Cultural Context of Learning

As the new technologies weave their ubiquitous threads through the information age a changing culture within the learning context has emerged. Themes arising from the literature indicate that there is no longer an expectation that learning will be limited to instructions provided by a teacher educator, but rather that the learner has the right and responsibility to discover and tap into other resources, not least of which being community learning (Longworth 2003). Boud (2006) focusses on learning and teaching communities where collaboration encourages interaction and cooperation within a social context. When this occurs, learning becomes less an individual concept, and more a communal achievement. When entering the process of learning within a community, learners need diverse skills and different methods of approach.

Kemshal-Bell (2001) and Harasim et al. (1995) propose activities where teams and relationships can be built by debates, definition matching exercises, text reading, and group discussions. They also propose that teachers engage their learners in brainstorming, mind mapping, research projects, case studies, role-plays, and practical and other activities. Teachers, they say, should adopt, adapt, and develop activities for specific learning and teaching contexts, since such activities foster collaborative and social constructive models of learning, in contrast to didactic knowledge transmission models.

In 2001, the Australian National Training Authority (ANTA) developed a paradigm called "flexways", which recommended a number of strategies in relation to commmunity learning.

These range from mentoring and coaching, study groups and action learning, to project-based learning, experiential learning and electronic and virtual communities. The Authority encourages activities such as tutorials, work-place visits, conferences, workshops and courses, reflective practices, reading and research – and combinations of all of the above – to foster an inclusive and expansive learning environment.

Naidu (2003, p. 179) recommends "self-directed and real-life experiences, including interactive activities such as small group discussions, simulation games, project-based work, and collaborative problem solving activities to solve educational problems". All of these activities result in experiential learning that is culturally different from that of traditional learning; that demonstrates a shift from traditional cultural attitudes and expectations to active participation in learning. Subsequently and indeed consequently, there has been less satisfaction with traditional learning as educationalists realise the effectiveness of constructing meaning from engagement, with personal inquiry forming the basis for developing new knowledge.

Prensky (2005, p. 1) advocates that "21st century schools need 21st century technology". The technologies Prensky (2005, p. 4) proposes for pre-tertiary schools are also applicable to university environments, where "some great future-oriented content (such as, for example, … nanotechnology, bioethics, genetic medicine, and neuroscience)" is 'delivered' in interactive ways. In such an environment learning and teaching take on new paradigms and approaches whose impacts and processes lie outside the walls of established institutions. These paradigms transcend borders, as they occur electronically and instantaneously on the global highway (King 2004) and within community learning.

Digital Immigration

Central to this study is the term "digital immigrant" which is used to indicate the concept of re-acculturation undergone by pre-digital teachers learning ICT. Although Prensky makes "grandiose claims that are entirely unsubstantiated with any evidence [and] presents no data or studies to back up his claims" (McKenzie 2007, p. 2), the metaphor is appropriate to this

research in explaining the immigration journey of experienced teachers. The notion is allied to Prensky's (2001a) delineation of pre-digital teachers and digital learners as "digital immigrants" and "digital natives" respectively. For Prensky, the digital native is that student who, having grown up with access to burgeoning communications technologies, finds the traditional classroom environment does not cater to his or her different learning abilities. For Prensky, this student speaks a different language and learns in a different manner to students of previous times. In this conception, learning for such students requires that their teachers embark on a journey of professional re-skilling that not only equips them with the knowledge they wish to impart to students with non-traditional learning proclivities, but also with the skills necessary to impart that knowledge. It is this journey from pre-digital ways and thought towards those of the digital native that constitutes the 'immigration' here; it is an intellectual journey onto the new digital landscape.

Here, it is important to note that the use of Prensky's immigration metaphor is just that: a literary device used to emphasise the attention of the research on the changes being experienced by the teachers. But in applying Prensky's terminology, the research is not accepting his argument that digital natives learn differently from digital immigrants. The research was, however, sensitive to the teachers' unfamiliarity with the world of ICT and used the digital migration allusion to acknowledge their trepidation in working with the new technologies.

The introduction of ICT and the resultant cultural shift brought about change, and with it the expectation that experienced teachers will 'immigrate' to the digital world. The metaphor of immigration is useful in explaining how these teachers, as new settlers "with the intention of making a permanent home here … [and] hav[ing] the intention to become … citizens" (Benyei 1961, p. 11), moved from a traditional to a learning-centred context. The metaphor also helps to clarify how teachers are required to adjust and adapt to the particular nuances of the ICT environment created in this study, and this in turn may relate to other areas of learning and teaching; but they may also be different.

Adapting to new environments and adjusting to change are often felt when people immigrate or move to a new environment or a new country. Jupp (1966) defines immigration as the movement of people, for permanent residency and for various reasons, from a foreign country to a new home. He points out that most immigrants have specific goals when they immigrate to become residents and eventually citizens of another country. They often take on 'hands-on' activities and learn experientially. Frequently, they associate with each other, interact, and collaborate to achieve immediate and individual goals. As a result, "immigrants seldom [blend] immediately into their new environment. They create ethnic communities [and] usually maintain contact with their homelands" (Osterhammel and Petersson 2003, p. 78). However, in order to survive, immigrants are forced to extend their interconnectedness, even though this may be minimal, within their new land. It would seem then, that the metaphor of immigration is particularly relevant to this study where, as will be seen, participating teachers exhibited analogous traits to immigrants who were tentatively embarking into a new environment.

These teachers, like immigrants, bring an array of experience and knowledge from their previous terrain. The importance of their prior knowledge and experience is particularly relevant to their learning and adopting of knowledge in an ICT rich environment. Their transition to competence in ICT can be likened to the changes that occur when people immigrate geographically to another culture or country. The immigration perceived to be taking place during the course of this study, constitutes a foray into a new developing environment or age, one where experienced teachers with limited ICT exposure attempt to acculturate into the digital environment. Hopper (2006) points out that this environment, a process of globalisation in which ICT and the Internet are the pre-eminent tools, has readily exposed people to different experiences and a different interconnectedness.

Digital Immigrant Teachers

Experienced teachers are being exposed to a different environment and they have become digital immigrants. Digital immigrant teachers grew up before the introduction of digital technologies and the ICT culture into schools, and they are not necessarily confident or

comfortable with its customs and practices. They were pre-digital teachers, educated in the traditional university classroom and had not acquired digital knowledge and skills. Therefore, the challenge for these teachers is to survive, learn, and try to teach their own students – who are digital natives – in the information age. This is an age where information is 'twitch switched', 'parallel processed', randomly accessed, graphics first, connected, active, and game played (Prensky 2003; 2001a). McKenzie (2007, p. 5) points out that Prensky oversimplifies the age and information communication, and stereotypes the digital natives who are much more varied in their use of technology (Bennett, Maton and Kervin 2008; Roberts, Foehr and Rideout 2005). Also he claims that Prensky knows "little about schooling over the decades" which argued for engaged learning and an appeal "to the senses [to spark] the curiosity of the young" (McKenzie 2007, p. 5). Further Prensky claims technology has meant that digital natives speak in what is to all intents and purposes a foreign tongue for the digital immigrants. The digital immigrant teachers speak an outdated language (Prensky 2001) that is firmly anchored in a pre-digitalised world (Prensky 2003), and their learning too is mediated by traditional means (Prensky 2006). Bayne and Ross (2008, p. 2) see the digital native and immigrant discourse "as dangerous for it places the teacher in a subordinate and impossible position; subordinate in technology knowledge and an impossible barrier between teacher and students, which both cannot be, and must be, breached by the teacher through her responsibility to change".

As digital immigrants the experienced teachers of this study are trying to teach digital natives. The digital native is that "native speaker of the digital language of computers, video games, and the Internet" (Prensky 2001a, p. 1). Digital natives are, by virtue of their familiarity with instantaneous computer processes, interested in immediacy; their motto is "just do it" (Prensky 2001a, p. 3). It is action which is of importance to them; they want to get "right into the middle of things" (Prensky 2002, p. 2). They prefer to connect and interact with other learners hypertextually within computer-mediated environments (Prensky 2003), yet reflection plays only a minor role in their activities (Prensky 2001a). According to Owen (2004, p.1) Prensky's statements are a myth and the metaphor is a "slogan for provoking argument. There have been clear social and cultural shifts that need to be investigated because they are deep and profound.

However, the slogan does not stand to inspection" and Owen gives examples of anecdotal evidence about teenagers' behaviour. By contrast, their teachers often reflect on their actions and learn in a Kolbian way where experience is valued within a cultural context.

Prensky (2006) states that prior to experienced teachers being able to participate in the cultural context, customs, and practices of the natives, they need empathy and certain abilities to participate, and must know how to harness the digital tools. Prensky (2006, p. 1) does not specify the form of empathy required, nor which abilities, but does emphasise a shift in practice where "teachers must practice putting engagement before content when teaching. [They must] …value and honor what their students know". He (2006, p. 2) suggests that teachers should collaborate with their students and be flexible so as to "capitalise on students' individual capabilities and skills". Condie and Livingston (2007, p. 346) agree with this notion, pointing out that "teachers need support to enable them to use technology effectively to support learning and to understand the importance of valuing, recognising, acknowledging, and building on students' own learning".

Digital Citizenship

In valuing and attempting to capitalise on students' capabilities and skills, in 1999, the Potomac Conference leadership series – which drew leaders from business, higher education and K-12 education in the United States – began discussions on developing a collaborative regional initiative on the theme "Digital Citizenship in the Digital Age". The intiative's overall goals aimed to:

- Produce a technically literate and well educated student body and future workforce;
- Empower the next generation with good citizenship, knowledge and skills;
- Develop a model for regional collaboration that can be expanded into other applications of technology and instruction;
- Provide for greater equity in educational opportunity across the region;
- Raise the technological sophistication of teachers and other educators;

- Create an exciting opportunity for our children to become successful digital citizens. (Potomac Knowledgeway 1999, p. 1).

Ribble, Bailey and Ross (2004, p. 2) continue the concept and define digital citizenship "as the norms of behavior with regard to technology use". Further, they propose a cyclical process that involves four steps, namely: (1) Awareness, (2) Understanding, (3) Action, and (4) Deliberation. Users are to reflect on how they use technology as they move through these stages.

In the United States, further attempts have been made to standardise the use of technology. The International Society for Technology in Education (ISTE) has developed a framework, for students as well as for preservice teachers, of National Educational Technology Standards (ISTE 2000). These standards, goals, and definitions focus on the empowerment of students in their relations to technology. Matrices and models have been proposed in Australia to benchmark against minimal standards (ACODE 2006). Much work has been done in the provision of definitions and the recognition of processes with regard to the teaching of ICT to digital natives, but, the literature is mute on how digital immigrant teachers – those who will actually be teaching the digital natives – themselves learn ICT and what goals, strategies, and standards they require to attain their digital citizenship.

Before digital immigrants attain their digital citizenship and teach digital natives, they, like all immigrants, need to be enculturated into the cultural practices (Cope, Castle, and Kalantzis 1991) of their new land – in this case the information age. Slyke and Bélanger (2003) point out that cultural assimilation can and does occur, even though previous customs or practices are rarely fully abandoned. And this is confirmed by Prensky (2003, p. 1) who perceives a "digital accent" among digital immigrants; "a foot in the past" that betrays their having travelled from a pre-digital background.

The teachers participating in the current study have realised that they have to immigrate to the information age, and must learn new and creative ways to enhance their journey into the third

millennium. They are entering a time and place where the acceleration of knowledge acquisition has allowed communications and the application of information to be rapidly disseminated. They must reflect on the ways in which they direct their practices to the resultant new literacies (Postman 1971). They must examine the underlying pedagogical approaches of their profession.

The Challenge

The challenge for teacher educators in the information age is to understand how experienced teachers learn as they immigrate. For teachers, the challenge is to immigrate to the rapidly accelerated digital knowledge environment and begin to construct knowledge that enables meaningful learning and teaching. That is, they must acquire the knowledge and skills necessary to function effectively in the knowledge-based society of the globalised world (Dondi and Moretti 2007), and they must understand the reasoning behind those new skills.

Teachers did not devise the knowledge-based society, nor the economy that evolved as a result of the information age. And an outside body determines the knowledge and skills required for their employment. The Victorian Department of Education, is now requiring that these teachers be computer literate and have a level of education appropriate for employment within their system. Yet the teachers in this study have willingly decided to upgrade their qualifications, by enrolling in a postgraduate certificate course, and which also consists of action research incorporating learning about ICT. They should be congratulated for having decided to undertake such an active and challenging part in their venture into the information age.

Conclusion

In essence, the literature reveals that learning for digital immigrant teachers in the information age has changed from the pre-digital learning environment. Where once a lecturer didactically instructed participants, there has developed a more student-centred learning approach. Additionally, for these teachers, as adult learners, entry into a digital world is seen to require them to learn and explore their own learning in their own environment. They are required, too, to accommodate their diversities and differences – through, in this case an action research

approach – in order to change and improve their practices and to become digitally literate. In this way they will be able to use and understand information in multiple formats and from a wide variety of sources via computers (Gilster 1997).

The literature suggests that there are numerous evolving definitions of literacy and learning for the information age, and that there are requirements of new forms of learning (Jochem, Van Merriënboer and Koper 2004; Longworth 2003; Rosenberg 2001). The reinvention of learning and a new learning culture and ownership need to be qualified (Jonassen et al. 1999). The literature suggests that learning in the information age can offer new forms of learning experience beyond those provided by traditional university learning (Longworth 2003). It can offer extended learning throughout the work life of the learner and it can be expanded beyond the limitations of the classroom (Longworth 2003; Rosenberg 2001). Nonetheless, the understanding of learning for the information age and, in particular the learning of experienced teachers with limited ICT exposure, is essential in maintaining the circulation of knowledge and information in a serviced-based economy (Hargreaves 2003), and in sustaining the present education system. Furthermore, learning in the information age calls for strong understanding of how to deal with a range of issues, and in particular, respect for diversity and different learning styles (Chickering and Ehrmann 1996).

Therefore, the work of Kolb, Gardner, and Vygotsky, is significant in this research. Kolb's (1984) experiential learning styles framework incorporates the process of learning through the inclusion of education, work, and personal development. Within Kolb's framework, learners progress through several stages to develop consciousness of their learning (Friedman et al. 2002). Through that framework, experiential learning creates an environment for adult learners that takes into account their life experience and bears lifelong learning in mind (Rainey and Kolb 1995; Kolb 1984). Gardner, on the other hand, draws his theoretical base from his background in psychology, and touches on some of the educational implications of his multiple intelligences definition (Gardner 2003), such as the diversity of human abilities to solve problems, to construct new knowledge, and to learn new skills in real life situations. Vygotsky,

as teacher, lecturer, psychologist (Vygodskaya 1995) and sociocultural theorist, focusses on the internalisation of learning through teaching and learning within a sociocultural setting.

In summary, the literature indicates that numerous models have been devised for effective individual ICT learning. Yet other, inclusive factors are needed for future ICT teacher professional learning to be understood and effectively modelled. Although the literature identifies that teacher professional learning is changing and that it is imperative that pedagogical examination take place to enable practising teachers to understand their own practice and their student's learning in relation to ICT, it is mute on how experienced teachers actually learn ICT. An important factor in the present-day teaching profession is that the majority of teachers have years of experience in teaching, but that their knowledge and skills in ICT are limited (Peralta and Costa 2007). In order to come to an understanding of the professional learning of ICT by experienced teachers, this study embraces a qualitative methodology and participant observation method to observe, understand, reflect on, and explain the ways these teachers learn in a social and cultural ICT context. The following chapter describes the qualitative methodology and the participant observation method employed by this study.

Chapter Three – Research Approach

Introduction

The previous chapter reviewed the literature relevant to how what have been termed digital immigrant teachers, in the process of upgrading their qualifications, learn for the information age. As fundamental technological and economic changes produce a profound revolution in learning (Rosenberg 2001), new forms of learning and teaching are required to enable teachers to transfer their new knowledge into their school classrooms. In order to identify the learning processes, the different ways of learning, and the emotional and intellectual developments undergone by experienced teachers learning new ICT knowledge and skills, a participant observation methodology was undertaken. This method entails observation and reflection aimed at facilitating programs to assist teachers in bridging the knowledge gap as an achievement necessary for their survival, establishment, and attainment of digital citizenship following a successful immigration into the information age.

This research took place over a period of one year within a post-registration primary teacher education course at an Australian university. In the previous year, the University Human Research Ethics Committee had approved the Research Ethics for this study. Consent forms were submitted to the teacher educator of the course under examination (Appendix C) and to the Head of Department (Appendix A), who agreed to permit the study to proceed. At the beginning of the following year, the research procedure and the events that would follow in that year were explained to the participants. Sixteen teachers signed the participant consent form (Appendix B) and all remained within the study for the year.

This chapter outlines the participant observation methodology of this qualitative research, as well as the analysis of the processes (Kolb 1984), different ways of learning (Gardner 1983) and the emotional and intellectual developments (Vygotsky 1999) of the sixteen teachers learning in a new ICT environment. The method incorporates observation within the university classroom

itself, interviews at three points of the course – beginning, mid and final points – and the teachers' written documentation, with verification from the teacher educator.

Contextualising the Research for the Teachers

The requirements, processes and procedures of the project and of what lay ahead for the university year were explained to the sixteen three-year primary-trained teachers. These digital immigrant teachers were made aware of the problems to be addressed and the challenges they faced, regarding the introduction of ICT into their workplaces. They realised that their participation in this research could enhance their own learning process and that of future experienced teachers.

Their participation gave them a sense of empowerment, knowing that they could analyse their own situations in order to improve their learning. They warmed to the explanations and to the importance of this research. Developing empathy and a relationship between the participant observer and the other participants was critical and was supported through the telling of stories of similar journeys to ICT, and through informal discussions during coffee breaks, and by chatting informally in class. Although only relevant data was included for analysis, these social activities enhanced the interaction and collaboration within the project and assisted the teachers in their acquisition of new ICT knowledge and skills.

Participating Teachers

It is important to give an account of the teachers' backgrounds so as to seriously attempt to understand their concerns (Lincoln 1993; Eisner 1988). The teachers, in this study, were experienced teachers with many years of teaching experience and a number of them were coordinators and heads of different learning areas in their respective schools. Patricia coordinated the early year's literacy program; Patrick headed the Arts Department in his school and Philomena was head librarian at her school. Technology was not formally integrated into their work; *it was something her twins did* as Philomena pointed out to the researcher. Amanda and Penelope were returning to teaching after some leave. Amanda bought her own computer in

the previous school holiday and asked her young brother in law to help her with her computer. Peg's children were *always on chat and other things*, but she *never really had time*, till she started the course *to really learn about ICT*. Dorothy and Danielle left those things to their children and husbands; *it's easier that way and less hassle*, Danielle told the researcher. Dorothy considered herself a veteran teacher, who had *been around for a long time* and *didn't really need computers;* what she *needed to do, was doable without computers*; and besides *her children are too small and the older upper grade children really need them*. Ashley and Doris were *doing CRT work* and Doris believed that *really getting the quals is more important than the technology*. But Doris did state that *it will probably be worthwhile knowing something about ICT.* David was doing the course because he needed the qualifications; but simultaneously, he and his *wife were here* (in Australia) *from Canada on a teaching exchange* and *this sure was a good way to spend some time*. Con was *more informed about IT than the rest of the group* and he believed that he *had an upper hand in the university classroom in comparison to the other participants*. Frequently, he would *assist his 'race horse' friend with technology problems*. Duncan and Con owned a 'race horse' and throughout the course on entry into the university classroom they would *check out the internet on the state of a particular race.* Delia and Pearl supported each other, since they *were teaching together and this was a good way to upgrade their qualifications*.

Although the group was somewhat reluctant and diverse in their approach to ICT, the early canvassing of this study helped in the achievement of an affirmative response to the research from most of the teachers. The research sample size comprised sixteen practising teachers who had enrolled in a course entitled Bachelor of Education (Year 4 Post-Registration) at an Australian university. They attended on a part time basis of three hours per week for one year – and also on a number of other days for six hours each – throughout the year. They were upgrading their three-year qualifications to a fourth year level so as to complete their undergraduate degree in education. As part of the course they were required to further enhance their learning through action research at their workplaces/schools. The context of their learning was not solely restricted to the university environment, but was also to occur in their workplace.

The content of the course allowed for exploration and flexibility, with knowledge and skills being obtained through direct ICT experience.

The context of their learning was not solely restricted to the university environment, but was also located in their workplaces. The content of the course allowed for exploration and flexibility, with knowledge and skills being obtained through direct experience of ICT in their own schools and classrooms. The content of the course and the teaching approach attracted experienced teachers from different areas of Melbourne. Their willingness to participate in this qualification enhancement can be appreciated by the fact that some of the teachers travelled long distances – some over 100 kilometres each way – to introduce themselves to the kind of learning which can be expected of teachers in the twenty-first century.

Ethical Considerations

Informed consent from the participants was sought in accordance with the University's Human Research Ethics procedures. Approval was contingent upon participation being voluntary and without coercion, and on participants being informed of the duration, method, possible risks, and the aim of the study (Denzin and Lincoln 1994).

After the research was explained to the teachers, and to the teacher educator leading the class, all generously gave their informed written consent. The university-approved Consent Forms (Appendices B and C) were read with each participant and time was given for the consideration of their contents and implications before the participants joined the study. The teachers were encouraged to ask questions about the project. Furthermore, it was emphasised they had the right to refuse to participate at any stage of the project. This refusal would not impact in any form on their assessment for the qualification they were aiming to achieve. Prior to every interview and the recording of the interviews verbal reminders about consent were given again. This procedure was repeated when written documentation was submitted.

There was concern that the teacher educator might feel uncomfortable, anxious, or stressed with another teacher educator (the researcher) observing their classroom and examining their students' work. To minimise any risks and safeguard the teacher educator and teacher learners, it was emphasised to the teacher educator that data would only be used with the participants' consent, thus assuring confidentiality, and enabling any participant, including himself, to withdraw from the project at any time. The provision of access to counselling when appropriate, and/or on request, was assured. The teacher educator was informed that the Student Services Counsellor had been advised of the project and he therefore generously agreed to support the research as necessary (Appendix C). Furthermore, the conducted research was on how experienced teachers with limited ICT exposure learn ICT, and the research was not conducted on what the teacher educator did nor how the students were assessed in the actual classroom.

Researcher's Stance

Often, for qualitative researchers, personal, professional and social commitments mesh intimately, bringing into play previous personal experiences and insights. According to Moustakas (1990b), during an inquiry the researchers' self is present and they experience growing self-awareness and self-knowledge, thus understanding the event with increasing depth. Douglass and Moustakas (1985) further argue that the researcher's personal experience and intense interest in the event yields an understanding of the occurrences within the research.

The researcher did not only observe the teachers in the setting of the university ICT classroom. As a digital immigrant herself – and as a teacher of ICT – she participated as a learner and teacher in the classroom. The researcher participated and interacted in the discussions and reflections of the learning process with both the teachers and the teacher educator. The researcher usually arrived earlier than the start of the class and discussed the processes of learning with the teacher educator. The fact that the teacher educator and the researcher were colleagues could be seen as problematic; however in this case, as colleagues, they often exchanged ideas about technology and some of the theoretical aspects of technology. However,

the teacher educator was not a primary data source and did no more than provide contectul detail about th course and teaching sessions.

In the meantime, on a personal professional and social level, technology was being explored in the researcher's voluntary work within the Ukrainian ethnic community. These explorations and movements enabled her to take the opportunity to explore the technologies of the information age. Consequently, through this movement and transition, the researcher could be seen to occupy the same place in the research as her classmates: a digital immigrant teacher. This progression through the highs and lows of digital immigration has assisted the researcher in becoming sensitive to the challenges facing the participating experienced teachers. Like these teachers, the researcher was originally educated in the predigital education system. She spoke the same language, and felt a connection with their "mutual effort to elucidate the nature, meaning, and essence of a significant human experience" (Patton 2002, p. 108). Over time, she too had entered the knowledge society and the information age. For the researcher, her unique personal experiences, reflections, and informed insights, aided her in her attempts "to understand the essence of the phenomenon" (Patton 2002, p. 108) and transform from practitioner to researcher.

Having experienced similar learning situations, the researcher brought to the study a certain level of sensitivity and understanding of the learning frustrations and processes that the teachers experienced. On the other hand, her being familiar with the subject matter could have made it difficult to pursue questions beyond the technology, which the researcher already knew and may have taken for granted. Thus, it was essential to use strategies that enabled her to observe, and yet participate in the teachers' learning process. She realised that these personal experiences were important to her understanding of the struggles of these experienced teachers. She needed to approach the participants and the research in a fluid and flexible manner. Yet she also needed to look at the environment "as it is" (Johnson 2005, p. 11), through systematic observation that was context-sensitive and data-driven (Mason 2002).

Qualitative Methodology

Qualitative methodology was deemed most appropriate for this research since it allowed systematic observation, over time, of the teachers' learning and their understanding of the construction of new knowledge. Additionally, it allowed conceptualisation of the usefulness of ICT for the teachers in their professional and personal worlds.

Qualitative methodology encourages the study of social phenomena; it is a naturalistic and interpretive approach, and uses multiple methods of inquiry (Denzin 1994). It answers questions of struggles, survival and learning. It asks questions about people's experiences and what they make of them in a particular environment (Patton 2002). It is descriptive, and is concerned with processes rather than simply with outcomes. The data gained is analysed inductively: the answer comes from the collection of data and meaning is found from the data (Bogdan and Biklen, 1992).

Qualitative methodology searches for and explores meaning and reality. To reach the meaning of a lived experience, there are numerous ways to display findings, and the display should be organised and concise so as to permit the drawing of conclusions (Miles and Huberman 1984). Sandelowski (1995), as cited in Clare and Hamilton 2003, believes visual and imaginative display allows researchers to look at their data and give them some sense of the data.

This 'sense' of the phenomenon is captured in writing, which "fixes thought on paper" (van Manen 1990, p. 125). Writing allows hindsight of an experience, and promotes reflection for the researcher, and for the potential reader of the study, who may then interpret the meaning of the particular moment. Writing is a journey for the writer, who reflects and critically examines content and context and searches for deeper understanding, accuracy and truth. The picture that the writer describes should evoke a similar journey to that undertaken by the participants, and within this study attempts to empirically demonstrate the human immigration experience of making sense of learning in the ICT context. Van Manen (1990) praises the exploration and writing of human experiences because they mirror the real and empirical world.

The qualitative research method results in an inquiry that is a private and reflective process; an inward struggle as well as a collaborative process, whereby each participant brings metaphors/stories (Jagielo 1998) from their own teaching experiences and knowledge. Such enquiry can lead to teachers gaining deeper understanding, facilitating application of the information to other contexts and fostering lifelong learning skills (Haslett et al. 2002; Wadsworth 1998). It can help people look at their experiences in the light of what they wish to achieve, and as self-reliant and self-determining social beings (Park et al. 1993).

Qualitative methodology has significant potential to allow detailed descriptions of learning through rich data-gathering techniques and so "should be systematically, rigorously and strategically conducted, yet flexible and contextual" (Mason 2002, p 7). According to Miles and Huberman (1984), Burgess (1988) and Rossman and Rallis (1998), the strength of qualitative data is that it is rich and holistic, with strong potential for revealing the complexity contained in the natural setting. The researcher should be actively and reflexively producing explanations or arguments rather than mere descriptions of the intellectual puzzle (Mason 2002).

Qualitative Method of Data Collection

In this study, intellectual curiosity results from consideration of the manner of use of computer technology, which has fundamentally altered the technological and economic landscape in the twenty-first century. Teaching, like many other professions, has been attempting to transcend the traditional learning environment.

Qualitative methods are used to inquire into selected issues with careful attention to the detail, content, and the different hues of the subject matter in the empirical world of teacher learning (Shank and Villella 2004). Research methods "find out what people do, know, think, and feel [and do so] by observing, interviewing and analysing documents" (Patton 2002, p. 145). Each form of data collection gives a picture of: the abilities used; the process of learning; and the emotional and intellectual developments experienced by the participants. This leads to a focus

on exploring how the teachers of this study make sense of experience and transform that experience into consciousness, with both individual and shared meanings. This research examines the learning experience of the teacher learners, through the interactions and conversations between the teachers themselves, with the teacher educator, and with the researcher. The latter was achieved, within the participant observation role, through the examination of the teachers' transcribed interviews, journals and online materials, as well as the researcher's journal.

The value of this method within the context of the present study is displayed in its ability to help in the identification of the learning processes, abilities, and developments utilised within a given ICT context over time. It becomes possible to relate and chart learning and to encapsulate the meaning attributed to the learning processes (Kolb 1984), abilities (Gardner 1983), and emotional and intellectual developments (Vygotsky 1999), in order to observe how experienced teachers solve learning challenges within ICT parameters. Additionally, the participant observation method allows the observation of the changes in learning and teaching, the shift in language acquisition, and immigration to the information age.

The method allows for triangulated data to be collected: participant observation; interviews and written documentation (teachers' journals, and online material from WebCt; bulletin boards and chat rooms). Figure 3 outlines the data collection schedule that was followed:

Total number of teachers	**Sixteen**
Participant observation -Classroom and Online	February to December, 2003
Participant interviews	February, June and November, 2003
Participant journals	November, 2003

Figure 3: Data Collection Schedule

Participant Observation

Traditionally in the field of qualitative educational research, numerous evaluative methods are employed. These include case study, action research, biography, ethnography, grounded theory, critical theoretical analysis evaluation, and phenomenology (Shank and Villella 2004).

In this study, the focus was on the process of adult learning in the ICT environment. It was discovered that within the social and cultural dimensions of adult ICT education, as in anthropology and in ethnographic methodology, the researcher needs to be accepted into the community. It is important to develop a rapport before any observation and information is recorded about the culture and behaviour of the participating subjects (Bordini and Campbell 1995).

Although participant observation is considered one of the most demanding of qualitative data collection methods (Trochim 2002), the researcher, as a participant in this particular ICT culture, was aided by her extensive familiarity with the educational setting. Participant observation was employed as it allowed for the focus, observation, investigation, description, identification and interpretation from within the particular setting and its teacher learning phenomena.

With "any observational study, the aim [is] to gather first hand information about social processes in a 'naturally occurring' context" (Silverman 2001, p. 14). Participant observation is the actual doing of the fieldwork; where the researcher describes "the activities, behaviour, actions, conversations, interpersonal interactions, organisational and community processes, or any other aspect of observable human experience. Data consist of field notes: rich, detailed descriptions, including the context within which the observations are made" (Patton 2002, p. 4). Further to this definition, participant observation as originally defined by Florence Kluckhohn (1940), as cited in Reinhartz (1984), is the systematic and conscious sharing of life activities,

interests, and affects of a group of people. Data regarding behaviour of the group are obtained through direct contact with the participants.

According to Adler and Adler (1987) observation occurs in naturalistic settings without the use of predetermined categories of measurement or response. Such research is interested in the observation of behaviours as they naturally occur, in terms that are meaningful to the people involved. Adler and Adler distinguish between observation and participant observation, suggesting that qualitative researchers tend to use the latter. Participant observation requires the participant observer to look, listen, and speak. Purely observational research omits the latter. Ely, Anzul, Friedman, Garner, and Steinmetz (1991) point out that classic participant observation interweaves observing, listening and asking, over a period of time, and requires considerable involvement by the researcher in the personal lives of the research participants.

Participant observation has also been described as a process of prolonged engagement (Guba and Lincoln 1989). The potential strengths of this engagement are understood to include the value of obtaining a grounded understanding of a particular program: as in the case of this study, action research within an education program. The engagement here is based on longterm relationships with the teachers, and resulted in improved access to the participants for research purposes and provided an important form of data validation.

A difficulty with participant observation is that the researcher can become an influence on the implementation of the program itself. This difficulty does not invalidate the use of participant observation but requires some assessment of the researcher's influence as part of the research method (Jorgensen 1993). In this study, such an assessment involved the views of the teacher educator, as well as the researcher's self-reflections. Documentation of this process of participant observation involved a diary that combined a description of the engagement and reflection from the researcher's:

- attendance in the university classroom over two semesters;
- attendance in the online environment over two semesters;

- informal discussions during the class breaks.

Appendix D presents a sample of the journal to demonstrate its content and form. The information gathered from the documentation was similar to what might have been gleaned in interviews. The conversations from the interviews were audio recorded and involved asking the teachers of their views and experiences in ICT learning. The essence of this form of observation is the social situation and "what we do when encounter the unfamiliar social situation. We observe and watch what others do around us" (Ely et al. 1991, p 43). Participant observers acquaint themselves with the social and cultural situations within a particular environment.

The qualitative participant researcher observes, takes into consideration what others take for granted, and has the feeling of being an insider as well as an outsider looking into the context with a wide-angle lens. The qualitative participant researcher engages in introspection and reflection to understand more fully the observed experiences, and finally, records the experience. The stance of the participant observer has become somewhat more complex and as Reinharz (1984, p. 157) points out:

> the researcher can choose any position on the continuum from complete participant to complete observer. Complete observers do not reveal their research intention to the members of the setting and therefore rely on pretence or disguise. They study the setting by adopting an available role and hiding their research identity… they have aroused ethical concern among other sociologists. The complete observer… minimises interaction with members and openly employs observational devices or relies on unobtrusive measures or techniques similar to spying. The complete observer eschews participation.

Burgess (1984) has similar views and further separates participant observation into three styles:

1. Active participant observer– besides being the researcher, in this situation, the person would have to have been the teacher educator;

2. Privileged participant observer – the researcher is known and trusted by the group, and the researcher has access to content and context information;
3. Limited participant observer – the researcher observes, asks questions and builds trust over time, but doesn't have access to all information.

In this study, the researcher fell between the two latter categories. Here, she had to gain the respect and trust of the teachers and develop a trustworthy collegial relationship with the teacher educator. This development extended over two semesters, and involvement in the intellectual journey of the teachers was unavoidable. Initially, the teachers were merely watched and their conversations listened to: a form of limited participant observation. However this initial stage was short-lived. The teachers realised the researcher also was a participant and teacher in the information age and indeed, a digital immigrant herself and embraced her presence in the classroom. Consequently, the creation of this understanding allowed more engagement with the research.

A further relevant factor in observation is attention to the physical environment within which the program takes place. Patton (2002) suggests that by having the physical environment described in sufficient detail the reader is permitted to visualise the setting. In this instance the setting allowed the teachers to interact with each other, with the teacher educator, and with the researcher. An inclusive, informal seating arrangement allowed the teachers to interact with certain individuals more and some tended to move around the classroom and interact. The collegial ambience of the room and the acceptance of participants of the researcher allowed for the collection of valuable data (Mertens 1998) regarding the social and cultural setting of the university classroom (Schensul, Schensul and LeCompte 1999) and the phenomena occurring therein, over two semesters.

Potential difficulties for the participant observer include the unwitting ignoring of what is familiar, and entering into the study with preconceived ideas about the process under examination. Recognition of these problems goes some way to avoiding their impact, and the

documentation processes of participant observation in this study involved a detailed journal (refer to Appendix D), which combined a description of the engagement and of the researcher's reflections in order to enable assessment of what may or may not have escaped notice. Another dilemma in this type of research is discerning the level of understanding of the participants' viewpoints on their learning. Reinharz (1984, p. 144) writes that:

> to achieve this, no effort should be spared to understand, to participate in, and to share their views. Being socialised into the setting by its members produces for the researcher acculturation in their perspective. When the members' perspective is not adopted, the researcher appears indifferent, hostile, or ignorant and will be tolerated only briefly. Their investment in assisting the researcher's work diminishes and the study is perceived as unsupportive of their perspective. Since people are interested in convincing others of the merit of their position, it is unlikely that researchers can entirely avoid the subtle confirmation that is intrinsic in interaction.

Interviews

The digital immigrant teachers of this study were interviewed at three points during the year. These interviews generated further empirical data (Holstein and Gubrium 2003) about teachers' ICT learning and indicated *how they learned*. The interview process took into account the participants' experience, knowledge, and ability to reflect. It opened up the potential for the researcher to reflect on the retrospective and anticipatory elements of learning (Darlington and Scott 2002). Such an approach conforms with Patton's (2002, p. 4) view that "open-ended questions and probes yield in-depth responses about people's experience, perceptions, opinions, feelings, and knowledge".

Semi-structured, face-to-face interviews allowed for the interactional exchange of information. The informal style allowed for "conversations with a purpose" (Burgess 1984, p. 102) where the teachers deliberately discussed their particular learning. The semi-structured approach gave the interviewees more control and freedom to discuss their perspectives. In total, each participant was interviewed three times for a total of forty-eight interviews conducted, recorded and

transcribed over the period of two university semesters. Appendix E shows the questions that prompted the conversation to flow but which simultaneously elicited the necessary information. In preparing for the interviews, careful planning assisted in contemplating the possible social dynamics, so allowing the researcher to focus on the social lived experiences, rather than hypothetical abstract concepts of learning.

Questions were prepared for the three interviews that would elicit a description of perceived processes of learning by asking the participants to contemplate their own learning:

1. The first interview (Appendix F) at the beginning of the research asked the teachers to describe their own learning prior to entering the realms of ICT. They were asked for the reasons for entering the course, and how they applied ICT in their personal and work lives. This stage was designed to obtain information on the participants' understanding and expectations of the ICT course.
2. The second interview in the middle of the course, asked the participants to interpret and evaluate their learning progress in the face-to-face and online contexts. They were asked about their achievements to date, and subsequently, their opinion on teacher learning and how teachers learn best.
3. In the third and final interview at the end of the university program, the participants were asked to theorise about their own learning, the course, its outcome, and the knowledge and skills that they had acquired during the year. They were asked to assess the learning process and whether or not their expectations had been met and, in their opinion, how they believed teachers learn best (Appendix E).

Therefore throughout the three interviews, the focus was on the general ICT learning of the teachers; and specifically, on their construction and negotiation of learning in the ICT context. Through the interview process, the teachers were asked to discuss the knowledge, views, understandings, interpretations, experiences and interactions that they felt were meaningful in their social reality (Mason 2002). The inquiry position of the research probed for answers that

explored and enhanced understanding of the learning processes of the participants. The research inquired about the teachers' perceptions of learning and how they articulated their own individual learning, especially in the ICT context. Through interaction, different accounts of learning would emerge. This enabled the analysis of the participants' discourse and consequent identification of themes that allowed understanding of learning in different contexts to emerge, and especially in this university context.

Depending on the participants' wishes, the interviews were conducted in either their own school workplaces or in a room assigned by the university. With the permission of each participant, these interviews were digitally audio-recorded as outlined in the consent form (Appendix B) that was distributed to each participant during their induction into the course.

After an exchange of greetings, the participant was reminded of the ethical protocols that applied to the project; their rights to not participate, or to withdraw at any time, to not answer questions, and subsequently to clarify, amend, or have responses deleted, were explained. Each participant was encouraged to regard the interview as a relaxed meeting opportunity for both parties, and to indicate, at any point, any concerns or feelings of discomfort they may have had towards the research. Teachers were also asked to request (once the interview was being taped) that the digital-tape recorder be stopped or replayed should there be any doubt about any of the questions or their answers to them. Once taping began, the conversation was directed by a semi-structured conversational interview format (Appendix E). On completion, the taped interviews were transcribed (Appendix F).

Documentation

The third method of data collection was through documentation; the written material. The teachers' journals and online material, including the computer-mediated discussions (Appendix H) and chats (Appendix I) were captured and preserved, so recording the participants' learning context (Patton 2002). The written online interactions were downloaded and saved to local storage media and the journals were either photocopied or emailed to the researcher by the

respective teachers. These were analysed for evidence of learning and then the documents were organised according to perceived major themes, patterns, and categories, before illustrations of these aspects were extracted through the content analysis. The course required the teachers to maintain a journal in which they reflected upon their learning process, styles of learning, and how and what they learned. The teachers provided access to their journals at the end of the two semesters. These journals provided another lens through which to view the learning of experienced teachers, and more specifically, into the ICT learning process itself.

Further, the participant journals recorded learning information, which was not obtained on the digital file, during the interviews, in the researcher's field notes, or during the observation. The journal entries were made to supplement the information gathered and provided another insight into the learning of these digital immigrant teachers. They confirmed and extended the data from the interviews and observations and became a useful source for the teachers' perceptions, reactions, and impressions, listing as they did, their learning achievements and challenges. In order to obtain a more thorough insight into the progressive learning process, it would have been beneficial to have collected these journals at mid-point of the research, but of course, hindsight is a great teacher.

Data Analysis

The voluminous documentation and various transcripts from the interviews, observations and written documentation needed to be processed in a methodical manner. The data needed to be reduced, simplified, and transferred into meaningful clusters, to sharpen the focus of topics (Miles and Huberman 1984). All the data from the transcripts of interviews, observation notes, journals, WebCt bulletin boards and chats was analysed and placed into clusters in Microsoft Word. From this data new knowledge was to be generated which would have to be trustworthy and validated by the teacher educator.

The meaningful clusters were derived from the major themes aligned against the frameworks of Kolb, Gardner and Vygotsky. The data was analysed using the following codes:

	Codes	Meaning of Codes
Participants	P1	Each participant was allocated a number
Observation	O1/P1/s1/page	Each field observation, participant and page was allocated a number.
1st Interview and page number	1i/2	1st Interview and page 2
2nd Interview and page number	2i/2	2nd Interview and page 2
3rd Interview and page number	3i/2	3rd Interview and page 2
Bulletin Board	1d/p1	Discussions/participant. The discussions were numbered once downloaded from WebCt
Chat/participant	1c/p1	Chat/participant. The chats are numbered once downloaded from WebCt
Journals	J/p1	Journal/participants.
Multiple intelligences 1-7	1mi 2mi 3mi 4mi 5mi 6mi 7mi 8mi	1-verbal/linguistics 2-visual/spatial 3-logical/mathematical 4-interpersonal 5intrapersonal 6-bodily/kinesthetic 7-musical/rthymical 8-naturalist (?-how appropriate to ICT?)
Modes of Learning	CE/p1/1 RO/p1/1 AC/1 AE/1	Concrete Experience/participant/page number Reflective Observation/ participant/page number Abstract Conceptualization/participant/page number Active Experimentation/participant/page number
Perezhivanija	Pz/p1/1	Perezhivanija/participant/page number
Mislenija	Ms/p1/1	Mislenija/participant/page number
Uchit	U/p1/1	Uchit/participant/page number
Push Buttons	PB/p1/1	Push Buttons/participant/page number
Apply Software	AP/p1/1	Apply Software/participant/page number
Change Practice	CP/p1/1	Change Practice/participant/page number

Each time teachers learnt new software, there was evidence that that they were learning how to push buttons, apply software and change their practice. Thus there were three moments where learning was observed. In the three moments, major themes appeared which allowed the researcher to categorise and align the data against the criteria of the following frameworks:

- Kolb's Modes of Learning (Appendix L) and Learning Style (Appendix K);
- Gardner's Multiple Intelligences (Appendix M);
- Vygotsky's sociocultural theory incorporating *perezhivanija*, *mislenija*, *uchit*, scaffolding, and zone of proximal development (Appendix N).

The major themes and criteria derived from the work of the three theorists (Appendices K, L, M, N) enabled the researcher to categorise the codes of individual participants which were summarised and presented into matrices in Microsoft Excel and the corresponding wording was transposed into Microsoft Word. This allowed the researcher to synthesise the descriptions from the observations, interviews, and written documentation and enter this synthesised data into tables. A series of histograms in Microsoft Excel were derived by using the coding system process with frequent meaningful clusters from the major themes aligned against the three theorists' framework. In the coding system process, the researcher analysed the highest level use of each individual mode of learning, multiple intelligences, perezhivanija, mislenija, uchit and PAC employed by the participants. The raw figures obtained by the participants in code were summarised. The totals were added and then each code was divided by the final total of the four modes, MI, perezhivanija, mislenija, uchit and PAC; and multiplied by 100 to obtain a percentage of the criteria within each category. The coding and the clusters proved invaluable, for they became the indicators and "signposts for action" that practitioners regard as relevant and accessible (O'Rourke 2003).

Once the indicators were in place, the raw data was re-examined to match them with the processed information. Microsoft Word also proved itself invaluable, for the synthesised information was placed into tables, which assisted the analytical, interpretative, and theorising stage of the research. Patterns emerged, threads appeared, and a tapestry of learning was seen to be woven through the data. Accounts were reconstructed around the themes and the text-shaped reality, bringing together the experiences of the sixteen teachers, the teacher educator, and the yearlong observation. This display of learning themes helped to process (Clare and Hamilton 2003) the understanding of digital immigrant teachers' learning.

The analysis of data employed the methods of qualitative research analysis, including concept synthesis coupled with content analysis, and constant comparison and contextualisation of all facets of the experience as depicted by the data. This complex approach results from the application of the theoretical background, the broad framework of the study, and the need to

completely understand the phenomena under examination, and was conducted through the rigorous examination of the breadth and depth of the world of teacher education. The process of ”crystallisation” of the phenomena (Richardson 1994) from many angles “provides us with a deepened, complex, thoroughly partial, understanding of the topic, yet paradoxically causes us to doubt what we know” (Richardson 1994, pp. 522-3). This “doubt” saw the incorporation of triangulated data: during the interview phase with the teacher educator, the conclusions and interpretations of the findings were discussed and verified. The end result was “a complex, dense, reflective, collage-like creation that represents the researcher’s images, understandings and interpretations of the world or the phenomenon under analysis” (Denzin and Lincoln 1994, p. 3).

Coding System

Qualitative software programs exist that facilitate data storage, coding, retrieval, comparison, and linkage of themes and ideas. For the descriptive statistics used in this study, however, Microsoft Excel and Word were used to establish categories and generate tables of findings. These two applications were used to sustain the rich descriptive narrative of the teachers and preserve their voices. These applications allowed a comprehensive drawing together of the digital immigrant teachers’ stories with themes, patterns, consistencies, and frequencies as they emerged, resulting in a descriptive analysis of the learning process within the ICT environment.

A coding system or data reduction (Miles and Huberman 1984) is devised to clarify the meaning and explore the relationships within the categories. The frequencies and consistencies of each identified theme are examined and relationships are sifted to arrive at knowledge of the meaning of the matter under examination; in this case experienced teacher learning in the information age. In this research, the coding system was initiated to identify the teachers and to maintain anonymity – each participant was allocated a pseudonym. From the respective paradigms a code was allotted to show which indicator was used at a particular moment. Those identified coded responses concerned: multiple intelligences in line with Gardener’s framework; modes of learning and learning styles according to Kolb’s framework; and Vygotskian terms. The

observations were numbered from one to twenty-four and the interviews were numbered from one to three. Each participant's journal was numbered and each journal's page was numbered. There were four online chatrooms, and each was allocated a number. The online bulletin board/discussion area contributions were similarly tabulated.

The coding system process allowed the reading, rereading and classification of the data to ensure that the data was verified and checked against the original text from the observations, interviews, journals, online discussions and chats against the work of the three theorists – Kolb, Gardner and Vygotsky. Matrices were constructed in Microsoft Excel and Word incorporating relevant elements of the data classification. The matrices showed the patterns, frequencies and consistencies of the data. Accuracy of data transfer was ensured by visually checking the data on the computer screen against the audio and transcripts. Once completed, the patterns, consistencies, and frequencies of central tendencies were recorded in Microsoft Excel and Word, in order to examine the data characteristics. This displayed the data values and the general patterns, consistencies and frequencies of the data. This was checked against the raw data to give a general overview of the data that could be used in the analysis.

Following similar steps to those outlined by Colaizzi (1978), the coding system (Figure 4) process was developed so that the transcripts would be read and re-read to allow the researcher to gain familiarity with the content, affect, and latent and overt meanings of each piece of information. Intuitive feelings about the learning experience (Bryman and Burgess 1994) were notated in the margins. Additionally, the phrases that stood out about learning were highlighted (Field and Morse 1985), and then the devised codes were applied and transferred into Microsoft Excel and Word. This results in an ordering of phrases with clusters and themes.

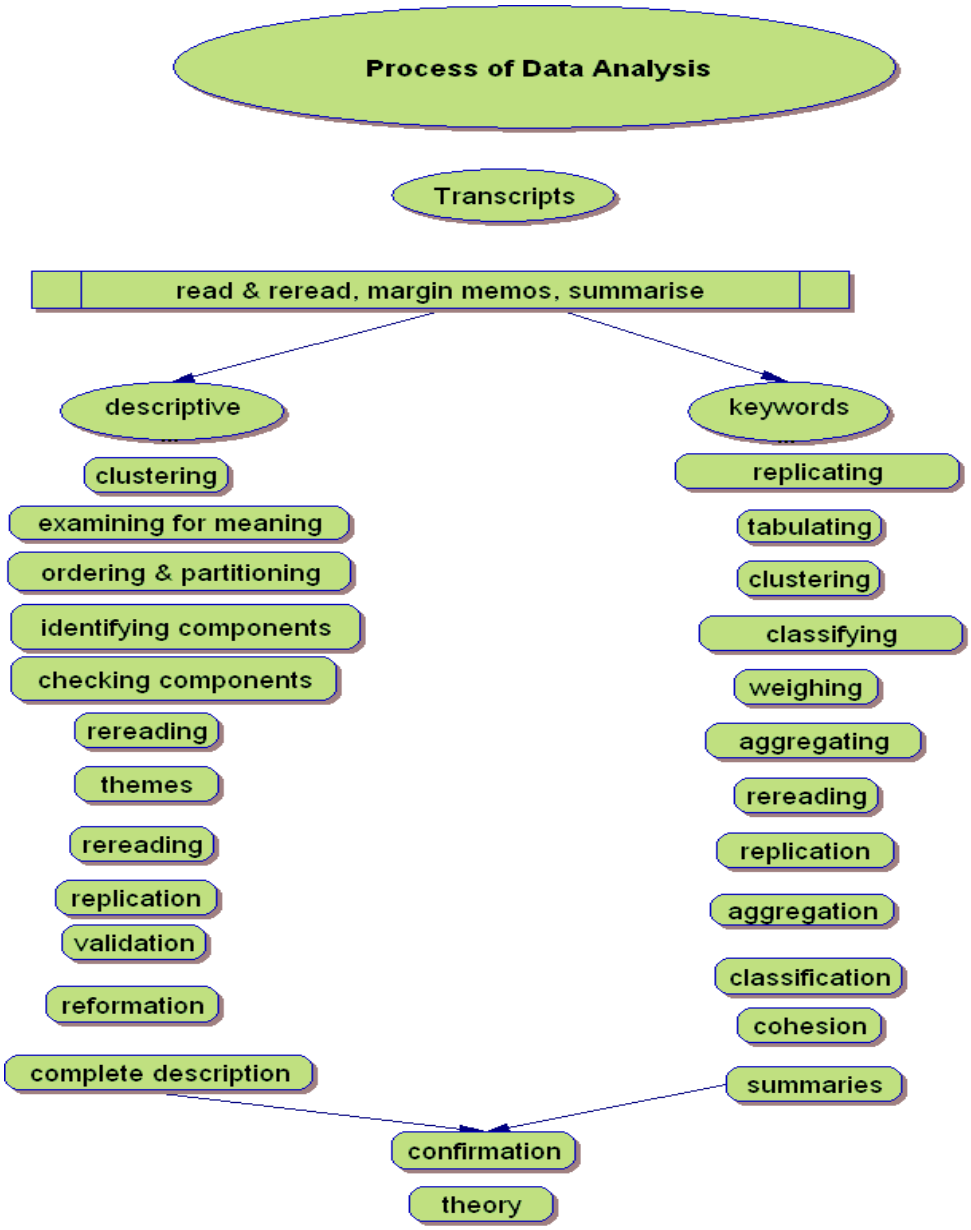

Figure 4: The Coding System

Again, the transcripts were re-read and re-examined to observe the development of distinctive themes which succinctly described parts of the experience, and illustrated their meaning. The transcripts were read within the context of each developing theme and its cluster of phrases, to determine if, collectively, they represented the whole experience of learning; if they constituted a thorough description of the phenomenon. This reading and re-reading is done to determine the composition of the phenomenon. The entering of the code into Microsoft Excel and the colour-coding of each section of the information enabled easy identification and organisation under that particular theme which best indicated a connection to the experience. Tabulated information

expanded each thematic illustration to reflect the underlying structure of the learning experience. A re-reading of the data and a comparison with the Microsoft Excel tabulated information brought about further organisation of the data under particular themes based on a Multiple Intelligences (Appendix M), Modes of Learning (Appendix L) Learning Styles (Appendix K), and Vygotsky's terminology (Appendix N), all of which were compiled in Microsoft Word. The next re-reading checked for replications and was aimed at validating the aggregations and classifications. This brought about the reformation and establishment of links between the descriptive phrases and the descriptors (keywords), so giving a complete description, cohesion, and confirmation of the data (Figure 4).

Each piece of data was treated in the same manner. This whole process was extremely time consuming; however the re-examination of the transcripts ensured that negativity or mismatched clusters were identified and that a comprehensive picture of the phenomenon was obtained. The teacher educator, in his interview was asked to describe and reflect on the learning experiences of the teachers, validated the analysis and the findings. He was asked to examine the researcher's conclusions in the context of the objective and subjective information supplied.

Treatment of the Data

Ely et al. (1991) stress that data analysis should be continuous and progressive from the beginning of the data collection. Heeding this advice, at the initial period of the data collection, to the researcher proceeded accordingly to "focus and refocus observational and/or interview lenses, to phrase and rephrase the research questions, to establish and check emergent hunches, trends, insights, ideas [and] to face [her]self as research instrument" (Ely et al. 1991, p. 140). Upon leaving the field at any time, the researcher's focus is on making sense of the data that has been generated and of the stories that have been narrated. Webb and Glesne (1992) summarise the analytical process as an initial disassembling through coding, then a reassembling of the data as descriptive findings or theories. Firstly, construction is achieved through coding, and secondly, a reconstruction and constructs of themes and threads weaving the findings into meaning. Descriptors with their descriptions were defined in terms of referential parameters to

Kolb's experiential learning theory, Gardner's multiple intelligences as abilities and Vygotsky's sociocultural framework. In reporting the quotes from the participants, their interviews, field observation and the documentation from online learning and the participants' journals, they have been *italicised* to facilitate their inclusion in the text.

Role of the Teacher Educator

The teacher educator was informed that while risks were considered to be minimal they had been taken into account, and strategies designed to reduce the possibility of their occurrence: participation by the teacher educator and course students were to be wholly voluntary, and withdrawal from the research was allowed and carried no stigma. The teacher educator was invited to participate and endorse the project and was informed that the teachers in the class had also been invited to join the research, by being interviewed and by contributing any documentation to the data collection. At the end of the course, the teacher educator had access to the data and was asked to verify the generated data. The teachers were told that the teacher educator and the researcher were to confer on the findings but that this would in no way have an impact upon their final marks. This then placed all decisions as whether to participate in or withdraw from the research, in the hands of the individual participants.

For effective conducting of the research to take place, and in order to gain access to observe the participants within his university classroom a rapport between the researcher and the teacher educator was needed. The teacher educator and the researcher had worked together previously as university colleagues, however this context was somewhat different and could be seen as problematic. It was important for the researcher to reassure the participants that the learning process of the teachers in the ICT context was being observed and not the teaching method or assessment of the teacher educator in any way. This eased any potential stress and created an amiable atmosphere in which the study could take place. Such clarification was important because the teacher educator's endorsement of the project meant that the participants more readily accepted the researcher's presence and the validity of the research project itself (Ely et al. 1991). In addition this rapport allowed a supportive and understanding ambience to develop;

one where easy access to participant information and their learning processes became natural and expected, rather than resulting in the research being seen as an intrusion.

Ethical considerations meant that it was essential to maintain a review and monitoring of the project. Additionally, in order to uncover facts about certain human conditions and to ensure that the ethical codes were adhered to, a form of verification and validation was essential (Denzin and Lincoln 1994). In this study, on completion of the course, a taped interview was conducted with the teacher educator (Appendix J) during which he was permitted to reflect upon the generated data, and to verify and validate the collected data. The multiple data sources and diverse frameworks for analysis of comparing data collected by a variety of methods, or from a variety of sources, or via the lenses of a variety of theoretical perspectives, supported this triangulation of the research data. The interview with the teacher educator supported the validity and reliability of research findings (Guba and Lincoln 1989).

Verification and Validity

In order to stay close to the raw data, the themes and the understandings generated through the frameworks were placed into matrices, allowing for greater data reduction and display, and the arrival at a valid conclusion and its verification (Miles and Huberman 1984). A number of tactics were employed to draw meaning from the data, namely: counting, clustering, constructing patterns, and the drawing meaningful conclusions that could then be verified. As the researcher was the sole collector of the data, this brought about a concern in relation to the reliability of the data collection. However, careful recording of the learning processes, abilities and developments was made. Every attempt was made to verify and maintain all evidence of teacher learning by carefully and thoroughly recording the insights and categorising the meanings and understandings of the learning as they appeared.

Triangulation

Data triangulation is an intrinsic part of the process of creating new knowledge. The intention of triangulation is to utilise a combination of methods for data gathering in an attempt to answer a

research question (Miles and Huberman 1984; Patton 1980; Denzin 1978). Triangulation strengthens a study by a combination of methods for data gathering (Patton 1980). By drawing on participant observation methods of fieldwork, and the interviews and documentation that were verified by the teacher educator, a deeper and clearer understanding was gained about these digital immigrant teachers' learning in the ICT world.

This form of data collection provided rich and detailed stories, which were manifested in the data analysis. Ely et al. (1991, p. 97) state that "one can also triangulate data by comparing those that were collected by the same person using the same method at various points over time". In this study, besides the fieldwork and documentations, three interviews were conducted at three points – beginning, mid and end of the course, so as to crystallise the understanding of teacher learning. That is, by using and combining a variety of data collection sources, the essence of the research was crystallised (Ely et al. 1997). The research from the different data sources told a fundamental story about the learning process of these experienced teachers in this ICT environment.

From the many stories recorded, it became apparent that the essence of learning experiences was very similar for many of these digital immigrant teachers. As Miles and Huberman (1984, p. 226) argue, there is a "need to be confident that the conclusions are not unreasonable, that another researcher facing the data would reach a conclusion that falls in the same general 'truth space'". Miles and Huberman describe triangulation as a way of increasing the certainty of findings by showing that various independent measures agree with a given finding. The term itself comes from land surveying, where the surveyor takes trigonometric bearings of two directions and locates herself at their intersection (Fielding and Fielding 1986). The term also comes from geometric shapes: the logic of triangulation is that no single method is ever adequate to solve the problem. Therefore, the intermingling of different methods of data collection provides a rich variety of information to illuminate the inquiry question (Patton 2002). This conclusion is confirmed by the present research.

Summary

The strategies and procedures that were employed with respect to the sample population of digital immigrant teachers were sensitive and reflective of improved ways of dealing with 'the researched' (Lincoln 1993; Eisner 1988). In this study, participant observation facilitated the collection of rich detailed data over a period of one year. The ICT learning context was familiar to the researcher, as both a participant in and observer of ICT learning, and this connected her to a better 'insider perspective' (Adler and Adler 1987) of such learning. The other two methods of collecting data (interview and document collection) enhanced the study by providing added accounts of the participants' learning experiences. The semi-structured interview questions were designed to engage the participants in recounting events, rather than in theorising about them. Their documentation assisted in the identification, analysis and mapping of the relationships of the different concepts against the frameworks of Kolb, Gardner and Vygotsky.

The findings through participant observation in relation to these experienced teachers' learning for the information age are presented in following chapters. Italic text is used to indicate direct reference to the collected data from the observation, interviews or other documents. Chapters Four to Seven focus on the research analysis of "how" experienced teachers with limited ICT exposure learn, according to the Kolbian, Gardnerian and Vygotskian frameworks. Chapter Eight, the final chapter of the thesis draws together the connections of the frameworks and comes to a conclusion on "how digital immigrant teachers learn for the information age". The next chapter, Chapter Four has as its focus the process of learning according to Kolb's framework and its practical orientation of ICT for experienced teachers.

Chapter Four – Practical Orientation and Processes

Introduction

This chapter is concerned with the practical orientation and processes of "how" teachers learn for – that is, immigrate to – the information age. If this study had been concerned simply with the "what" — the outcomes from the experiential learning — then it would suffice to note that these teachers could, indeed, be trained to demonstrate Information and Communication Technology (ICT) competence. If the concern was primarily with the concrete ICT experience then it would be enough to say that with time teachers could, indeed, receive Recognition of Prior Learning (RPL), once they had completed the desired learning outcomes in the units of the course or they can prove that they have the required learning outcomes. However, the observation of these digital immigrant teachers was designed to discover if there is a process of learning and what it is, rather than to simply accumulate records of their experiences, knowledge, and skills and describe the "what" of their learning; that which Kolb (1984, p. 7) describes as "the identifiable knowledge and skill outcomes of learning from accumulated experience" (Kolb 1984, p. 7). The art of teaching, whether it be pedagogy or andragogy, needs to incorporate the theoretical base of learning. Teachers in the process of their own learning need to understand the theoretical knowledge of learning in order to comprehend the ICT learning of their students.

As detailed in Chapter Three, the data gathered in this study by qualitative methodology and participant observation method – through observation, interview, and documents – were verified through much of the teacher educator documentation. This allowed the observation of the participants' ICT learning processes, abilities, and intellectual and emotional developments. These digital immigrant teachers primarily wanted to obtain their fourth year qualification, learn ICT, and survive in the digital environment. Like many geographical immigrants, their journey was undertaken with a purpose; an example of "agency", reflecting a "voluntary decision" to take "control over the decision-making process, indicating, their personal desire to immigrate" (Maydell-Stevens, Masgoret and Ward 2007, p. 185).

The observations of the survival and learning process of these teachers were analysed and interpreted using Kolb's Modes of Learning as an analytical tool. Kolb (1984, p. 54) states that to understand "how people generate from their experience the concepts, rules, and principles that guide their behaviour in new situations, and how they modify these concepts to improve their effectiveness", learning processes need to be examined. Kolb's (1984) interest lies in the process of learning from experience within a given cultural setting. Concerning learning from experience, Kolb and Kolb (2003, p. 6) argue that a learner "touches all bases" from concrete experience (CE) to reflective observation (RO) and abstract conceptualisation (AC), which in turn leads learners to active experimentation (AE) (Figure 5).

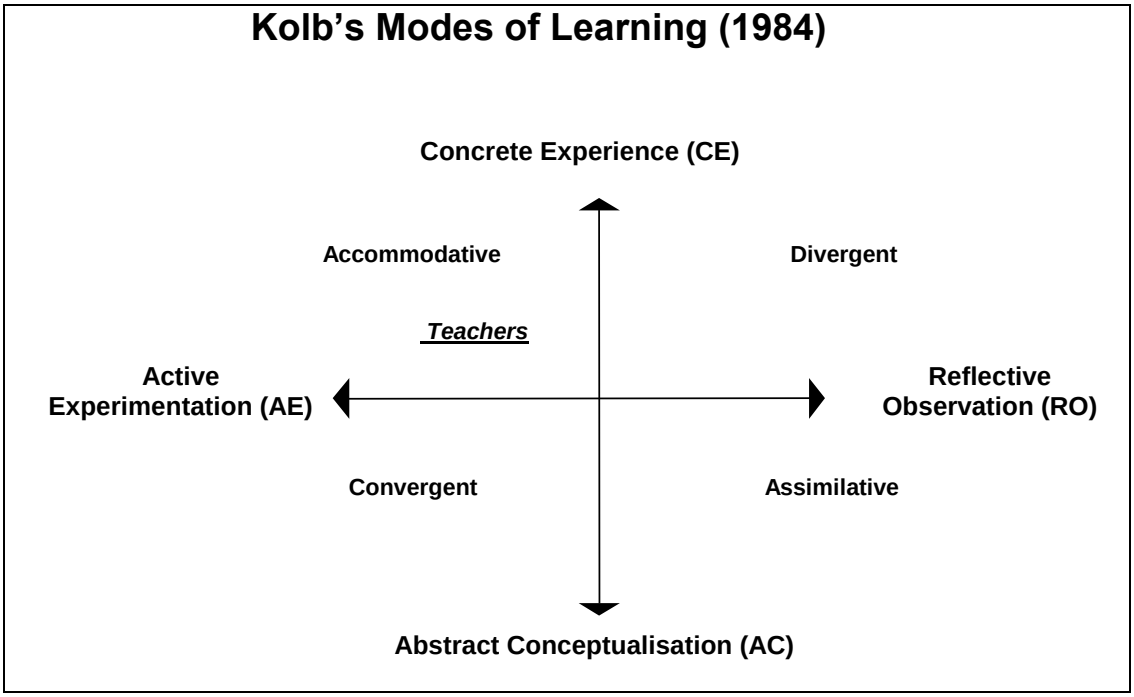

Figure 5: Modes of Learning - Teachers

Furthermore, Kolb (1984) also proposes that two modes determine a person's learning style (Appendix K). According to this framework as depicted in Figure 5, Kolb suggests that teachers prefer an accommodative learning style with an orientation towards concrete experience (CE) and active experimentation (AE).

The modes of learning were of particular importance in the data analysis and interpretation, whereas the learning styles according to Kolb's framework played a minor role. Within the context of this research, the learning styles were found to be not as clearly evident as Kolb states in his framework.

Kolb's Learning Style Inventory

In 1971, Kolb proposed a Learning Style Inventory (LSI). This inventory assesses the "individual orientation toward learning" (Kolb 1984, p. 67) as displayed by the participants in this study. However, instead of relying on the Learning Styles Inventory, this study employed participant observation to discern the learning orientation and approach of the learners.

Had this study utilised the LSI, the objectives of the LSI would not be fully informative, formative, or summative of the learning process, since the LSI leaves it to the learners to be the sole deciders of their learning orientation and how they learn. This could lead to a subjective and partial analysis of learning within the ICT environment. In the survey method employed by LSI, there is no provision for learners' feedback during their learning, and there are no indications as to whether or how, and to what extent, learners achieve the required learning outcomes. So by gathering data through observation, interviews and documents, the researcher was allowed to gain greater insights into the learning orientation of experienced teachers, their learning processes, and the modes of learning that they employed as they immigrated to the information age.

Process of Learning

The data in this research provides evidence that a distinctive form of learning was displayed in this university classroom. These experienced teachers were not listening to *some guy just talking* (quote from the participant's comments during the observation) as in the traditional university classroom. In the classroom of this study learning was different. It had obviously changed and taken on a more interactive form. One in which the participants were observed to be very active and *doing things*. Therefore, Kolb's theory of experiential learning was used to

uncover and analyse how these adults were learning. Kolb's (1984, p. 4) theory is adult learning-based and:

> pursues a framework for examining and strengthening the critical linkages among education, work, and personal development. It offers a system of competencies for describing job demands and corresponding educational objectives and emphasises the critical linkages that can be developed between the classroom and the "real world" with experiential learning methods. It pictures the workplace as a learning environment that can enhance and supplement formal education and can foster personal development through meaningful work and career-development opportunities. And it stresses the role of formal education in lifelong learning and the development of individuals to their full potential as citizens, family members, and human beings.

This theory is the "basis for applications of experiential learning to education, work, and adult development" (Kolb 1984, p. xi) and citizenship; in this case, including digital citizenship.

In order for the digital immigrant teachers of this study "to become successful digital citizens" (Potomac 1999, p. 1), a cultural and methodological change must take place in the way that their learning is processed (Prensky 2001, p. 4). In the university classroom of this study, the process of learning had altered from the "sage on the stage" (van Ast 1997) didactic approach of traditional lectures, to experience-based learning, which encompassed group work, partnership, and collaboration. The outcomes were dramatic.

For example, Dorothy, a participant who initially was *afraid to touch the buttons on the keyboard* and had to ask which button switched on the computer, started to do her *banking on the Internet* half-way through the course. She explained the procedure to another participant, Doris saying: *this sure saves you a lot of time*. Even though Dorothy was aware that her adult children had been doing their banking on the Internet for some time, she hesitated to attempt this practice. However, on returning to the university classroom – after her children had shown her the process and she had experimented at home – she explained the procedure to the other digital immigrant teachers. The documented use by geographical immigrants of "family

members" as a "first resort and rich source of advice [and] help" (Maydell-Stevens, Masgoret and Ward 2007, p. 188) during their acculturation process in a new country, adds further weight to the analogy drawn by this study between geographical and digital immigrants.

Additionally, the teachers realised that *by doing this course, I'm able to bring more technology into my class, especially this PowerPoint stuff*. Penelope *talks about her own learning in her area cluster, reflecting on her peer learning experience and how she was able to bring the skills into her class.* The participants often observed, discussed, and reflected on how they could utilise the technical skills for their immediate needs, in order to function in the information age, and in their particular learning and teaching environments. In brief, these teachers developed learning skills and knowledge through doing and experimenting with the concrete experience. A summary of the applications encountered by the teachers is provided at the beginning of this thesis.

Penelope noted that, *once she started to explain PowerPoint, one of the students wanted to extend the skills. Hold on boy… one step at a time, I haven't learned that yet… Simultaneously, she didn't want to lose control of the teaching situation.* Penelope was prepared to mediate the learning environment within the socio-cultural environment of the twenty-first century. Nevertheless, as she said in her second interview: *I still want to be the adult or the person in charge of my students' learning*. On the whole, the learning process for the participants progressed through doing and experimenting; focussing on the immediate experience of technical know-how and skills. This knowledge and the skills attained were transferable to their workplaces and practices (Schuman 2004). The digital immigrant teachers preferred to experiment with the technology in order to solve particular teaching concerns based on their situational evidence through action learning. For example, Patricia developed a database for her school's literacy program and Phoebe introduced e-portfolios into her classroom. Both teachers explored the practical application of their newly-discovered knowledge and improved their practice by doing, experimenting, and finally reflecting on their immediate situations to try to

solve problems based on their immediate needs. This can be regarded as a learning cycle (Kolb 1984) to understand and explore practice.

It would at first appear that, in line with Kolb's (1984) prediction, the participants "touched all the bases" in the learning cycle; most of them learned through active experimentation with concrete experience and reflection. Yet those who 'touched' abstract conceptualisation were interested merely in the mechanical understanding of ICT. It is important to note that these teachers, as pedagogues, did not conceptualise ICT pedagogy. During the field work in the classroom, examination of journals, and during the three interviews, the researcher noticed that there was a lack of a rationale for their ICT learning and teaching. Teachers did not discuss, theorise or reason (Shulman 1987) their ICT practical acquisition for the classroom; they just *wanted to do it*. Their main concern was to acquire and transfer knowledge and skills, and immediately implement their individual learning into their classrooms. The teacher educator, during his verification interview at the end of the course, also noted that the participants were interested in practical matters; many of the teachers heard that the course *is very practical from previous participants.*The teacher educator commented that *this way they self select themselves for the course, and that's what I inherited.* However further into the interview, he commented on *Seymour Papert's work when he was teaching logo to primary school teachers, Papert sensed that everything wasn't quite jellying properly and eventually one of the teachers said: "I keep trying to work out how this can be used in the classroom, this is the fun!". The working out is really what teachers want;* however the teacher educator did comment that *it's good to read every now and then.* The teacher educator seemed to question the lack of reading to support their learning and *doing the ICT.*

When Kolb (1984) developed his framework, ICT was not as ubiquitous as it is today. The information age has brought about considerable change (Romano 2003; Castell 1996). Digital natives now prefer to learn by doing and experimenting: their motto is "just do it" (Prensky 2001a, p. 3). Reflection plays a minor role in their learning (Prensky 2001a). Therefore, the ICT environment of this study encourages active experimentation through concrete experience, but

additionally, the reflective observation encouraged the participants to reflect on and build from their previous knowledge to their newfound technical knowledge and skills through established activities in their particular practices. That they chose not to apply this reflective process to the pedagogical approaches of their professions is of key interest to this thesis, and should be noted.

Strategies and Actions

Kolb's experiential theory and its framework, including the descriptors, were employed in the ICT milieu of this study in order to reach an understanding about digital immigrant teachers' learning process. Figure 6 presents the synthesis based on Kolb's learning modes and styles, characteristics and descriptions (Kolb, Osland and Rubin 1995; Kolb 1984).

Modes	Descriptors	Description
Concrete Experience	Experience	Functions well in unstructured situation, open-minded approach, specific experience
CE	Immediate	Emphasises the perception of feeling, focussing on the uniqueness and complexity of present reality as opposed to theories and generalizations
CE	Concrete	Learns from specific experiences
CE	Inductive	Has an intuitive approach as opposed to systematic, scientific approach to problems
CE	Artistic	Has an artistic approach, non-systematic
CE	Decision Maker	Is often a good intuitive decision maker
Active Experimentation	Experimentation	Gets things done and accomplished, tries new activities
AE	Do	Prefers hands-on activities
AE	Change	Actively influences people to change situations
AE	Pragmatic	Prefers practical application and pragmatically doing things in order to see results.
AE	Influence	Likes to influence people and events through action
AE	Self reliance	Is self reliant
AE	People reliance	Relates to and values people, social interaction, prefers collaboration, being involved in real situations, with an open-minded approach to life
Reflective Observation	Thinking/Reflective	Emphasises thinking as opposed to feeling, a concern with building general theories as opposed to understanding intuitively unique, specific areas, an emphasis on reflection as opposed to action
RO	Brainstorm	Looks at things from different perspectives and appreciates different points of view; prefers to gather information before making a decision
RO	Deductive	Prefers concise and logical analysis of ideas
RO	Observe	Understands the meaning of ideas and situations by carefully observing and impartially describing them
Abstract Conceptualisation	Abstract	Thinks abstract ideas and concepts are more important than people issues. It's important that learning has a good logical explanation
AC	Technical	Prefers technical tasks and shies away from social and interpersonal issues
AC	Systematic	Prefers systematic planning, acting on intellectual understanding of a situation, a scientific approach to problems. People with this orientation value precision, the rigor and discipline of analysing ideas, and the aesthetic quality of a neat, conceptual system

Figure 6: Descriptors based on Kolb's definition of the Modes of Learning

These descriptors indicate the strategies, orientations, approaches, and actions employed by the teachers during their learning. The descriptions are the explanations of the modes of learning that Kolb (1984) uses for his experiential learning model. The descriptors of the concrete experience mode focus on the immediate experience of ICT, and active experimentation incorporates the descriptors pertinent to the active experimentation of educational tasks performed by the participants. Reflective observation emphasises the thinking and reflective

aspects of ICT learning. Finally, abstract conceptualisation identifies the theory of ICT learning. These modes of learning, their descriptors and descriptions provide a means of interpreting the observation and identifying the modes of learning.

The researcher analysed the highest level use of each individual mode of learning employed by the participants. The raw figures obtained by the participants in each mode of learning were summarised. The totals were added and then each mode was divided by the final total of the four modes and multiplied by 100 to obtain a percentage of the criteria within each category.

Situating the Study

The participants' learning was observed by employing Kolb's modes of learning, but these digital immigrant teachers did not "touch all bases" as suggested by Kolb and Kolb (2003, p. 6), nor did they show a preferred learning style according to Kolb's framework. His framework states that two modes of learning are normally associated with each individual learning style and that a learner's two scores from the modes of learning indicate their preference for one or the other of the two dialectics: CE - AC and AE – RO (Kolb 1984). This in turn indicates the preferred learning style.

Figure 7 depicts Kolb's four learning styles: accommodative, divergent, convergent and assimilative. However, it has been noted that this approach may be inappropriate for certain environments. Squire (2000, p. 8) suggests that "Kolb's four key stages are weakly developed" and points out ways of effectively strengthening the links between the stages. Lord (1998) uses Kolb's LSI and finds that there is a preponderance of accommodator (AE – CE) and divergent (CE – RO) styles among low achievers in Computer-Assisted Learning (CAL) environments when testing students in higher education (Atkinson 1998).

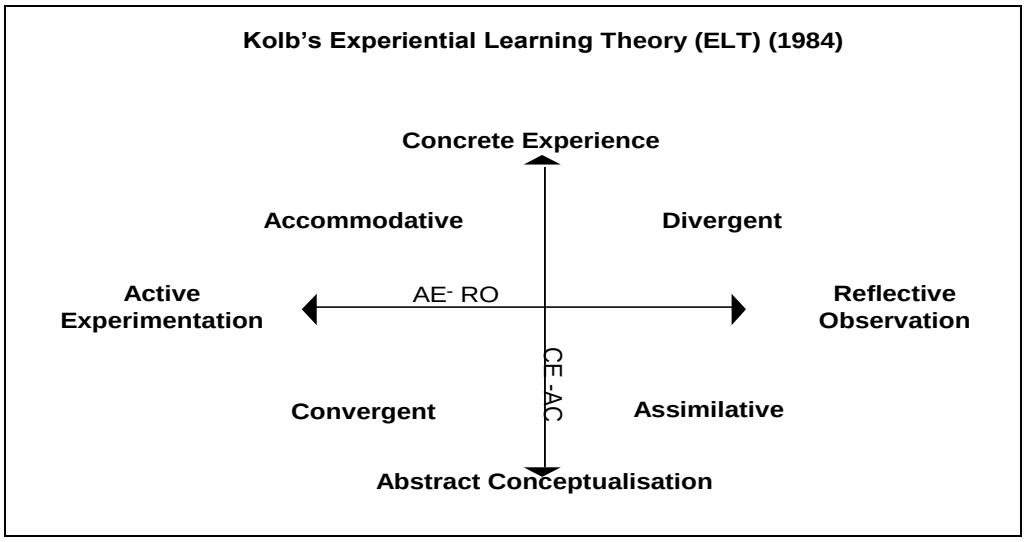

Figure 7: Experiential Learning

This study, like others mentioned by Kolb and Kolb (2003), found that the combination of the modes of learning differs from Kolb's original modes and therefore his learning styles categories became inappropriate in the ICT environment of this study. Nevertheless, the modes of learning proved beneficial in that they show the process of learning of ICT in this educational environment.

Figure 8 indicates that the majority of participants preferred to learn with three modes of learning: active experimentation (AE) through concrete experience (CE) with reflective observation (RO). Some of the teachers exhibited an orientation towards abstract conceptualisation (AC) although they engaged in learning the technical and systematic elements of ICT learning, and its application in their practice, rather than exploring any pedagogical implications. That is, the participants' ICT learning in this environment was limited to learning about the equipment rather than the pedagogical issues related to ICT learning.

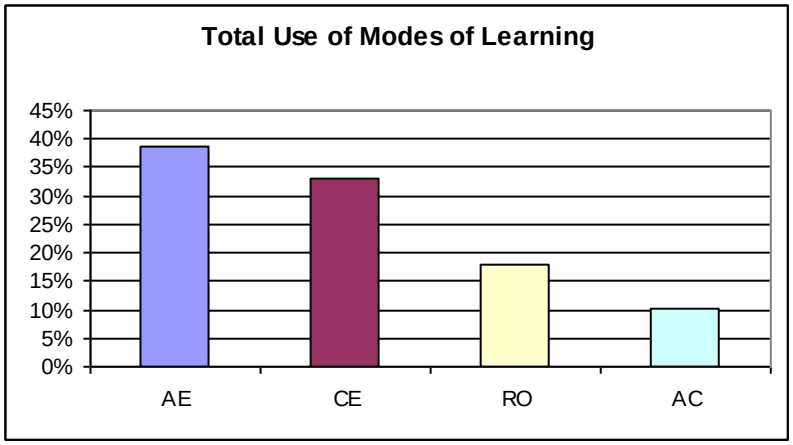

Figure 8: Total Useof Modes Learning

Interestingly, some of the participating teachers became ICT coordinators in their schools. Penelope was appointed as ICT Co-ordinator because she was completing the course and was more familiar with ICT than the other staff members. Con was already the ICT Co-ordinator and managed, with the help of his grade six students, to publish the school newsletters and magazine. These digital immigrant teachers had progressed into a survival state in the new information age and their learning was similar to the learning of new arrivals in a foreign country. They could survive by "seeking out niches" in this new world (Ling 2004, p. 17) and utilising their recently acquired basic ICT skill levels. Yet, when placed in an environment that required abstract conceptualisation of their profession, they appeared to be neither fully comfortable nor confident, and were definitely not thinking and acting with the technology at the creative level employed by digital natives (Lester 2007, p. 1).

Like pioneering immigrants, with the assistance of their own children, and the digital native children in their classrooms, the teachers survived in this new environment. Philomena attempted to email the teacher educator her initial work *with the assistance of her twins*, saying that *perhaps one day I will be able to do this … one day…* During the chat sessions, Peg wrote that *this is what my children do after school… and now I know why they spend hours doing it… it's fun*. She could relate to the enjoyment and amusement of chatting online.

Penelope, too, saw the benefits of this hands-on learning environment because if she *had to read about the technology and discuss what some guy said*, she *would fall asleep* as she *did in her previous courses at university*. However she wanted to maintain control over her teaching environment as her previously noted reaction to one of her students attempting to show her some new features of PowerPoint. Her reaction was *hold on boy, I haven't learned that yet*. Penelope's pedagogical sensitivities had not been sharpened by the course and her conceptualisation of ICT learning involved only the transmission of her new knowledge rather than implementation of the actual learning process within her own classroom.

Other teachers, such as Patrick, emphasised how much they enjoyed the course because *if he had to do what he did in his undergraduate studies*, Patrick *certainly would find it hard with this technology stuff*. Despite the ICT learning and support they received, these digital immigrant teachers, as pedagogues, did not examine the pedagogical issues involved in their new learning.

Modes of Learning

In this study, Kolb's modes of learning provided a comprehensive base for the analysis of the participants' learning. Ordered according to the participants' preference, the modes of learning demonstrated were:

1. Active Experimentation (AE)
2. Concrete Experience (CE)
3. Reflective Observation (RO)
4. Abstract Conceptualisation (AC)

1. Active Experimentation (AE)

All participants at different stages of the research preferred the active experimentation (AE) mode of learning. What became evident is that "experience alone is not sufficient for learning; something must be done with it" (Baker et al, 2002, p. 10). In this study, the transformation of knowledge and the acquisition of skills were the focal points of learning for the immigrating

participants. They processed information by experimenting, doing, changing, and influencing people, as well as relying on other people and themselves.

Six participants (Figure 9) stood out in their interaction and learning process, as they were more interested in the active experimentation throughout the course. These participants preferred to rely on each other for their learning, and on activities that incorporated 'hands-on' experimentation.

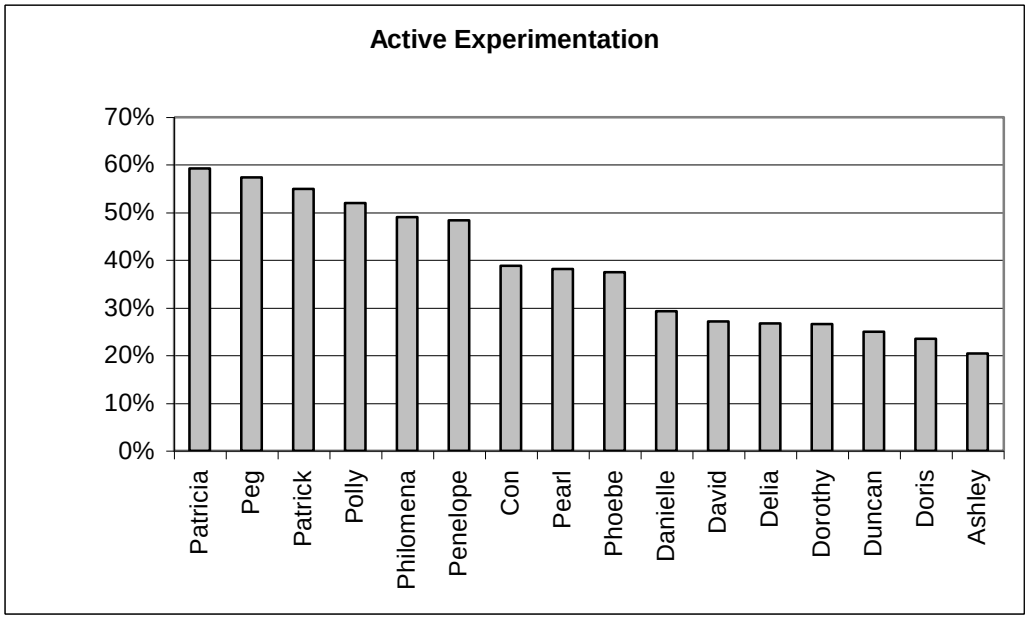

Figure 9: Active Experimentation

Patricia liked to work with people, in *groups* (Patrick, Penelope and Danielle), *discussing browsers and the different difficulties they all encountered*, such as the *hardware and downloading*. And generally Patricia's attitude was *involve me and I will learn*. She *liked to collaborate*, especially in order to achieve a set goal and complete a task. This became evident when, as literacy co-ordinator at her school, she organised spreadsheets to record all the literacy material for all grade levels. In her journal, she wrote:

> *many hands made light work*; *What a team... Look at database* (the material needed for the literacy program) *on cupboard door* and finally when the work was done: *We've*

> *done it again. All staff have their own hard copy and a list is hanging in the storeroom for each grade level.*

Patrick was another participant willing to experiment, learn, and collaborate with others. He was:

> *only new to the technology but* the students he taught *had computers at home,* although at that stage, he *didn't have one* and as far as he was concerned *the good part about all this, was for them to have an opportunity to teach* him *something.*

Patrick *liked to have time to have a go at it, have time to talk about it with a colleague, interact with the person organising or facilitating, or with one another*. And Penelope preferred to *cooperate and discuss the features of PowerPoint that they* (Patrick, Patricia, Danielle and herself) *were not familiar with*, because *she wanted to exchange information about the browsers and problems about connections … meaning the Internet*.

Technology opened up new ways of thinking and approaching learning. These digital immigrant teachers found a new form of collaborative environment to solve immediate concerns. They began to form communities and build knowledge to survive in their new environment (Laferrière 1997). Penelope's experience was similar to the experience of many immigrant as new arrivals who often share and assist each other on their arrival in a foreign country. As Ling (2004, p. 14) states: "survival [for the immigrant] in an alien environment … relies heavily on strategies of mutual aid".

Philomena was similarly taken with the idea of active experimentation. As far as she was concerned *teachers learn best by doing, yes and experimenting*: *I'm happy to give it a try or … to find help if I need to…* The same theme recurred throughout the course and in her second interview; she said that what she liked about the course was:

> *just the hands on experience of doing it and then I need to go home and actually have a practice at home*. She *experimented with PowerPoint: clicking, doing and experimenting*.

Philomena's confidence in her knowledge increased, and her skills developed. She began to email attachments to herself, and she opened up her newly acquired knowledge and skills to others, especially her students: *great excitement today* with *my PowerPoint group – hit the computers!* Philomena continued to write in her journal about her new found enjoyment; about how she actively influenced others by applying her new learning in a practical manner. Of then sharing of this knowledge in her school workplace and in university classroom she wrote - they all *learned how to print the computer screen*! This single activity brought about great excitement for her and she recorded this fact in her journal.

Polly was a participant who felt quite comfortable and well-suited to the unstructured environment found in the facilitative ambience of this university classroom. Her approach was to:

> *just do it that way, check out the real thing and try it yourself and if it doesn't work out the first time, it will the second time*. *It's just time to just sit down and fiddle around and play with it and enjoy it.*

Polly also became involved in group work and shared her knowledge with others. This sharing, and having the opportunity for interaction and dependence on each other, created a sense of community within the university classroom. It allowed the participants to jointly deliberate and collectively pursue their learning. They would *tell each other how to crop and about the different icons*.

Another participant, Phoebe, also actively experimented and *got things done by asking other people*. She displayed an open-minded approach to her learning which she expressed by asking, and by becoming personally involved in this new, present situation. Her journal relates how:

> *I knew I was starting a new school year at the end of January and I knew I had to have some basic knowledge because the children would be using computers in the classroom and so I bought a computer over the Christmas break.*

Peg, who unfortunately did not submit her journal which could have thrown further light on her learning, preferred to experiment, do, reflect, and learn the technical skills as she progressed. Her initial trials and experimentation predictably produced errors. These she contemplated before asking for assistance. She sought the advice of other people – such as the teacher educator – when she *was having difficulties in her school classroom with PowerPoint*. She liked to solve problems and find practical solutions to the technical tasks.

Con was eager to know how a computer program worked. He was pragmatic and actively experimented. He thoroughly enjoyed solving problems, learning the skills, and then passing the information on to his students:

> *I went back and tried it at home… Well, home and school, just to try and develop the skills a little better. So I knew a bit more of what I was doing, so then I could pass onto the children or just for my own benefit, so that I was, I guess, a bit more aware of where and what was happening.*

Con reinforced his own learning and looked for practical and concise ways of attempting a task. As Con and the other participants became more confident with the technology, their observed language changed and began to sound more cryptic:

> *in here, you need to place this section, once you've done that, then return to this part and here you need to copy this line and then go to… Go back and make it attractive…*Con *gives* Doris *directions.*

This became the *common language* among the group and *created a bonding*. Although the language of these new arrivals appeared cryptic, they understood each other and accurately conveyed their messages. (See Glossary for a list of digital terms and their meanings.)

Con organised his knowledge in a hypothetical-deductive manner, focussing on specific problems. He preferred to deal with technical tasks and problems rather than social and interpersonal issues. He displayed a marked tendency to focus on specific tasks and aspects, and to actively experiment with technical tasks. He brought into class new programs for his colleagues to view – *Kahootz* (a Window's PC-based multi-media narrative creation software for children) and the latest version of *Kidpix* (a similar media manipulation program for Macintosh computers). He explained the technical aspects of the programs and talked about the specific tasks of the two programs. Pedagogical issues were not mentioned; only practical concerns were discussed.

During the field observation, Con constantly solved problems and experimented:

> *I picked this up by doing this…and then you do this… by pressing this icon and all I get is this running square, I'm after a box…No, that's just to select, the actual box is further down, here let me show you, he proceeds to show* Doris *who leans over to see it on his computer*.

The same mode pattern of learning occurred for most other participants, the exception being Dorothy who scored a low preference in active experimentation (AE). She was often late for class due to her school workplace commitments. However she was adamant that she *did want to learn about computers* and that this was the *purpose of doing the course*. Initially she said that she *was terrified of* computers. Nonetheless by mid-year, her confidence had increased and in her second interview, she stated that she had *really learned a lot, and one of the things… is that you can play around and not destroy the computer*. This enhanced capability allowed her to experiment, and by the end of the year, although she still *came in late* she could now *muck around with PowerPoint* and other programs.

Ashley scored the lowest active experimentation (AE) score in the group of participants. He was not confident about his ability to learn ICT. However, a change occurred in his life during the course when he obtained a permanent teaching position. This led to a new attitude and his approach to learning became more positive. He started to experiment and do things; he obtained

a laptop and, like many of the other participants, bought himself a USB memory stick. He even e*xplained and showed another participant the process of setting up the memory stick if the technology did not take it*. He did so utilising the common language the group was discovering and developing: *take yourself to Windows…* etc.

During the latter part of the year, when Ashley gained his permanent teaching position – *a prep class for the remainder of the year* – he cheerfully, and quite seriously felt confident enough to decide that for these five and six-year-old digital natives that *their computer experience is limited*. His experiences within the university classroom increased his confidence and he started to evoke a positive attitude. Ashley became more interested in, and excited by, experimenting with the technology rather than just theorising about possibilities in regard to its mechanics, but he, too, was not obviously concerned with the pedagogical theory in relation to learning. He became active in the online discussion and the following appeared on the bulletin board: *Hey, I think I've actually done it right... we'll see. An interesting site to have a play with- www.pets.info.vic.gov.au, I hope this message gets through*.

A notable feature of the university classroom environment of this study was the degree to which interaction allowed team building and collaboration. Kolb refers to this interaction as "team learning, [which is] the process by which teams gain clarity about purpose, develop good working relationships, and effectively accomplish their goals. It involves valuing individual differences, learning how to focus on a common purpose, and sharing responsibility for getting work done" (Kolb et al. 2004, p. 1). Doris observed and worked with Duncan, Dorothy, and Con. And in her case, Doris felt that she:

> *always just* found *a little group work was better, because you sort of… bounce* [ideas] *off each other… Cooperative learning, it's very good, because I do think you open up a bit more, and brainstorm…*

For many of the participants, experimenting with and within the new environment of ICT assisted them in identifying their own needs with regard to ICT learning. Many of the

participants echoed Peg, who said in her second interview that, *as far as she was concerned, teachers learn best: just by doing. Yeah, just by doing*. These experienced teachers were like many new arrivals who explore and experiment with different aspects of their new environment. For example, new immigrants may buy new types of food and try to cook it, but they cook the food using styles they know from their former home: mixing "leftover macaroni with vegetables and fragrant garam masala" (Giri 2002, p. 1), as it were. These digital immigrant teachers experimented in an analogous manner; they used Microsoft PowerPoint to organise presentations. These presentations were in the traditional linear text format, and did not utilise the program's inbuilt dynamic organisation which would allow them to organise information and connections through hypertextual links to other documents and tasks. However they were indeed *experimenting* and *doing*, and developed a pragmatic approach to their immediate classroom needs. This experimentation gave meaning to the different concrete experiences that they were encountering in the information age.

2. Concrete Experience (CE)

The participants focussed on the concrete experience (CE) of their ICT learning; on their perceptions of the doing, and the dealing with immediate concrete situations and experiences required meeting their immediate individual needs. Their survival in this new milieu depended on their focussing and dealing with the immediate situation. All had enrolled in this course primarily *to get* their *fourth year* qualification or to enhance their existing qualifications.

The data indicated that the majority of the participants learned through concrete experience as shown in Figure 10. The notable exception to this was Ashley whose display of learning via concrete experience was significantly less significant that that of his classmates. This seeming aberration will be discussed.

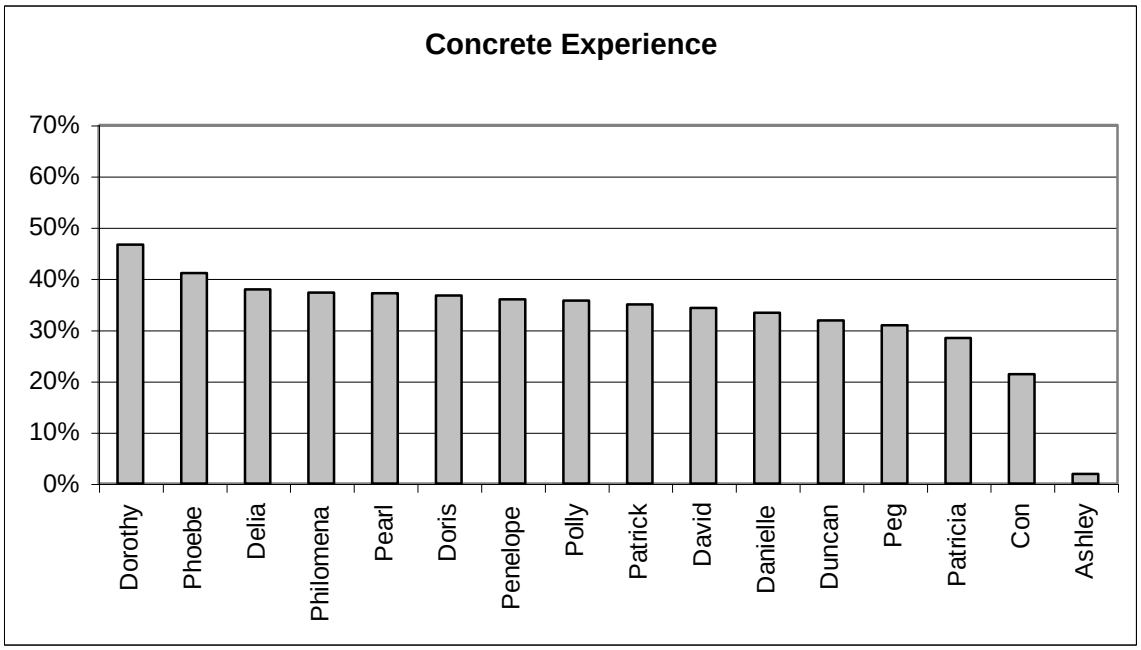

Figure 10: Concrete Experience

According to the data in the study depicted in figure 10 Dorothy, Phoebe and Delia focussed on being involved in the experience of learning the new technology. Delia related her concrete experience to immediate and real situations, and as far as she was concerned:

> *I've achieved a lot. A great deal. Just in my confidence to have a go at things. I couldn't use a digital camera and now I can. I've gone out and bought myself one, and I've played at home, mucked around and things. I'm even starting to take little video snapshots*.

The teacher educator encouraged the participants to approach learning in a non-directive manner and to become involved with the learning of their classmates, so that, as he said:

> *they can go 'oh'* [with pleasant surprise]*... then they all see such a great quality of work by sharing ...it just puts a bit of pressure on them to get thinking to get ideas, because they are doing things all the time…*

With this attitude the teacher educator encouraged the participants to become interested in learning from specific experiences and immediate situations that did not necessarily need to be structured. The whole experience in this class tended towards concrete learning and 'just in

time' learning to meet their particular needs: doing maths sheets in Microsoft Excel and then sharing the production. They began to feel proud of their achievements and this in turn allowed the participants to warm to the idea of sharing, and the activities this sharing entailed further extended their learning in this relatively unstructured university learning environment. For example, Patricia shared her immediate experiences by writing on the class bulletin board:

> *Subject An inspiring teacher*
>
> *I was at a conference in Ballarat and met an inspiring teacher who has done amazing things with computers and the internet. She works on the global classroom ideology. Have a look at her school's website www.araratacc.vic.edu.au especially the global classrooms.*

Patricia found this practical and concrete work fascinating and, as her confidence and skills improved, she made decisions and changed her own working environment; *look at database on cupboard …* meaning that the staff could access a printed spreadsheet which was also available electronically. Patricia engaged others in her learning and in the changed situation: *we've done it again.* She was also most adamant that she would continually be *on the computer now… and have everyone involved in the experience*. Her emphasis was on community collaboration and interaction. In her own school, she gathered other staff members together and involved them in her present learning context. She preferred to be actively involved and experimenting with concrete experiences.

Other participants who grouped together included Penelope and Danielle. They worked at the same school and in the university classroom they sat together. They interacted and collaborated with each other, discussing the computer program icons and *how to do* the given activities. As a result of their successful completion of this course, they received leadership roles in their workplace, Penelope becoming the IT Coordinator and Danielle the Early Years Coordinator, where she introduced ICT into her immediate workplace environment. Penelope was aware of her preference for learning through concrete experience and experimentation, by:

> *trial and error, yeah, just listening, watching, following through the steps that were presented to us. Trying to understand, and again have the ability to go back and do it for myself* [and] *I think we all just learn by doing really*.

Dorothy scored the highest level of concrete experience (CE) within the participating group. On her arrival at class, she first observed and focussed on the immediate situation, simply watching and relating to other participants who were on time for class. She did comment that *if I'm watching and don't get it, I talk to someone next to me or someone on the other side… they show us and that's how we do it*. Dorothy's learning was importantly influenced by her relationships with the other participants, and with the teacher educator whom she mentioned in her second interview, because *every time I'm here,* he *introduces me to something new and says try this and try that and do this*. Where previously she had *never tried to do* any of these things with technology before, here someone kept encouraging her to attempt new experiences and she was rewarded by the outcomes.

As noted previously, Ashley was exceptional in that he was not interested in the concrete experience. Initially he appeared to be rather frustrated. One evening, as he was leaving class, he turned to the researcher and said:

> *I come to class all excited, waiting and wanting to learn something but by the end I'm often frustrated, although by nature I'm a patient and thoughtful person.* [The researcher made note that] *The frustration on his face makes it evident that he feels that he hasn't learned anything in this class…*

He did not feel that he could relate to the classroom experience in which he found himself. However by the third interview at the course's end, Ashley's confidence had risen and he concluded that it's all *just practice… and just keep on going with it … just doing things* and *feeling your way around things*.

The majority of participants functioned well in the unstructured environment and brought an open-minded approach to this university experience. They willingly shared and reflected upon their different experiences and observations.

3. Reflective Observation (RO)

A majority of participants – the exceptions being Penelope and Philomena – preferred reflective observation (RO) as their third mode of learning. Penelope and Philomena were less reflective about their observations and they were very interested in the technical aspects of the technology when compared to the other participants (Figure 11).

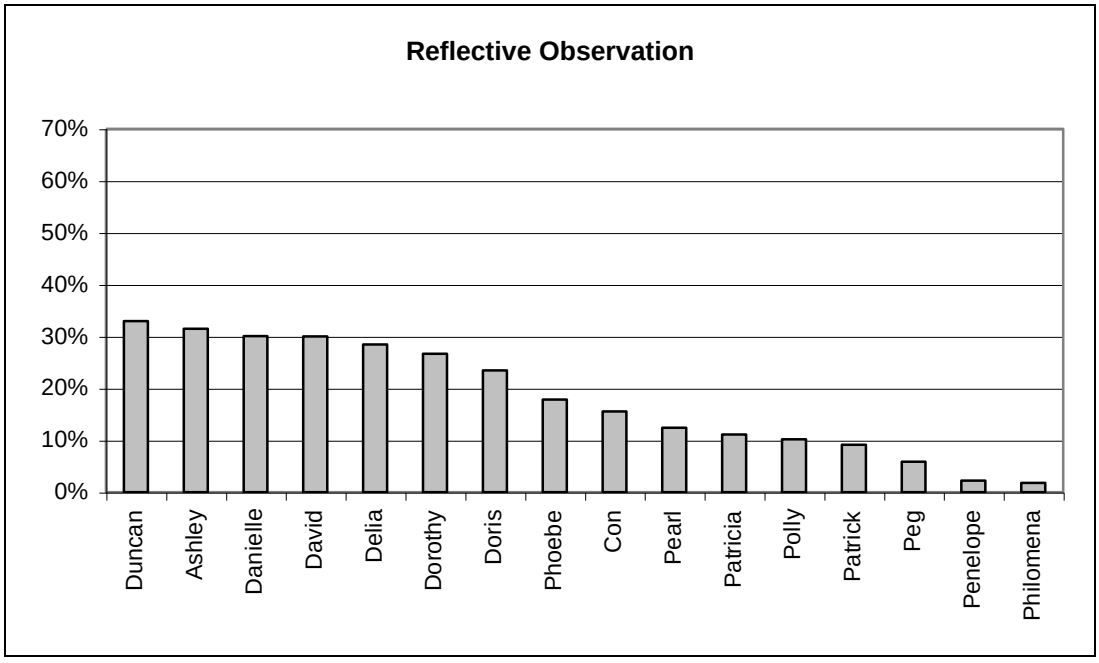

Figure 11: Reflective Observation

The majority of participants attempted to come to an understanding of the ICT environment by observing and by listening to the discussions taking place around them. They also reflected on and wrote about their experiences in their journals. The noteworthy participants in this study were Dorothy and Doris who scored the same percentages for their active experimentation (AE) and reflective observation (RO) modes. They were intense observers, reflecting on the knowledge and skills that they observed the other participants exhibiting, and then when their

confidence rose they too experimented with the software. Duncan was another participant who actively *observed, took notes and reflected* about, for example, *the zipping* but also *the unzipping* [of compressed files]. Finally, he also concluded that *it's just practice and seeing what others are doing*.

Danielle and David also observed the other participants and their work. David began by observing and reflecting, and in his journal he wrote that *part of* his *delay in writing up his diary was his school placement;* as he was *trying to find a school placement*. Regardless of his obstacle, he was continually contributing to the bulletin board and sharing his ideas:

> *I am currently running a few ideas through my mind. I have put these thoughts down on the attached document. Please feel free to read it if you have the time. I believe I will have a concrete idea once I have started my school placement in the not too distant future.*

David's approach changed once he was able to access a school classroom and he became more involved in his university work. He felt that he was now part of the culture and could validly participate in the new environment.

Other participants wrote on the Bulletin Board about their ideas concerning the practical aspects of technology. Peg, Penelope and Philomena scored a low level of reflective observation (RO) and definitely preferred to *do* the activities rather than *observe and think* about them; to the extent that even while *the lecturer explained about the extra features of WORD,* Peg simultaneously *clicked and experimented; she tried to find her own way around the different buttons and screens.*

In the reflective observation (RO) mode, the participants observed and described their observations. Duncan, Ashley, Danielle, David, Delia, and Dorothy preferred to think, reflect, and brainstorm about ideas and situations that related to the technology. They examined ICT situations from many points of view, trying to understand the situation presented. Many of the participants worked in groups, brainstormed, and together reflected on the workings of the

technology. This was especially so for Patrick, Patricia, Delia, Pearl, and Danielle. They formed their own group and remained together in that familiar group, enclaved in a similar cultural background throughout their ICT learning journey. In their school workplace, they would gather together at lunchtime to discuss what they had learned in their university classroom. Patricia commented in her journal that at her school, in which Patrick, Pearl, and Delia also worked, that they used these times *to share what they had learned in the university classroom*. They showed each other *the different features of the program*. Patrick often commented that as a group, they collaborated and *bounced ideas off each other*. In her second interview, Pearl commented that the group had *just been terrific support*, *cooperating*, *discussing* new programs and hardware, consulting and working together. Pearl and Delia *sat down and worked out a few details to their project*.

Phoebe, although she obtained a medium score for her reflective observation (RO), reflected in a different manner to the other participants and, as she said in her second interview, preferred to listen and take notes because:

> *usually I can't take notes and do what is being asked of me at the same time. Normally if I take the notes and do it, then I have something to look back on if I do a step wrong. If I'm busy taking notes, I can't do it at the same time. So that's what I'm having trouble with: doing both.*

And so, Phoebe often just listened, observed, and reflected in the university classroom. The other participants often brainstormed together, thought deductively through the different problems relating to the technical tasks deductively, and then attempted to conceptualise and think through the abstract concepts relating to the given ICT tasks.

4. Abstract Conceptualisation (AC)

In this study, abstract conceptualisation (AC) was related solely to the mechanical and technical issues of the ICT learning environment. It was not applied to the pedagogical issues that usually

inform the learning process in a learning and teaching environment, and which the Kolbian descriptors detailed previously intimated should be the outcome (Figure 12).

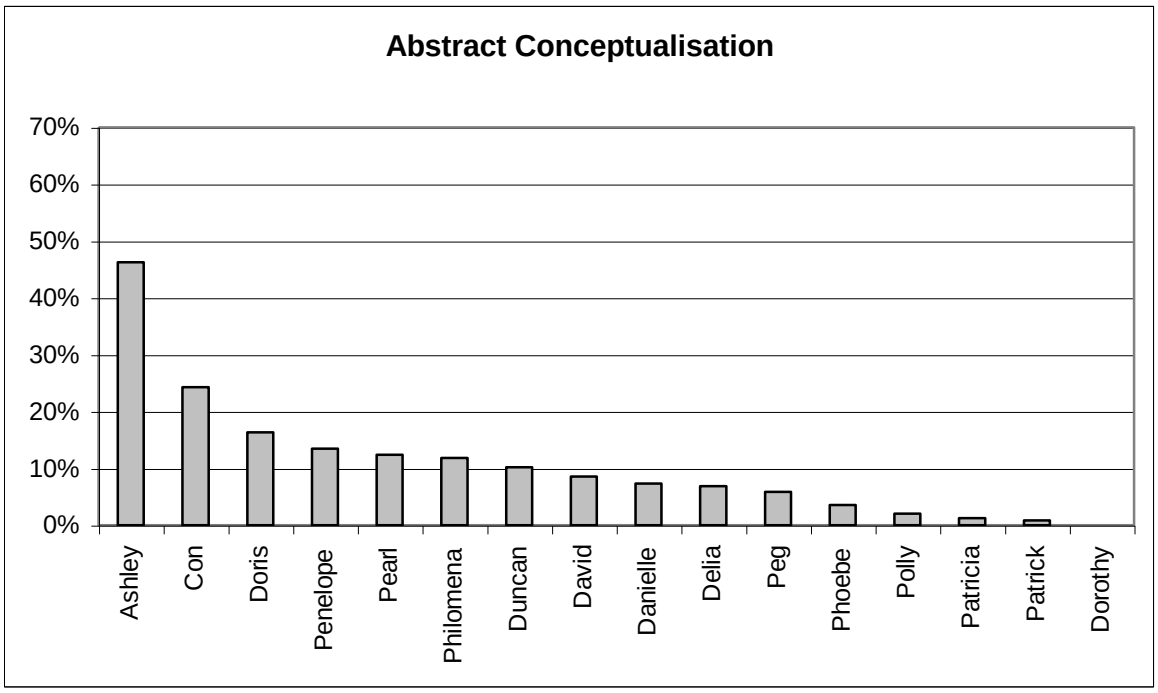

Figure 12: Abstract Conceptualisation

Of all the participants Con and Ashley (Figure 12) pondered the most how they could use the mechanics of the software and they were the greatest users of abstract conceptualisation (AC) mode of learning in relation to the technical and systematic approach to ICT use. Despite their thoughtful engagement in the course, neither Con nor Ashley sought to explore the pedagogical implications of ICT.

Con, as the IT Co-ordinator at his school, was more interested in the use of the technology than the pedagogical issues relating to the technology. He had immediate technical issues that needed to be solved before he re-entered his school workplace. During assessment week at his school, one of his colleagues was having trouble with Microsoft Excel and Con approached the researcher during a coffee break to ask about the movement of data within the application. After the coffee break, the researcher and Con returned to his computer to solve the immediate technical problem. During the problem solving session, Con theorised about possible solutions

to the technical problem in a systematic way. However he did not make any references to the pedagogical issues involved in setting up the assessment methods.

Ashley used abstract conceptualisation (AC) relatively more often than his other modes of learning (Figure 12). He tended to theorise extensively about technological issues but like Con – and indeed the rest of the participant group – not about pedagogical issues. He was less inclined to participate in group discussions and work with the other participants. His interests lay in systematic and planned learning; a learning process in which he could:

> *write* everything *down as soon as I can, with arrows, little pictures, step-by-step diagrams I guess, that's my way of trying to pick things up, to take as many notes as possible. Rather than actually doing it in class, I was pretty much writing anything in the book.*

Ashley interacted less with the other participants and was more concerned with ideas and abstract concepts relating to the technology. He approached knowledge and skill acquisition logically and sequentially using graphs, diagrams, and systematic methods to master the new environments. Ashley enjoyed the systematic planning, manipulation of abstract symbols, and quantitative analysis: *a little bit of browsing to see where, what I can teach, forward planning.* He wanted to overcome his lack of knowledge and skills, and he wanted to become empowered in his new environment.

Ashley commented that his students seemed *forever to know something new*. He felt that his immigration process was still at the survival stage and all he could do was ponder about possible projects – listening and reflecting whilst others around him were doing. In comparison to the other participants, Ashley thought, reflected and looked for precision and sequential methods of approaching any project before he attempted to actually approach the task at hand: *as a rule, I write things down, step-by-step and then have a go at home*.

And unlike other participants, he wrote in his journal about the readings that the lecturer prescribed:

> *Jamie McKenzie (author of an article) thinks that there is too much 'wow' factor rather than content on what has been learned in most PowerPoint presentations. He says that there should be 80% research and 20% presentation.*

Of all the participants Ashley seemed most concerned about the readings and he was willing to discuss this particular reading. However, he seemed to be a 'lone ranger' (Douglas 1976) in this activity. His main concerns were with the building of general theories of technology use; thinking about the technology and how to use it, rather than attempting to understanding unique, specific areas of study. He preferred the mathematical study areas and leaned towards a scientific approach as opposed to a more creative, artistic approach to problems*: I will do something linking the use of computers in the classroom with the teaching of mathematics and/or the literacy program*.

He grew to understand the meaning of ideas and situations by carefully *listening, reflecting patiently and observing*. He established his knowledge base, gained understanding of the ideas behind the activity, and only then experimented and interacted with others:

> *we're not supposed to be there, but we can do this, I've done this before…* he explains how he has set up homepages without templates and then says *you've got better control this way.*

Ashley learned through gaining an understanding of the different process and techniques involved in ICT. He conceptualised the processes through the different models that he created for himself through his *planning and writing in his book*, rather than by actively experimenting like the other participants. As he became more familiar with ICT, he *obtained his own laptop and USB stick* and *explained to the others how to install the software*. The more technical aspects did not dissuade him from using the technology.

Con saw his own learning process as involving the solving of problems with regard to his work as IT Co-ordinator at his school – in particular, solving technical problems – having time to contemplate, and obtaining a deeper understanding of a particular software program. He said:

> *a possibility for a project* (his action learning project) *could be the Grade Six magazine. It would involve all sorts of information technology, publishing aspects, before, after and during the process. It serves a purpose, is relevant and the children and I will be learning something…. Last year while working with the Grade Six students they produced a high quality magazine. This magazine involved the use of Information Technology through, word-processing, digital camera, scanners, printing, networking and installation of software. I desperately want* to solve this problem; *therefore I'm sticking with my original idea of the Grade Six Magazine. I feel this will enable me to learn stuff here and then teach the children various skills such as, Digital Camera, Scanner, Word, Adobe Conversion, Photo Shop and possibly placing the Magazine on the school WebPages. All this will keep the children and I, very active...*

Like Con, Penelope and Philomena often focussed on the technology. Philomena's interest during first semester was the digital camera: she could use it in the library with the different classes that came to the library. As she became more competent in using technology, she developed a systematic approach to her learning. She stated that she took *notes so I'd remember what I was doing* and *what* the teacher educator *said*. Learning, for her, had to have systematic processes with explanation and so her inclination was to use the teacher educator as a reference point rather than experimenting and discussing in collaboration with the other participants. The lecturer would talk her through the activities as she wrote down all his instructions systematically and asked: *do I put it here*. She was often observed asking for directions and reinforcement.

Con, Philomena, Doris, Penelope, and Pearl would often *start discussions with colleagues about the knowledge of the programs* and they showed a higher abstract conceptualisation (AC) level with regard to the technology in comparison to the other participants.

Penelope was a surprise with her abstract conceptualisation (AC) level, especially as in class she often claimed that she learned *best by doing and* that *everything*:

> *has to be hands on … To be honest, I'm not one to come home and read things from front to back cover… Unless I'm doing and playing,… I'm not a teacher who will stand at the front and dictate, I have to be hands on; colouring and down on the floor with them. I'm a hands on person, but that's just my personality*.

As far as Penelope was concerned, she learned by experience with practical approaches and application to her given tasks; she felt that she *never really learned by reading* about the task. She saw herself as a practical person who learned *by doing* and not having had to read about an activity followed by *great discussions* about the possibilities of the task.

In Penelope's school workplace, ICT was being introduced in an ad hoc manner. Penelope, at the end of the year, began to think of ways to introduce ICT in a more systematic manner. She was going to write some procedures that *could be useful* to the staff. This experienced teacher, who claimed to gain little from reading was even planning to *put together a book on how to use PowerPoint and other things*. Obviously, the university ICT classroom environment suited her personality; she was interested in the technological issues but baulked, like the other participants, at any examination of the pedagogical implications of her learning. A full transformation into a digital citizen teacher with understanding of pedagogical issues was at this stage of minor significance to her. She wanted to *survive this year and this course*, so that she *could get* her *fourth year*. She attained her goal and at the end of year, because she had completed the course and knew more than the other teachers at her school workplace, she even became the school's IT Coordinator.

Penelope had great plans for her school workplace: *I'll write a technology book for all the grades and set out what they need to know by the end of the year*. She was concerned about the technical aspects in regard to ICT; about 'what' the children should know, rather than 'how' that knowledge should be transmitted. She began to systematically plan for her new job as IT

Coordinator and began to manipulate different ideas to form a neat conceptual system for others in her school. She became interested in different standards and when she asked *where do you get some idea about standards, she was shown the standards on the web.*

In regard to abstract conceptualisation (AC), these participants were concerned with the mechanics of the technology. The pedagogical issues of ICT learning did not materialise. In effect, they had arrived in the foreign country of ICT learning and their goal was to survive attain their digital residency through completing this course. That more extensive, deeper knowledge and understanding of the ICT teaching and learning process that would constitute digital citizenship remained an elusive goal.

Summation of the Modes of Learning

The researcher observed that most teachers preferred to use active experimentation with the technology, like new arrivals in a foreign country they were enclaved in cultural groups, in which they *bounced their ideas and thoughts off each other*. Like new arrivals in a new land they collaborated and developed strategies to help each other (Benyei 1961) in their learning of ICT. Their experience was concrete, reflective and active; however their abstract conceptualisation was directed towards the technical use of ICT. The pedagogical implications of ICT were of no significance to these digital immigrant teachers.

Kolb's (1984) processes of learning suggest that an individual touches all four modes of learning. The participants "touched all bases", however their preference was for three modes of learning. All participants preferred to use active experimentation (AE), though not to the same extent. Fifteen participants preferred to use concrete experience (CE), the exception being Ashley (he, like the other participants, utilised reflective observation (RO). A noteworthy factor occurred in this research. Four participants preferred to use abstract conceptualisation (AC) with greater emphasis on technical tasks as the course progressed, however their conceptualisation focussed not on their professional skills as teachers, but rather on their immediate roles as learners of ICT.

Over the year, these pragmatic people concentrated on the practical aspects of ICT. However, the research data showed that the learning processes were different in comparison to traditional didactic, lecturer-led courses. The data indicated that change was evident and teachers were learning in a different environment to the one that they remembered from their undergraduate studies; an environment which encouraged discussion and collaborative learning.

Significantly, the data indicated that the participants showed a definite three-stage pattern to their learning: they moved from learning how to push the buttons (P) on the computers they now found before them, to thinking of how to apply software(A) to their professional practice, before displaying a willingness to change their practice (C) by employing ICT. Figure 13 displays the consistent utilisation of the modes of learning as the teachers progressed through the P A and C of the ICT learning process.

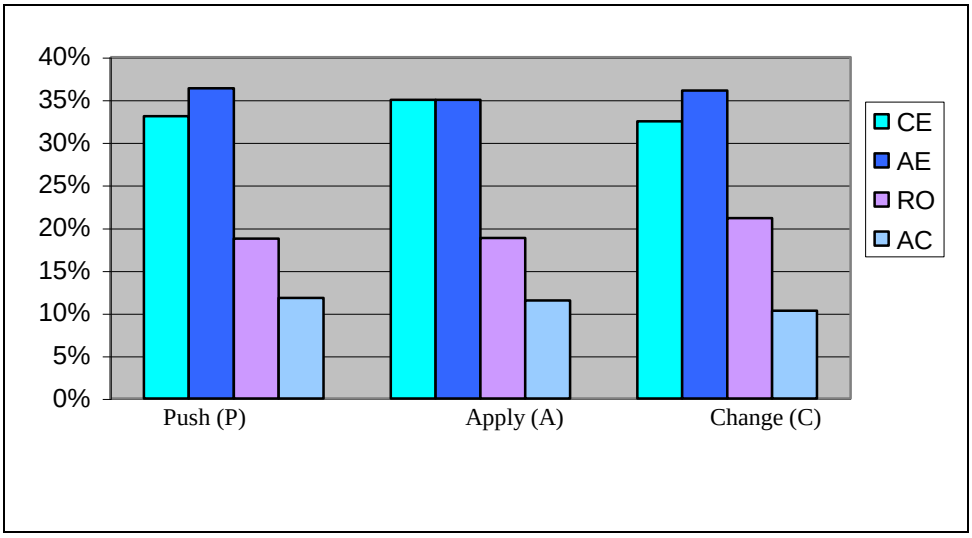

Figure 13: Summation of the Modes of Learning in PAC

Learning How to Push Buttons (P)

At this stage of their learning the participants were mainly interested in concrete experience and experimentation with the new buttons they encountered (Figure 13). For example, Dorothy came into class and asked another participant: *where's the on button?* Discussion often centred on the software buttons/icons used to operate the different software programs. They apprehensively *played and toyed* with the technology. They *were excited* when they *could do an*

activity that the teacher educator set. The concrete educational experience as defined by the teacher educator played a significant part in the teachers' learning because it related to their immediate needs. The teacher learners and the teacher educator often negotiated activities that could be applicable to the participants' classroom *the next day*. They were also willing to experiment with the buttons and *show each other … what the buttons do*.

Learning How to Apply the Software (A)

The teachers were still experimenting through concrete experience (Figure 13). However, their reflection shifted to the different software packages they were presented with as well as to the application of the software to their existing practices. Delia and Pearl developed a PowerPoint presentation for their school's Multicultural Week. They *thought through the steps on how to utilise the technology to enhance* their *presentation*. There *certainly* was *a lot of doing, interaction and talking with* Patrick, Patricia, Penelope, and Danielle in the university classroom *about this PowerPoint … What* they *noted was that previously* they *would have got* their *students to do posters and things like that …whereas, now, this PowerPoint has got some potential* as Delia commented to Patrick.

Midway through the course saw an increase in the level of the participants' examination of the different concrete experiences, and reflective observation about these experiences, in regard to the applications' and for their respective classrooms. They began to brainstorm and exchange ideas within the university classroom about what they were doing in their own workplace classrooms. They began to comprehend the basic aspects of different software and its applicability to their own learning.

Learning How to Change Practice (C)

The participants began to change their established practices by introducing ICT into their workplace classrooms and their home lives. For example, Phoebe and other teachers introduced PowerPoint to collate their own work and their students' work into e-portfolios, rather than maintain their previous practice of *collating all the students' work in scrapbooks*.

Active experimentation rose slightly at this stage as they began to apply ICT to their practice. Now they were experimenting to change their practice (Figure 13) and reflecting on how to use the technology to change practice. The participants now had a greater understanding of the technology and its function and applicability. They were working on their action research projects, their e-portfolios, and finalising their assigned homepages. They were also identifying their achievements, but were still not analysing or testing to check the validity of their concrete experience based on pedagogical theories. They were assimilating the technology into current practice but without referring to any pedagogical theory (Loughran 2006).

Contextualising Learning and Culture Change

It is critically important to mention that the participants did indeed learn how to use technology in their practices; and within the year of this study. However they did not reach a stage of abstract conceptualisation in which they discussed pedagogy in relation to the ICT learning environment. They did inhabit the digital world alongside other digital immigrants and digital natives (Prensky 2001a). They became capable of discussing and reflecting about the mechanics of ICT; they could buy their *USB sticks and other equipment*. Philomena pointed out towards the end of the year that she could now go shopping without her children and that she found *interesting sites on the Internet, especially the Sun-Herald site which she showed others in the library.*

The change encompassed their new propensity to work in collaboration with their colleagues. They observed each other's work and reflected on the different ICT situations they encountered. The traditional didactic lecture methods had been replaced by learning groups that interacted and collaborated, and with the participants' own active experimentation in the concrete world of technology. They achieved residency in the digital world and lost their mechaphobia (Breck 2002), even if their limited depth of pedagogical understanding made digital citizenship a goal still to be attained.

By the end of the year they had purchased technological tools in order to enhance their work and to further experiment and reflect on the ICT possibilities. They updated their storage devices – from antiquated 3½ inch floppy disks to higher capacity USB stick; a significant displaying of their need to store and retrieve vastly greater amounts of information. Their purchasing of USB sticks can be regarded as a proxy for the amount of information they had learned. They were now 'pushing the right buttons' with regard to the technical aspects of learning and the technology was being applied to their established routines of classroom practice. And they reflected on the application of this technology, that is, on how to compile the different classroom activities and organise their actions and observations utilising such technologies.

The transformation of their learning, as for many adult learners (Knowles 1998), occurred because it led to the attainment of a personal goal. They had concluded that *technology is important* and that they needed to be empowered. This sense of pending empowerment was echoed in many teachers' interviews: *I want to get my fourth year … I want to use this* (ICT) *stuff*. At the end of the course, the empowerment and transformation could be seen in their confident active experimentation and reflection on their concrete experiences. Now, they could *talk to the IT person* at their school and they could *talk to their children.* However, as Peg pointed out, the children *are secretive about* this world and the digital immigrants saw that they were not being fully accepted into the digital world by the digital natives. However within their own community, they were as Negroponte (1995) terms it 'being digital'. That is, they were beginning to understand the mysteries of digital technologies and using them with 'hands-on' activities. The data showed a practical experiential approach to their learning.

The learning processes and modes of learning indicate that, although the teachers experimented and reflected on their experience, the learning process itself may take longer than one year. For the teachers to abstractly conceptualise technology and discuss pedagogical issues relating to ICT will only be possible for some digital immigrant teachers given time, and may not necessarily be possible for all. When attempting to understand how teachers learn, it is

important to recognise and understand the learning process, and how they can be empowered through their learning and consequently begin to take responsibility (Eickmann, Kolb and Kolb 2002) for the construction of their own learning and knowledge development in a concrete situation.

Kolb (1984) indicates that learning in concrete experience and active experimentation modes requires *doing* and often falls within the realm of immediacy, whereas abstract conceptualisation tends to be extended and requires a greater amount of time. Although, this study took place over one year, abstract conceptualisation was minimal and limited to technical aspects of knowledge acquisition in this ICT learning environment. The digital immigrant teachers of the study were not theorising based on their new experiences, nor were they asking: what is the significance of the doing and observing in my practice?

Conclusion

This chapter presents the findings of the study utilising Kolb's (1984) modes of learning. The four modes of learning were identified with selections from the fieldwork: participant observations, interviews, and participant documentation. The selections were used to identify the breadth and depth of each learning mode, and to capture their meaning. The researcher paid particular attention to the descriptors of each mode in relation to their applicability in the ICT environment. The descriptors were developed based on Kolb' categories (1971) and allowed a categorisation of all the observations.

These descriptors identified each mode of learning in terms of the learning process that the participants' employed to achieve their aims and goals in attaining ICT knowledge and skills. On the basis of the modes of learning, the descriptors assist the analysis and provide a collective conceptualisation by identifying the learning process of each participant. Kolb's descriptors, as applied in this study, enable a valuing and analysis of the data of the learning of the participants. This research was formed on the "basis [of] applications of experiential learning to education,

work, and adult development" (Kolb 1984, p. xi), which could be applicable to the ICT university classroom.

The learning and modes of learning, indicate that although the participants experimented and reflected on the experience, the ICT learning process can be expected to take longer than one year. And for the participants to abstractly conceptualise the technology and discuss pedagogical issues relating to ICT will only be possible with time for some participants and not necessarily be possible for all participants.

The participants touched all bases of Kolb's modes of learning although they preferred three modes of learning and did not learn ICT according to Kolb's accommodative learning style. They increased their knowledge about ICT learning and teaching by active experimentation (AE) and reflective observation (RO) on the concrete experience (CE) and through their action research projects. They used abstract conceptualisation in regard to only the technical aspects of ICT. They learned how to push buttons (P), how to apply software (A) and how to change their practice (C). They started to think about their concrete experience and how to apply technology through the established routines of their classroom practices. Their immigration experience in the year had allowed them to inhabit and survive in the digital world.

Besides experimenting with and reflecting about learning and teaching ICT, these experienced teachers with limited ICT exposure attempting to learn for the information age valued certain abilities as they immigrated to the twenty-first century and the digital world. The following chapter discusses the patterns of multiple intelligences as abilities which these digital immigrant teachers employed in their efforts to gain knowledge and skills in ICT.

Chapter Five - Survival Abilities and Approaches

Introduction

The previous chapter focussed on the modes and processes of learning in relation to the practical orientation of immigration by experienced teachers to the information age. The process of how teachers with limited ICT exposure learn practically was interpreted using Kolb's (1984) theory of experiential learning. The previous chapter contended that active experimentation on concrete experience and the reflective observation of activities and work were the principal learning modes for the participants of this study. It declared that the digital immigrant teachers' learning consisted of three modes: concrete experience (CE), reflective observation (RO) and active experimentation (AE). The chapter disclosed the stability in the general learning approach adapted by the teachers, while at the same time it showed that there was change in practice and language used in the learning process and orientation.

Chapter Five assesses the observation of the teachers' abilities and approaches through participant observation method within a qualitative methodology. The observation and description contribute to understanding the new and challenging cultural environment of the participants. It uses the concepts and descriptions of Gardner's (1983) multiple intelligences as a framework. Gardner's (2003, p. 4) concepts are based on "learning about human abilities" which he reframed into intelligences. The importance of these intelligences is Gardner's claim for their universality in application to learning: everyone can learn and they learn in many and diverse ways. People approach learning in their personal way to survive and thrive in a particular culture.

In this study, experienced teachers participated in a formal professional development program over one academic year. The study supports Gardner's claim that learners perceive, reflect, store, and organise information in diverse ways. The study indicates that the participants valued the learning of ICT in diverse ways. They also valued certain abilities more than others in their

survival and transition as digital immigrants attempting to function in the ICT culture of the twenty-first century. This chapter describes the diverse ways of learning, and the abilities that these experienced teachers displayed in their ICT acquisition. The form of learning they undertook was unfamiliar to them from their previous university classroom learning environments.

Within the university classroom context of this study – an environment qualitatively different from the traditional teacher educator-led course – participants were required to solve a number of problems in this new culture of the twenty-first century and from the perspective of diverse environments. The teachers desired and required their fourth year teacher qualification and had applied to enter this course which framed their acquisition of ICT competence using action research strategy. These participants used action research in their classrooms similar to what McNiff et al. (1996) point out where action research processes allow participants to plan and design learning practically, and to seek further explanation for their real life thinking and acting within the socio-cultural context. Furthermore, Phelps (2003) states that the participants' action research projects need to be relevant, applicable and practical in their own classrooms. As a consequence, teachers began to resolve their qualification problem and simultaneously, through action research, which was relevant to their classroom situations, began their ICT learning journey. In the journey towards digital residency and citizenship, they employed certain abilities that became valuable for them in solving learning problems about ICT.

Intelligences as Abilities

Gardner (1983) refers to intelligences as abilities: abilities to solve the problems one encounters in life; abilities to generate new problems to solve; and abilities to make a valuable contribution within one's culture. He further relates intelligences to the ways in which particular cultures value individuals and the ways that individuals create different products or serve their cultures in various capacities. Gardner's method explores how individuals function and how they develop different competencies (Silver et al. 2000; Gardner 1983) within a culture.

According to the multiple intelligences theory, “these intelligences constitute the ways in which individuals learn, take in information, retain and manipulate that information and demonstrate their understanding (misunderstanding) to themselves and others” (Veenema and Gardner 1996, p. 70). Gardner (1993, p. xxiii) stipulates that “there exists a multitude of intelligences” and all human beings possess these intelligences. Certain intelligences are associated with schooling (verbal and logical), the arts (kinesthetic, musical and spatial), and with personal (intrapersonal and interpersonal) abilities. Not all intelligences appear simultaneously, however when they do appear they help in understanding how learners are most likely to learn.

Gardner’s (1983) model divides the multiple intelligences into seven distinct categories. In this research, descriptors and descriptions were used to develop an understanding of the multiple ways teachers learn. The following table (Figure 14) names the multiple intelligences, used in this study, with the respective descriptors and descriptions employed (Hoerr 2000):

Intelligence	**Descriptors**	**Descriptions**
Verbal	Words	People with linguistic intelligence have a sensitivity to the meaning of words and are proficient in conveying information. They have the ability to use with clarity the core operations of language.
Logical	Numbers/ logic	The ability to handle chains of reasoning and recognise patterns and orders. The ability to use activities that involve abstract symbols/formulas and outlines. They see numeric sequences and like calculation. They are good at deciphering codes and problem solving.
Kinesthetic	physical experience	The ability to use the body skilfully and handle objects adroitly. Use activities that involve the body or parts of the body.
Visual	Pictures	The ability to perceive the world accurately and try to re-create or transform aspects of that world. They use activities that involve art, pictures, sculpture, drawings, doodling, mind mapping, patterns/designs, colour schemes, active imagination, imagery, block building.
Interpersonal	People	The ability to understand people and relationships. Learners think by bouncing ideas off each other. They use activities that involve group projects, division of labour, sensing others' motives, receiving/giving feedback, and collaboration skills.
Intrapersonal	self-reflective	The ability to access one's emotional life as a means to understand oneself and others. Individuals who exhibit this intelligence have an accurate view of themselves. They use activities that involve emotional processing, silent reflective methods, thinking strategies, concentration skills, higher order reasoning, "centering" practices and meta-cognitive techniques.

Figure 14: A Short Description of Gardner’s (1983) Multiple Intelligences

The sequence of intelligences has importance for Gardner. He begins his list of intelligences with logical and verbal intelligences because they "are particularly important in the kinds of schools that we have today — ones that feature listening to lectures, reading, writing and calculating" (Gardner 2004, p. 31). With traditional methods of learning from the time of Aristotle up to our own classrooms, these two intelligences have been, and continue to be, highly respected. Students are considered successful if they are articulate and can persuade their audiences to think in particular frames of mind (Gardner 1983).

However, several multiple intelligences are valued above others in the solving of challenges within a technological learning context. The several intelligences employed for the ascendance into the ICT educational culture are logical, intrapersonal, and kinesthetic intelligences (Gardner 1999). They mark a shift from the traditional intelligences for schooling and permit individualised education with "active hands-on learning" and "explicit step-by-step thinking" for students of the future (Gardner 1999, pp. 44-43). In this study, the challenge was to observe and understand whether experienced teachers solved their ICT learning according to Gardner's diagnosis of this shift from the intelligences used in traditional educational settings.

Teachers' Abilities

During this study, raw data concerning the teachers' abilities were collected as they learned about the mechanics of ICT. Like the learning processes (Chapter 4), the ability frequencies were converted into percentages and a pattern developed (Figure 15). Although there were variables within each participant's individual ability use, the same patterns of survival occurred as with economic immigrants, who associate with each other, interact, collaborate (Jupp 1966) and often take on 'hands-on' activities to achieve individual and immediate goals (Zubrzycki 1964). Immediacy became an important issue for the participants of this study: *how do I use this IT stuff tomorrow?* was a question frequently echoed by many of the teachers. Usually, they were interested in doing, reflecting, and immediately applying ICT to their established practices.

Learning and teaching in this university classroom, was observed to have changed in comparison to the traditional university approach.

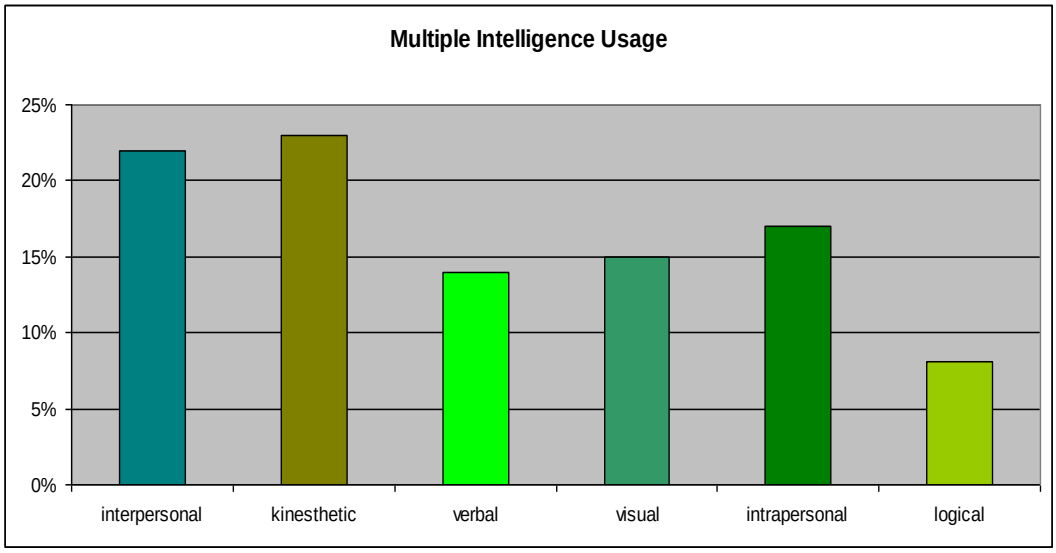

Figure 15: Summary of Teachers' Use of Abilities

As Snyder (1997) points out and this research agrees the landscape of learning had changed and this research further recognises that the way these digital immigrant teachers approached learning and communication acknowledges the shift in learning from the traditional didactic university classroom to a focus on an interactive, active, and reflective approach to learning about the mechanics of ICT.

According to Gardner (1983), in the traditional university classroom – and in education generally – verbal and logical abilities are highly valued. Gardner (1999) further writes that students of the future will value the "explicit step-by-step thinking" (p. 43) of logical ability. Prensky (2001, p. 3), also, alerts us to the fact that some logical thinking "will continue to be important" although not in the linear form of the predigital environment. This study indicates that, for experienced teachers, logical ability and visual and verbal abilities played lesser roles in their real life problem solving.

For Gardner (1999, p. 44) kinesthetic or “active hands on learning” and intrapersonal individualised education abilities are important when learners attempt to master ICT. The digital native and immigrant value *doing* and utilise their kinesthetic ability. They also value intrapersonal ability, albeit in different ways and forms. In addition to the intrapersonal and kinesthetic abilities that they evidenced in this study, digital immigrant teachers valued interpersonal abilities when solving problems.

The need to solve real life, practical problems occurred in the university and school workplace classroom of each individual during their action learning. The focus of action learning is on the “chang[ing of] processes, participation and reflection" (Phelps 2002, p. 4) so as to improve practice and try out ideas in practice as a means of increasing knowledge about learning and teaching (Kemmis and McTaggart 1988). According to Akdere (2003) and Schön (1983) learning and teaching are improved by reinforcing, modifying, or changing perceptions, based on systematic observation and reflection through action. These co-exist and operate simultaneously towards the solving of problems, and in learning, in real life, within a particular culture.

The participants of this study did indeed display many learning abilities. Figure 15 summarises the learning abilities of the teachers in this research. It shows that they valued kinesthetic, interpersonal, and intrapersonal abilities in order to find out, acquire, and *know how to use* the necessary skills in order to function and survive in this ICT culture. The participants reflected individually on their use of the technology, but simultaneously they *bounced ideas off each other* in their learning, acquisition, and reflection of ICT knowledge and skills, and in doing so displayed interpersonal ability. They valued this interaction and collaboration in their immigration process, during which they *discussed the different ideas on how to use PowerPoint* and other software that the teacher educator introduced to them. Additionally, the teachers focussed on *hands-on* activities that connected the technology to their purposes and goals, thus expressing kinesthetic ability.

1. Kinesthetic Ability

Kinesthetic ability allowed the participants – through their *doing* and *hands-on* activities – to become involved in, and give meaning to, their learning of technology. The immigration process encouraged *hands-on activities* within *concrete experiences.* Figure 16 presents the researcher's observations which revealed that these teachers, like many immigrants, used kinesthetic ability to *do*, become involved, *solve problems* and give meaning to their new cultural settings and become active members of the new community (Benyei 1961).

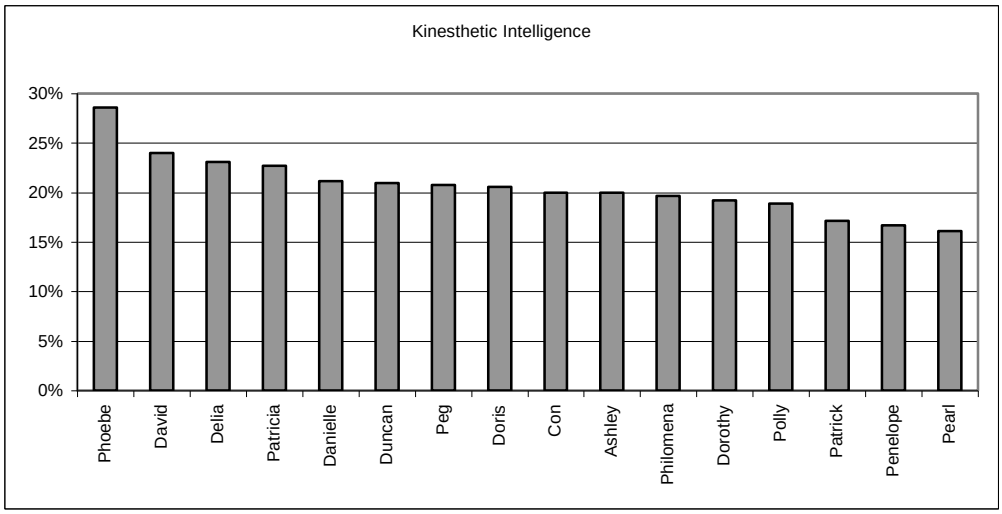

Figure 16: Kinesthetic Ability

Phoebe, (Figure 16) who employed the highest frequency level of kinesthetic ability within the group of participants, worked independently on her projects. She bought her own computer during the summer holidays and *experimented with it, with the help of her younger brother-in-law and nephew* before the course started. She developed her skills, experimenting with digital portfolios, and then demonstrated these newly acquired knowledge and skills to her school colleagues, sharing with them, for example, how PowerPoint could be utilised to compile their own digital portfolios. During her presentation to her university colleagues, she also demonstrated, shared, and explained her learning process, and described how her own students were able to now display their work and photos in their individual digital portfolios using PowerPoint. This was a trial project for her grade one students that she implemented herself. She felt positive in interacting and demonstrating her new knowledge acquisition. Like a traditional geographic immigrant, who often observes the culture of the new environment

(Lewins 1978) and then performs functions using kinesthetic ability to survive, resettle and "get a roof over [their] head and find work to pay for [their] upkeep" (Benyei 1961, p. 9), Phoebe made sure that she acquired the knowledge and skills to survive and enter the digital environment. Also, like many geographical immigrants, she maintained her knowledge about her own culture (Lewins 1978) and she approached technology not in the style of digital native but by compiling her portfolio in a linear manner with minimal hypertextual links.

The point at which she felt confident enough to exhibit her newly acquired knowledge took a long time and as far as Phoebe was concerned, her final success was in demonstrating and:

> *presenting her work to the group – this has taken me a long time. I had a few problems, … to say the least, but my colleagues and Principal have been supportive. After I finished my students' digital portfolios, the Principal was impressed and asked that I show the whole school. That was somewhat scary, but exciting. I had never done something like this before. But it all went fine and here is the work that I showed them…* [the researcher's observation notes reveal that she then began to explain, show and do the presentation].

During the three interviews, in her journal, and during the observations Phoebe was adamant that learning in the ICT milieu is achieved:

> *by doing … by doing, definitely. Because, I know, we've had a professional development session here. It was on computers. I sat there and a lot of it just went right over the top of my head, I didn't get any of it – because I wasn't sitting in front of the computer and doing.*

Other participants, such as Delia, also exhibited a high level of kinesthetic ability. She bought her own digital camera and experimented with it. She took pictures *to download them into my pictures and things where I wouldn't have dreamed of doing anything like that before*. *I've learned how to use the scanner*… She also used Microsoft PowerPoint, the newly learned

scanning processes, and her digital camera for the Multicultural Week Displays at her school workplace.

David emailed his attachments and tried to zip, that is, compress, the file size of his PowerPoint presentation. This was something he would not have attempted a year previously, and yet in this instance he demonstrated to Ashley how he did it. Con, with his students, produced his school's Grade Six Newsletter and he said to his university colleagues during his presentation:

> *they produced a high quality magazine. This magazine involved the use of Information Technology through word processing, digital camera, scanners, printing, networking and installation of software. I desperately need to improve my understanding of the digital camera, scanners adobe acrobat and pdf files so as to further guide these children in the production of further magazines.*

Con was aware that there were other possibilities for teaching and learning, but he still wanted to control the situation until he had learned how to use these skills. He *was aware that his students probably knew how to use Microsoft Publisher*, but he *told* Duncan *that he* was *not ready to go down that path*. He had heard his students talk about this software program and he approached the researcher for advice, but at this stage, he said: *I think I'll stick with what I know and learn it down the track…*

David, who initially worked on his own and preferred to try things by himself before he approached others, also exhibited a high frequency of kinesthetic ability use. Duncan, Danielle, Peg, Doris, Con, Ashley, and Philomena all felt that they had progressed and made great inroads into their ICT learning journey. Duncan, in his third interview, talked about …*being able to do things; putting down text to pictures, minimising things on a screen and the fact that* he *could now work and open PowerPoint*. For Duncan, this was a great achievement: he had learned how to push the buttons (P) and was now able to apply the software (A). He was preparing to become a digital citizen and use technology in the new environment (Senjov-Makohon 2007;

Mossberger et al. 2007) and progress to the next stage of his survival in his lifelong learning quest.

As adult learners, the participants approached ICT as part of their lifelong learning, even though at this stage they were merely surviving in the new cultural milieu. They focussed on experimenting, and on hands-on activities which connected the technology to their immediate purposes and goals, employing their kinesthetic ability as the means of mediation in their production of old things by new means.

The landscape of learning had changed (Snyder 1997) and the way these experienced teachers approached learning and communication acknowledged that there was concomitant a shift in learning. The immigration process of learning in the ICT environment was one of doing and employing kinesthetic ability. Of course this ability was not the sole ability exhibited in this learning environment. Gardner (1983) informs us that learning requires multiple abilities within a given cultural setting so as to solve problems and challenges. And this was confirmed by the participants of this study, who all employed other abilities to facilitate their immigration to the ICT learning environment.

2. Interpersonal Ability

This study found that these teachers valued interpersonal ability to assist them in the acquisition of ICT knowledge and skills. Furthermore, the social context of the study's ICT learning environment assisted them in gaining new experiences, knowledge, and the ability to solve problems (Neo 2003).

Interpersonal ability aided in the creation of a collaborative learning environment that enabled teachers to articulate their points of view, and listen to those of others, in order to create knowledge and meaning together (Neo 2003). As Gardner (1983) states people like teachers use their interpersonal ability to understand people and relationships. The participants of this study used their interpersonal ability to *bounce ideas off each other*. They used activities that involved

group projects, division of labour, sensing others' motives, receiving/giving feedback, and collaboration skills – all in accordance with Gardner's model (Gardner 1983).

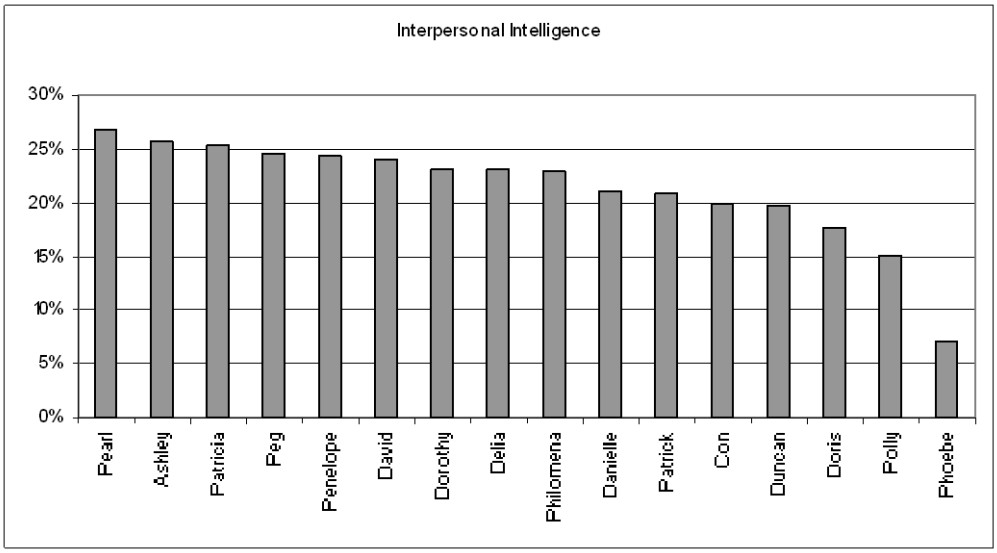

Figure 17: Interpersonal ability

Figure 17 shows that there was a high level of interpersonal use, like the other abilities, however different individuals used this ability more than the kinesthetic ability for example. Patrick, Pearl, Delia, and Patricia preferred to *discuss their ideas, investigate issues and develop plans on how to solve particular concerns*; Penelope and Danielle often *joined the group to solve particular problems*. Philomena and Peg *worked together* and intermittently with Con, who enjoyed the interaction, and participated in discussions once he felt confident with his newly acquired knowledge. Mid-way through the year, David and Ashley *bounced ideas off each other*. During this period, Ashley exhibited the second highest frequency use of interpersonal ability use, after Pearl (Figure 17). Ashley preferred to work mainly with David, rather than within a group. As David commented, they:

> *helped each other out, because there is a positive learning environment; where we can share, rather than competing against each other, and not ignore someone, but ask each other how did you do that? What do you do here? This way it's probably more accessible, because there are twenty of us and only the one lecturer, so we tend to help each other*.

The interrelationship, of thoughts and the caring support exhibited by participants to each other, promoted an environment of engagement and a dynamic interpersonal approach. Adam in the presentation of his work at the end of the year *thanked everyone who helped* him. The researcher observed the manner in which collective knowledge sharing (McLoughlin 2008) and the acquisition of *small bits of things*, as Penelope stated half way through the year, became important. They began to survive and establish themselves as residents in the new surroundings of the information age. Peg appeared as the spokesperson of the group and *after being given instructions by the lecturer*, gave the same instructions to Patricia, Delia and Pearl *who have meandered across to see what she is doing with the help of the lecturer who observes the interaction. Peg is sharing her knowledge about a new program, she says to the group: I've learnt a bit, but as I learn more, I'll show you later*.

3. Intrapersonal Ability

In addition to interpersonal ability in this ICT environment, intrapersonal ability played an important role. Gardner (1999) stresses that intrapersonal intelligence permits individualised education and has high significance for students of the future (Gardner 1999) and this would include the ICT culture. The teachers in this study exhibited it during their reflection on the mechanics and use of ICT.

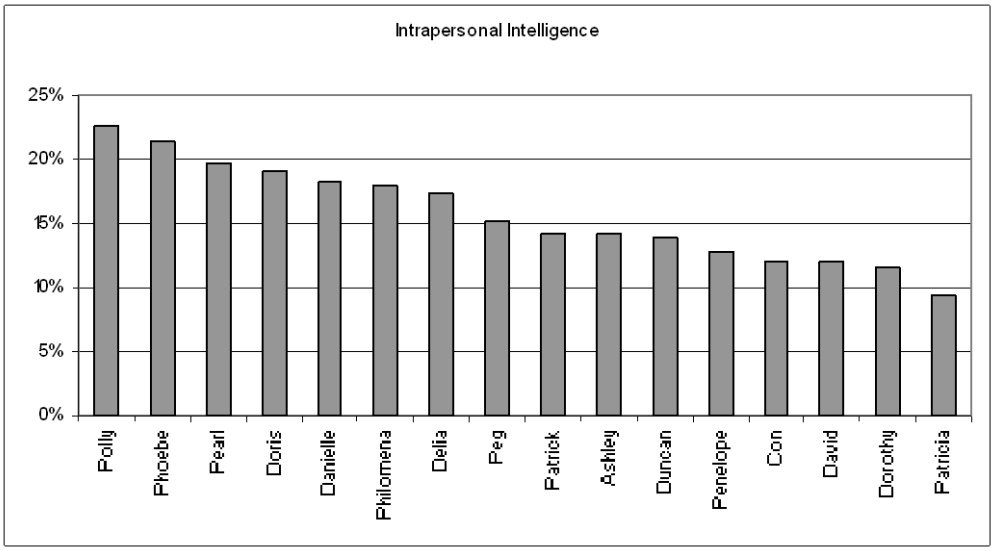

Figure 18: Intrapersonal Ability

Polly approached learning in a reflective way. She exhibited the highest frequency of intrapersonal ability use (Figure 18) often working on her own and exhibiting her own "feelings, needs, anxieties" (Gardner 2004, p. 39) regarding the doing of the activity. At this stage of her learning, she *just wanted to use it.* As she commented in her first interview: *I've just returned to teaching after being away for a long time and I feel that some of the students might know more than me.* This concern led Phoebe to perceive a need to *learn how to use the computer before the course began. She bought her own computer* like Polly, and *with the help of her brother in law and nephew learned how to use it.*

As the course progressed, Pearl, Doris, and Danielle often *played on the computer to see what the button did.* They also listened to other group members, especially as *they explained how to use the Internet*. But these participants did not employ their intrapersonal abilities to reflect and listen in isolation; they used other abilities entwined with that intrapersonal ability.

4. Visual Ability

Dorothy, Con, Phoebe, and Patricia used visual ability to observe the activities of the other participants (Figure 19). Dorothy often watched *the other participants' screens*; the computer became a mediator and stimulator for socially interactive learning; the instrument through which to conceptualise actions by the use of visual, interpersonal, kinesthetic, and verbal abilities. For Dorothy, the lecturer provided the *focal point of authoritative reference*. Whenever the lecturer explained anything about ICT, for example about the *Avid Software*, Dorothy felt that she *should listen and watch rather than question*. Others like Patricia, Patrick, Delia, and Pearl also listened intently to the lecturer, watching his monitor's screen to learn, for example, when he switched *to PowerPoint and started to talk about the Point of PowerPoint—Jamie McKenzie's ideas*. At other times, participants grouped together around a computer and pointed out to each other different features on the screen. On the other hand, Penelope, Patrick, and Con were often *clicking and watching their own screen rather than the lecturer's LCD screen as he spoke and explained the different features of a particular software program*.

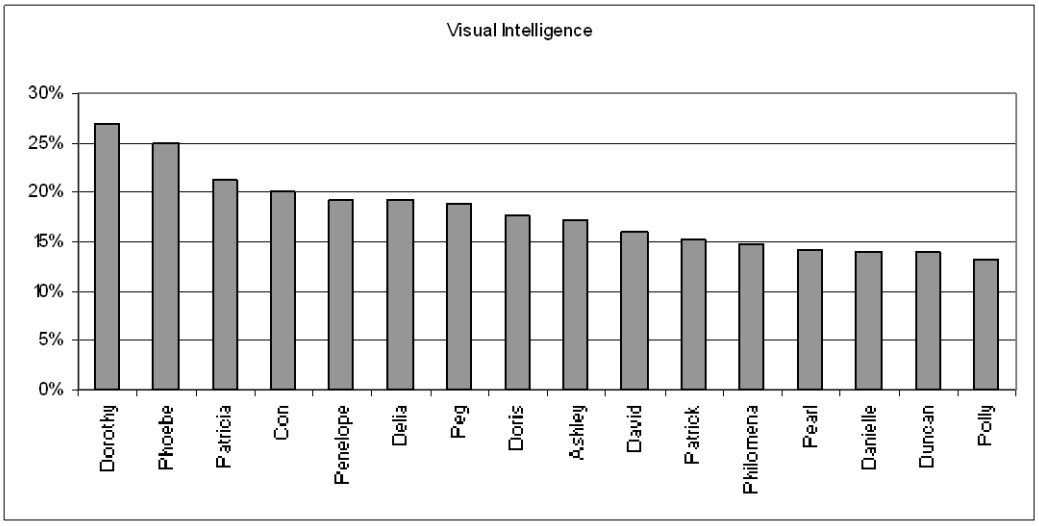

Figure 19: Visual Ability

It was noticed that Peg preferred to represent her information in graphic, map, and flowchart form; she saw the new technology as an assistant in the new age and as she commented:

> *it's not that you are learning more, but it's just there are more abilities* [being used]*... the conversation has been about webquest and the way students learn with the net. Students have more at their fingertips ...* [returns her eyes to the screen].

Although these participants were not digital natives, there were aspects where the approaches they displayed could be compared to that of the digital natives they would teach: Philomena said *I like to see it… can you show me?* Philomena and Peg preferred to *work together* and often commented that *seeing something is the best way to learn*. In this respect, they resembled digital natives, who prefer to learn visually, as they have been repeatedly exposed to the visual complexity and creativity of computer games and other digital media (Prensky 2001b). But that is as far as the comparison stretched. The digital native sees, thinks, and processes information differently from the digital immigrant (Prensky 2001; 2003). And as far as Philomena was concerned *technology has revolutionalised her teaching and she needs new approaches to assist her in her new learning environment. She needs the skills to empower her in this new environment*. She liked to utilise her newfound ideas and represent them visually, especially in her workplace:

> *…I organised for Clifford the Big Red Dog* [a popular picture story character] *to visit the junior school to promote the* book *fair and hopefully an interest in the book. I used the digital camera to take photos of Clifford and have put a display up at school…*

Her learning differs from the digital native, whose social experience and ability to process information in certain visual ways is intrinsically linked to computer-mediated, instantaneous information provision, and this gave Philomena's newly acquired language an 'accent' within the ICT learning environment (Prensky 2001a; 2003).

As Gunter Kress (cited in Snyder 1997, p. 55) informs us "the visual is a vastly more efficient mode for carrying and 'processing' great amounts of information", and in the context of technological development and globalisation, this ability cannot be ignored or underestimated. Although visual ability is important in the ICT environment, for these experienced teachers who were undertaking their immigration journey, there was still a sense of them keeping "a foot in the past" (Prensky 2003, p. 2), as evidenced by Philomena's use of her digital photos in a *display* that she *put up,* meaning into her computer and not online.

5. Verbal Ability

Gardner (1983) alerts us to the fact that people who enter the teaching profession tend to use verbal ability to convey meaning and to solve problems within a given cultural setting. However in this ICT environment, the participants were not the disseminators of information. Instead they verbalised the mechanics of their ICT learning interpersonally. These learners, within their immigrating groups, verbalised the problems they encountered, asking each other *how did you do that?* referring to the different technical challenges that they were facing and which they were attempting to solve.

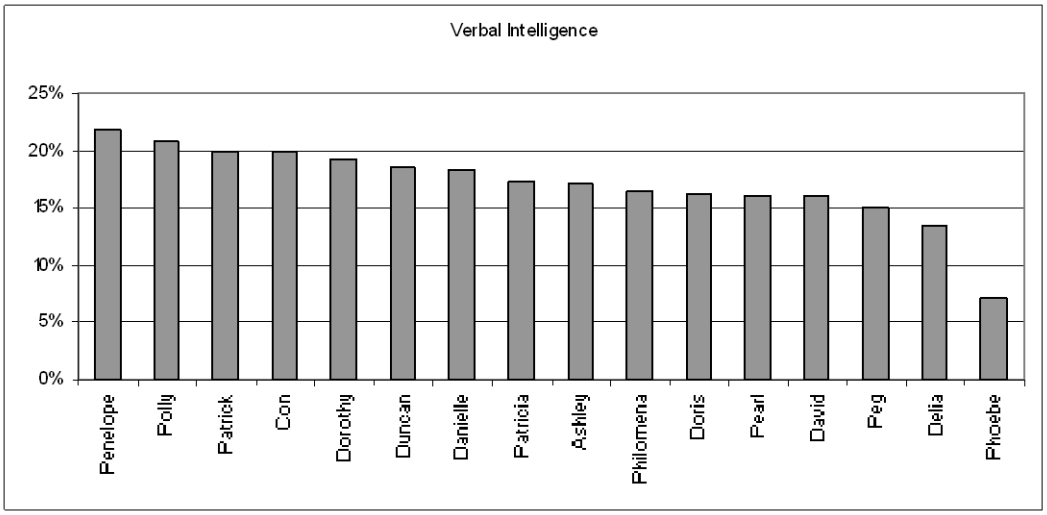

Figure 20: Verbal ability

Polly and Penelope frequently turned to their partners and asked; *how do you do*… These two participants (Figure 20) employed the highest frequency level of verbal ability. As far as Polly was concerned, *the only way* she learned was *by asking and talking about it.* Penelope often talked about the different software programs with Patrick. In turn, Con and Patrick learned through explaining the activities.

Con used verbal ability to *help Doris when explaining about WebCt*. He *talks about my learning – I need to do these things before I can teach the children – how to publish the school magazine, scanning, digital camera and web pages* … and he *discusses the screen and how to locate the images*.

The other participants, especially Patrick, Penelope, Patricia and Danielle, tended to talk about their actions whilst working and collaborating within a group, describing the sequence of events, and outlining the complex process of learning the respective software programs and their usage in the classroom. There was a noticeable air of achievement within the confines of this ICT environment. The digital immigrant teachers knew that they had a digital accent, which meant that they had a 'foot in the past" (Prensky 2001a p. 2), when they *talked with their teenage children* and as Philomena said: *where do they get all that information?… it's taken me all this time and I just forget!* However, this did not deter them and they were often observed

working together, collaborating and interacting. And when they were *not confident… they asked the lecturer* who, as the authority figure, assisted them in solving a problem. Doris and Dorothy also preferred to ask for assistance from the lecturer, and Dorothy said that *you need a focus, a facilitator to give you directions, but then by talking to people* and, as Duncan pointed out, during the sharing:

> *of problems encountered and actually talking through things and trying to solve it together... [t]here's always one person who knows more than the other person and tends to lead the way, so if you ask them they say yeah that's how you do it. But just opening yourself up and saying I've got no idea how to do it and asking for help basically and I think that's the general way of learning; saying I need help and being open and saying you can't do it and don't be afraid or scared or embarrassed because you can't do it. You think you should be able to do it and it doesn't matter.*

These thoughts of sharing and assisting each other were evident throughout the course.

David initially seemed shy and kept to himself. He slowly started interacting and talking about his project and his work place challenges. He wanted to solve problems and apply:

> *computer technology. PowerPoint is good to use for students to present their assignments. I could design a web site for students to share their experience with the rest of the world… Wheelchair Basketball is an area of interest.*

He described the relationship between technology use and his students to critically think about their interest and use the technology. Frechette (2002) also discussed this aspect of becoming critical thinkers in cyberspace and providing educators with concrete learning strategies to use the technology. David was willing to experiment with the technology in a practical and concrete manner. He explained, especially to Ashley, his plans in regard to the ICT usage in his class and applied critical and reflective thinking to how to use the technology *to achieve goals*. Like many immigrants who act so as to "provide their children with better options for the future" (Maydell-Stevens et al. 2007, p. 185), many of the participants within the study talked about similarly directed goals: to attain ideas and possibilities in order to help their students. They discussed the application of particular software programs to the concrete experiences in their individual

school classrooms. Discussions, group work and interaction with each other in regard to different aspects of learning developed through the course.

The participants communicated, interacted, and collaborated, learning about ICT and how to harness it for their own learning. Generally, during this process, the participants tended to give voice to their learning, actions, and movements within a group in the classroom situation. Patrick said, *involve me and I will learn … and show me and I will remember*. They were quite comfortable with expressing their concerns and findings within the group situation in this ICT learning milieu. Patricia often offered positive reinforcement to Patrick who would break into conversation about learning and constructing new knowledge. He talked about his own learning and the way he learned:

> *I like to talk about it rather than write…* [the researcher observed that] *he recapitulates about his undergraduate study days, when he would go to see his lecturers, discuss the issue, feel confident about it but when he had to write about it, he would go blank. Often after the lecturer would ask him what happened especially since he verbalised everything so well!*

These teachers were quite open and forward in their discussion of the activities in peer-to-peer interactions. Patricia often commented that by talking, interacting and showing others she also learned, and reinforced her own learning. She was often observed to work with the other participants. Unlike Pheobe, who *just sat at her computer and worked on her own*. Patricia, Patrick, Penelope and Danielle were *working together and were showing each other different strategies to achieve their goals and what they have learned.* Patricia *told them: I'm learning a lot this way, where we just share things.*

Generally, the participants enjoyed the social interaction, communication, exchange of ideas and procedures, and talking about their concrete experiences in the ICT learning environment. Duncan liked to discuss and explain his thoughts and actions, especially to Doris, Dorothy, and Con, with whom he had both personal and professional connections. Duncan and Con owned a

horse together and often when they arrived in class, they *would immediately connect to the Internet to check out the state of their horse and of the racing industry*. Pearl, Delia, Patrick, and Patricia *worked at the same school and often drove to University together*.

There were many opportunities for the participants to discuss their newfound learning. Penelope and Danielle also *worked at the same school*, and *shared activities between their school classes*. Peg and Philomena had originally *met at a previous teacher professional development session* and they were familiar with each other. All these social and professional connections assisted the participants in their interactions, enabling them to participate comfortably in discussions about their new found knowledge. When employing verbal ability, they sometimes *gathered around one person's computer and showed each other particular features of a given application*. Through this process, they employed visual, verbal and interpersonal abilities.

6. Logical Ability

Gardner (1983, p. 390) describes how learning about computers might involve multiple abilities, especially "logical-mathematical ability [which] seems central … to [the solving of] a problem or attain[ing] a goal in a finite number of steps". Gardner writes that mathematicians love to deal with abstract ideas, and skilfully handle skilfully long chains of reasoning and validate information (Gardner 1984).

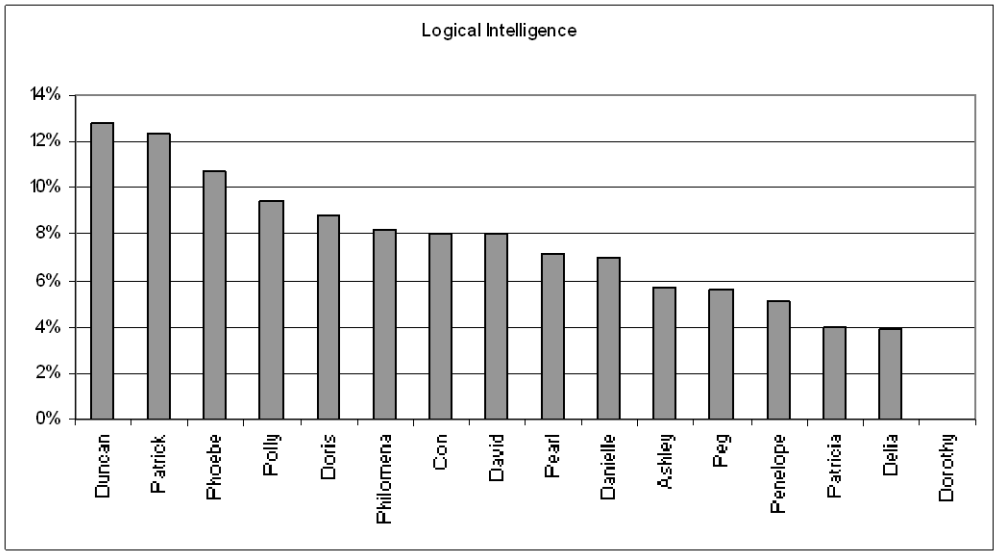

Figure 21: Logical Ability

Duncan and Patrick exhibited the highest levels of logical ability (Figure 21). Duncan and Patrick liked to collect and analyse material and Patrick liked to put information into a *Microsoft Excel* table, where the results were worked out without too many laborious steps. Patrick *often questioned the sequence of the activity.* He *compiled activities and then systematically showed others, explaining the logic behind their working*. It is noteworthy that the use of logical ability scored the lowest frequency in comparison to the other multiple abilities. Gardner (2004) contends that this ability was highly valued in the predigital era, and proposes that students of the future will prefer this step-by-step logical sequence. If we were to compare to Gardner's above contention, in this study, in regard to the learning of ICT and in this digital environment its value was not as prevalent as he claims for digital natives.

Multiple Abilities and Technology

This study has found that these experienced teachers in their learning process employed mainly interpersonal, kinesthetic, and intrapersonal abilities to immigrate into the ICT environment. They also displayed visual ability in observing the computer screens and the other participants doing and applying ICT. Logical ability, which is highly valued in a traditional classroom (Gardner 2004) was minimally applied, but verbal ability, also highly valued in a traditional classroom (Gardner 1983), was applied in conjunction with interpersonal ability. In order for digital immigrants to begin to lose their accents and approach digital citizenship, the traditional learning process needed to change. A new learning process – one which "reconsider[s] both

[the] methodology and [the] content" (Prensky 2001, p. 3) of teaching and learning and incorporates abilities that allow collaboration, interaction and hands-on activities – requires development.

Learning Challenge in P~>A~>C

The ICT learning environment of this study was culturally different from the teachers' previous didactic, lecture-oriented learning context. Human communication took place within a sociocultural environment that required "interfunctional relations" (Vygotsky 1962, p.1). Learning in this environment was not an individual activity; it required: others to support the learner; a space to *bounce ideas off each other*; and action within the learning. That is, kinesthetic intelligence or *learning by doing* was activated in order to solve the challenges of ICT. The third ability, intrapersonal, was valued for individualised education, but this study found that it was employed by the participants to reflect on and self-direct their learning specific to the mechanics and use of ICT, rather than being applied to pedagogical issues relevant to the teachers in their own workplace classrooms and schools. Indeed pedagogical issues were not even contemplated by the participants.

In 2004, Gardner (p.141) wrote about education that: "any topic of significance can be represented mentally in a number of different ways". For Gardner, entry into a topic conforms to the same sequential order that he advocated in 1983, that is, it commences with verbal and logical abilities. However this study found that entry into this ICT learning context encouraged interpersonal ability. The case was similar with regard to kinesthetic intelligence or *hands-on* ability of "working directly with tangible examples" (Gardner 2004, p.141). Originally Gardner (1983) placed this ability as fourth in his sequence, but later he acknowledged (Gardner 1999) kinesthetic ability as important and significant within the ICT culture. This study also found kinesthetic ability to be important, and with a greater significance in the twenty-first century ICT learning milieu than in previous university teacher learning environments.

Gardner (2004, p. 39) has insisted that interpersonal intelligence is important in the twenty-first century stating that "nearly all business involves working with other persons". It is evident from this study that, in education, too, and in this university classroom specifically, the interpersonal ability played an important role. Gardner, in his Catalyst Projects, also found that if novices had considerable help, they would complete a task within a cultural setting (Walters and Gardner 1998). Vygotsky (1987) also advocates learning from more capable individuals to solve problems. For both Gardner and Vygotsky, learning is a social activity that takes place within a cultural context.

In this study, the cultural context encouraged teachers to support their learning by interacting within their own communities and not exclusively with the teacher educator. This was the case for Patricia, Patrick, Danielle and Penelope, who *gathered together around the computer to show, try and think about the features on the screen*. In addition, Pearl, Delia, Patrick, and Patricia *often talked about the Internet and some of the good things there*. Another example is that of Doris and Danielle who would *look on* as Peg and Philomena would *discuss and show each other the icons in* [the software application] *FrontPage*. Interpersonal ability was constantly employed through the study as these teachers immigrated to the information age and grouped into communities. They began to speak the language and they tried to lose their digital accents (Prensky 2001a); to sound like native speakers of the new region they were beginning to occupy in the ICT landscape.

Three ways of learning, which this research terms PAC, became evident. Although, at this early stage the task was difficult, the participants were learning how to push buttons (P), how to apply software (A) and how to change practice (C). Generally, the participants valued three abilities above others during each of these three ways of learning (Figure 22).

Push Buttons	Apply software (A)	Change practice (C)
Interpersonal	Kinesthetic	Kinesthetic
Kinesthetic	Interpersonal	Interpersonal
Intrapersonal	Intrapersonal	Intrapersonal

Figure 22: Abilities in P~>A~>C

1. Learning How to Push ICT Buttons (P)

Like immigrants in their initial stage of immigration, these digital immigrant teachers, congregated into communities to facilitate their transition to a new cultural milieu (Hatton and Leigh 2007, p. 1). They explored this new culture and became aware of new possibilities. Although, the new buttons presented by their computer screens and the functions they activated were unfamiliar to the teachers, they connected with each other, *helped each other and bounced ideas off each other to learn about the buttons and their functions* to facilitate their individual learning. For instance, Patrick, Pearl, Delia and Patricia *preferred to think and discuss things* and, Penelope and Danielle often *joined the group to solve particular problems*. Similarly, Philomena and Peg *worked together and were often joined by Con*, who *showed them things about the different buttons*. Con also enjoyed the interaction and participated in the group discussions once he felt confident with his newly acquired knowledge. Others like Ashley and David *joined their forces to bounce ideas off each other* in this period. As Ashley pointed out one evening after class *technology was no longer scary* or *frustrating*.

The participants of the study found that learning and teaching within the specific ICT environment *is so different*. Gardner (1983) alerts us to the fact that people who enter the teaching profession tend to use their verbal ability to convey meaning in a given cultural setting. However, although they may be proficient in explaining to others about how to solve a problem, they may not necessarily interact and collaborate and therefore, they tend to be didactic instructors.

So, unlike Gardner's interpretation of teachers' didactic use of verbal ability, these teachers-as-learners asked each other *how did you do that?* Yet rather than deriving pedagogical meaning from the *how to do the technology stuff,* they instead referred their interaction to the different technical challenges that they were facing and which they were attempting to solve within this particular ICT cultural environment. Polly and Penelope frequently turned to their partners and

asked: *how do you do…?* On one occasion, Polly conceded that *the only way she learns, is by asking and talking about it.*

Interpersonal ability in the diverse ICT environment becomes increasingly important as learners face the challenges of lifelong learning for the information age. The digital immigrant teachers were aware of this importance because *it is so different* to their previous teacher learning. Patrick and Philomena often discussed how *things are so different here,* where by *talking to everyone … you can learn so much more…* Penelope, Patricia and Danielle who *all worked together* with Patrick, often *demonstrated that collaboration and working with others are beneficial*, especially when *they were learning FrontPage*. Whilst working and collaborating, the participants tended to describe their actions, the sequences and events, explaining the different buttons and their functions, within their immediate learning environment.

Things changed during the course and the teachers believed that *things were so different.* They knew that they had a digital accent (Prensky 2001a), especially when they *talked with their teenage children* who seemed to *easily get information ... they just simply know where to go.* Philomena noted: *it's taken me all this time and I just forget.* Peg pointed out that *remembering all the buttons is sometimes hard*. However, this did not deter the participants from persevering and *working together,* collaborating and interacting, so that they could *learn more about this technology stuff*. They believed that they were successfully achieving and they were no longer apprehensive in asking others for information. But as illustrated above, these requests were for information regarding the technology and were not pedagogical in nature.

As the teachers collectively learned more about the different buttons, they felt positive in knowing that they could *try and work things out for themselves*. For example, Dorothy in the first few weeks *looked on*, but as she began to understand and reflect on the technology, she found that she wanted to *do things.* The participants valued *doing*, observing, and reflecting with their peers and individually about the technology. They appreciated the interactions and

they would *try and work things out … to do things*. Interpersonal, kinesthetic, and intrapersonal abilities were intertwined specifically in the learning of ICT.

2. Learning How to Apply ICT to Practice (A)

The teachers' survival process was not confined exclusively to pushing buttons. The participants' approach to ICT changed and they became willing to apply ICT to their practice. The teachers first increased their *doing* and this resulted in an increase in their collective reflection about the software. They reached a point where they began to think about how to apply their new technical knowledge in practical classroom activities for their classroom. They no longer exclusively asked about the buttons and their functions, but they collectively and individually reflected and thought about how to apply the respective softwares into their workplaces. Gardner (1983) and Kolb (1984) stress the importance that thinking and reflecting play in solving problems and both authors maintain that *doing* and *experimenting* are significant processes and abilities in learning.

In this study, the ability to *do*, that is, kinesthetic ability, especially in conjunction with interpersonal and intrapersonal abilities, was of prime importance. Nevertheless, the sequence in which these abilities were applied was different to the way the participants had learned to think about how to apply the technology in their established classroom practices during the button pushing stage of their learning. Even so the participants still concerned themselves with the actual use of the technologies in their classroom, rather than on how their teaching processes would be impacted.

In groups, pairs and individually, the teachers were *thinking and doing*, explaining how the software *can make life easier for them…* and *more interesting for the kids*. For example, Patricia explained about Microsoft Excel and how she had organised the literacy program at her school. During her final presentation, she commented that she had *spent a long time thinking and agonising about the literacy program…*, *everything was everywhere… what a mess!* However, she manipulated Excel and constructed a system which organised the literacy program. She

demonstrated her worksheet and commented to Patrick *at least now I know where everything is …* Phoebe also manipulated the technology, using PowerPoint to develop e-portfolios instead of the *big portfolios for grade ones… things were less messier.* Con *talks about his learning – how to publish the school magazine,… scanning, digital camera and web pages …with technology it's easier to organise things.* As far as Patrick was concerned, his approach was *involve me and I will learn*. By *doing and surfing on the Internet*, Patrick *discovered the Louvre site in Paris for his art class* which he *excitedly showed his university colleagues*. He told the other participants *you can show the kids more than what's in the book*. They valued the interaction and the ability to construct and demonstrate how to operate the different technology so as to *make life easier* and *more interesting*. Boheman (2003, p. 2) writes that in a collective reflection process "collective professional knowledge" is networked and collected by different members of a group that develops an awareness of a given activity before applying this knowledge to their practice.

Many of the teachers discussed the application of particular software programs and how transferable the programs would be to some of their classroom text activities. Yet their thinking remained embedded to a large extent within their own previous learning framework. The dynamic organisation of knowledge with random access to hyperlinking was not present, but with time, they extended their skills to encompass the utilisation of number of softwares – Microsoft PowerPoint, FrontPage and Hyperstudio – that foster such informational organisation. Generally, the teachers felt that PowerPoint was closer to their way of thinking and as Delia said, *it is less complex than the others!* These digital immigrants held onto the linearity of their previously learned thinking and doing processes, although, they began to incorporate elements of new processes, and especially in regard to the use of PowerPoint.

The digital immigrants became conscious of their new environment and the necessity of understanding the software in order to apply it. However, they did not think within the new environment's cultural context, or in the terms of digital natives who processed information in a *different way*. In other words, their students, as digital natives, "process information more

quickly, to multi-skill and parallel process more easily, to better perform certain visual tasks, and to communicate in new and different ways" (Prensky 2003, p. 1). The participants of this study were still mixing their "macaroni with … garam masala" (Giri 2002, p. 1). Penelope reflected that her students were *doing things differently;* they were learning in diverse ways (Gardner 2003) in the digital environment and she was not the provider of information. Yet she did not attempt to analyse what this new manner of learning may have been nor how she could adapt her teaching process to accommodate it. She felt that she was not the controller of information in her classroom and she still *needed the control*, that her students were taking it from her.

Regardless of these feelings, the participants were at least thinking through and applying the technology to their established practices. They were ready to share their knowledge and skills amongst themselves and to change their practices.

3. Changing Practice Using ICT (C)

The teachers began to change their practice from a paper-based to an electronic, or e-based format. For instance, Philomena who worked in her school's library, used Microsoft PowerPoint instead of posters to display *the children's work* during book week. Instead of scrapbooks, David and Phoebe used PowerPoint for portfolios. Others were like Delia, who exhibited a high level of use of kinesthetic ability, and bought her own digital camera and experimented with it.

Evidently, the teachers wanted to change their practices – to modify their behaviour and accommodate to the new environment – but, like immigrants, they still wanted to retain and employ their former cultural values (Kovacs and Cropley 1975). For instance, Polly told Dorothy that i*nstead of getting your students to write about this topic you can use* [the software application] *hyperstudio to create and reinforce what you have been teaching*… and Dorothy added… *in my classroom, I could apply it to SOS*. These two teachers valued Hyperstudio's capacity because, as far as they were concerned, it could visually represent many ideas and was appropriate when creating stories or other activities. They *scratched the surface of Hyperstudio*

and were not fully confident in exploring it further. Finally, after much deliberation, they decided that they preferred to *stick with PowerPoint … it's easier to use*.

These teachers transferred technology into their established practices, but not all software programs and technology were considered for inclusion. They preferred PowerPoint in comparison to FrontPage and Hyperstudio; *it just goes everywhere* as Delia pointed out to Patrick. Delia commented, after their sessions with Hyperstudio and FrontPage, that *PowerPoint is easier to use and in my case less complicated, I don't have to think and do all the stuff with linking.* The concept of hypertext and non-linear methods of communication were still foreign to them.

The action and the *doing* as applied to the mechanics of ICT were important, and the participants were obviously learning differently in comparison to the traditional university environment. They were learning in diverse ways using multiple abilities in tandem. They had expanded their horizons, increased their knowledge of technologies and methods of which they had been previously apprehensive, and even frightened, but pedagogical issues were still not discussed. These teachers realised ICT could make a valuable contribution in their classrooms, but they were not able to theorise about its applicability.

The evidence indicated these experienced teachers had the ability to change their established practices and learn ICT. They adopted three ways of learning: pushing buttons (P); applying software (A); and changing their practice (C). And whilst doing so they valued three dominant abilities that were dissimilar to those traditionally valued within the didactic university culture.

The Culture of ICT in the Context of Teacher Professional Learning

In the culture of this ICT university classroom, teachers solved problems and in doing so, valued certain abilities more than others. And these abilities assisted them in learning about ICT in many and diverse ways, instead of merely obtaining information solely from the lecturer. They gained their knowledge and skills by experimenting with the software applications and

demonstrating newfound knowledge to their colleagues. They incorporated ICT knowledge and skills into their existing classroom activities. They were also beginning to assimilate into the digital world and their perceived alienation was reduced (Kovacs and Cropley 1975), as they began to feel more positive about ICT. They realised ICT was transforming all human activities dependent on information, including teaching, and further, that ICT was presenting new opportunities for teachers and their workplaces. Penelope's thoughts epitomised those of many of the teachers:

> *learning is different now and the kids' world is different, this stuff is part of their world and then* the teachers *start to talk and think how they can use these icons in Internet Explorer and how Google can enhance their students' learning*.

In summary, these teachers were beginning to rethink learning. Learning took on a different form and these teachers were beginning to realise that passive learning and the three hundred year-old tradition of linear didacticism might be improved by an active and interactive learning environment.

It has become critical to understand that collaborative and active participation are essential components in teacher learning. The challenge is to understand the educational context of ICT, and how teachers construct their personal knowledge in a meaningful and socially valid environment; one that is both culturally beneficial and valued as knowledge within the digital community. As Hatton and Leigh (2007, p. ii) contend of geographical immigrants, "the longer the immigrant community has been established the better adjusted it is to the host society and the more the host society comes to accept that ethnic group".

The notion of inborn intelligence originally challenged by Gardner (1983) is being further challenged within the ICT context, as learners are portrayed, in accordance with Vygotsky's theories (1962) as active and collective creators of their own knowledge. Interpersonal ability in this study gave rise to meaning for the participants and enabled them to reach a personal goal within the ICT context. This ability allowed the participants to support, mediate, and collaborate

in their own and other's learning processes. The participants used this ability in conjunction with kinesthetic and intrapersonal abilities to construct a learning process through a social synergy in order to reach their ICT learning goals, and finally, though with a digital accent, to begin immigrating to the information age.

Gardner's work (1983) assisted significantly with the understanding of the abilities essential for teachers in their immigration to the digital age. However, his work did not fully inform the changes and transformations that occurred in the process. Vygotsky's work, however, is valuable in assessing and understanding these transformations and changes. His work presents a richer and more informed basis for the interpretation of the data, and will be discussed in the next chapter.

Conclusion

This research concurs with Gardner's statement (1999) that in the ICT culture, kinesthetic and intrapersonal abilities are valuable – albeit that the latter ability was exhibited in a reflective way in this study, rather than in individualised education (Gardner 1999). Although the other abilities were valued, they were not as highly valued. This was especially and surprisingly true of logical and verbal abilities, which according to Gardner (1983) have long been valuable in the traditional classroom. In fact Gardner (1999) adds that students of the future, presumably digital natives, will also highly value step-by-step logical ability. However, for the digital immigrant teachers of this research – who were beginning to survive in the digital environment, though with an inevitable emerging digital accent – their learning proceeded *by doing* and interacting. This was emphasised by the majority of the participants during their third interviews. They related how they saw themselves as surviving in the new learning environment through interaction, action, and reflection in the quest for new knowledge which they could immediately apply.

Gardner does not clarify the operations and applications of his posited abilities, rather he identifies and describes them as ways to achieve goals within a particular cultural context. The

present research is significant in that it not only identifies three dominant abilities employed in ICT learning, but also demonstrates how teachers operate and apply ICT, in the cognitive domain, to their practice.

The next chapter follows the alighting of these digital immigrant teachers onto the shores of the digital world and into the ICT culture in relation to the work of the Belarussian theorist Lev Vygotsky who wrote extensively in Russian. The world of ICT is a new culture that requires more than just development in the cognitive domain of learning and teaching and Vygotsky's has much to say about the emotional and intellectual developments of the participants, as they enter the information age and learn how to push buttons (P), apply software (A), and change their practice (C).

Chapter Six – Leaving the Shores

Introduction

Chapters Four and Five argued that experienced teachers with limited ICT exposure gained confidence in learning and applying ICT through active, experiential, concrete, interpersonal and reflective approaches to learning. The frameworks of David Kolb (1984) and Howard Gardner (1983), respectively, were used to come to a broad appreciation and understanding of experienced teachers' learning as they immigrated to the information age. While showing that teachers possessed a common general learning orientation, the Kolb and Gardner standpoints did not account for all of the changes and transformations observed in the teachers' learning practices over the year of the study. To account for the dynamic nature of the learning observed, Vygotsky's theoretical ideas were approached. These presented a richer and more informed basis for the interpretation of the data.

This chapter is divided into a number of sections. The first section is a summary of the learning processes and abilities noted in this study according to the frameworks of Kolb and Gardner. The second section examines the learning transformations and developments that became evident in the data through the lens provided by Vygotsky's sociocultural theory of learning (Vygotsky 1999; 1978; 1962). While the concepts such as scaffolding and the zone of proximal development (ZPD) were relevant to the explanation of the learning development of the teachers participating in the research, they were not the primary connections to Vygotsky's learning model. The continuing process of struggle and accomplishment experienced by the teachers over the year prompted a wider exploration of the significance of Vygotsky's learning theory. Learning as a process in which struggle leads to accomplishment – as observed in this study – became explicable only by reference to lesser-known elements of Vygotsky's (1999) sociocultural theory. To remind the reader about Vygotsky's lesser known elements and as referred in chapter one of this thesis; learning is also a continuous process it involves perezhivanija (переживания) – an anxiety or apprehension, which is felt keenly and often taken to heart when enduring new learning experiences; and mislenija (мышления) is the making

sense of learning. These insights led directly to a consideration of the underlying conditions for learning and changes in learning practices. The third section of the chapter presents a complex interpersonal and intrapersonal examination of Vygotsky's powerful ideas about scaffolding and the zone of proximal development (Vygotsky 1987).

Section One – Modes, Abilities and Three Ways of Learning

P~>A~>C and Teacher ICT Learning

The participants in this study experienced learning anxieties in the new social and cultural environment of ICT to which they were exposed. However, they were able to resolve the ICT challenges with the support of the teacher educator, and through their support networks and communities during their learning. This chapter describes the teachers' transition from digital immigration to what has been termed digital residency, if not digital citizenship. This process was observed to entail three ways of learning which this thesis has designated as pushing buttons (P), applying software (A), and changing practice (C): PAC.

As the participants entered the university environment after many years of absence, they noticed that the university classroom had changed. Tables and computers replaced the traditional university lecture hall: *things have certainly changed …* according to Penelope. Furthermore, many of the teachers were unfamiliar with the technology before them and they asked: *where's the on button?* Initially, they began to learn how to push buttons (P) in this new environment. However, as they began to apply the software (A) and change their practice (C), they valued and processed learning differently to the way they had in the traditional university classroom. They were, in effect, digital immigrants leaving the shores of the traditional university classroom and they began to, as it were, PAC technology into their personal and professional lives.

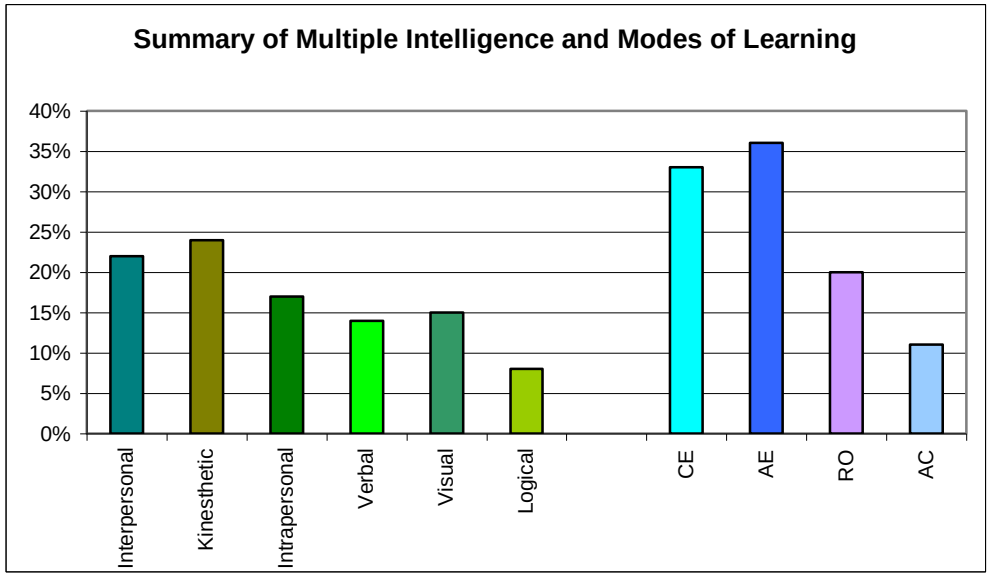

Figure 23: Summary of Abilities and Processes

The teachers consented to the place of ICT in their professional lives and they became receptive to changing their practice. Figure 23 summarises the data from chapters 4 and 5, and displays the consistent employment of the various modes and abilities exhibited by the participants over the year of the post registration course. The participants learned ICT by employing a number of processes: namely active experimentation (AE), concrete experience (CE) and reflective observation (RO). As shown in figure 23, they also valued kinesthetic, interpersonal and intrapersonal abilities. These digital immigrant teachers interacted with those in their community and networks and, moreover, they were *doing* and reflecting as they actively experimented within their concrete experiences. They learned about and discussed ICT technical issues; however, they did not extend their learning to encompass pedagogical discourse regarding ICT learning and teaching.

Learning in this study, when analysed through the frameworks of Kolb's and Gardner's theories appeared to have a static character. These frameworks did not allow the charting of any changes; Kolb's and Gardner's theories did not value what appeared to be the emotional and intellectual developments experienced by the participants through their social interactions in the new cultural ICT environment. There was a substantial shift over the year in the participating teachers' learning approaches and practices. There appeared to be an evolution in their learning approach and process, as well as an acquisition of a new language for these digital immigrants.

Thus, an interpretive framework was needed to explain the teachers' learning in which the transformations and transitions in their practices, in the language in their conversations and in the accompanying strengthening in their personal ICT confidence, were marked. Learning for these teachers had a social, as well as a personal developmental and experiential character. For this reason – in an attempt to account for the changes and developments observed in the ICT professional development program over the year – Vygotsky's sociocultural conception of learning was approached.

The application of Vygotsky's ideas rendered meaningful the changes in teachers' practices and discourse that were relatively insignificant when considered from the perspectives of Kolb and Gardner. The next section examines these learning transformations, language changes and social interactions, and the results of the analysis of the research data within each of the main Vygotskian learning concepts.

Section Two - Learning Transformation – *Perezhivanija* and *Mislenija*

Sociocultural ICT context

The global economy and the information age brought about social and cultural upheaval for these (and indeed for many other) experienced teachers. They perceived a need to enter this new technological milieu and become digital immigrants, learning a new digital language and culture. During the upheaval, these teachers experienced emotional and intellectual shifts, as they interacted with each other and became immersed in the new, ubiquitous ICT environment. Similar upheavals were experienced in the post-Russian Revolution years (1920s and 1930s) in the former Soviet Union where there was an outcry to eliminate illiteracy and transform society (Moll 1992). During this time, Lev Vygotsky elaborated his sociocultural theory of "how the developing individual acquired these [higher psychological] processes from his or her culture" (Rosa and Montero 1992, p. 78) in order to survive in a society.

Vygotsky's sociocultural theory is characterised by three general themes:

1. Development is a transition from the simple to the complex in a social context;
2. Higher mental functions have their origin in social life;
3. Tools and signs mediate the human interpersonal and intrapersonal process of learning (Vygotsky 1962).

According to Lantolf (2000, p. 1):

> Vygotsky argued that just as humans do not act directly on the physical world but rely, instead, on tools and labour activity, which allows us to change the world, we also use symbolic tools, or signs, to mediate and regulate our relationships with others and with ourselves and thus change the nature of these relationships.

In this study, the tools, artefacts or devices mediated a different learning approach to that of the traditional university classroom. The structure of this university learning and teaching environment favoured an interpersonal and collective cultural approach.

In contextualising this study, Vygotsky's sociocultural theory became a powerful theoretical paradigm and a foundation for educational application in this ICT environment, since it enunciates the social and cultural aspects of interpersonal and collective learning. Additionally, it has critical relevance for people such as teachers, who are active in the creation and application of a significant diversity of literacies (Snyder 2005; Kalantzis et al. 2003; Gee 2002; Bawden and Robinson 2002; Bawden 2001) and information for the new digital environment. The ability to use and understand information in multiple formats from a wide variety of sources via computers (Gilster 1997) has become increasingly significant. However, for these teachers in this ICT context, the use of technology brought about an anxiety or apprehension which they may have not anticipated. Vygotsky (1999), too, perceived such apprehension in the subjects of his studies and applied the Russian term *perezhivanija (переживания*) to the phenomenon.

Perezhivanija is probably Vygotsky's least known concept. It "describes the ways in which the teachers perceive, experience and process the emotional aspects" (Mahn and John-Steiner 2000,

p. 3) of learning. P*erezhivanija* is the process of endurance: taking learning to heart or feeling something keenly. It is an emotional experience that learners live through (Van der Veer and Valsiner, 1994). It manifests itself as an apprehension, and often frustration, about a new learning experience. This anxiety evolves as students enter new and unfamiliar contexts and is a natural consequence of the learning experience. As Brookfield (2006, p. 95) claims, "learning activities are emotionally laden … and can be named and presented as normal and predictable." He further argues that learning anxiety is "a sign that you are alive and alert in the classroom".

In addition to *perezhivanija* in their learning context, the participants of the current study were observed to *think, contemplate* and *reflect* on their new learning experiences and thus make sense of ICT. In Vygotskian terms, this is called *mislenija* (*мышления*), and its application in this study saw the teacher learners making sense and connecting their experiences to the devices of technology and to the new ICT environment itself.

Life for these teachers, as for any immigrants, involved transformation. They experienced *perezhivanija* concerning the new experience. Nevertheless, within an academic year they were gradually introduced to different softwares and began coping with the new learning environment. As the year progressed, their emotional upheaval began to subside and they were no longer as anxious about the technology. This transformation progressed from initial *perezhivanija* – anxiety and apprehension, where they felt that they *might break something* if they *pushed the wrong button* – to *mislenija*, and indeed, a collective *mislenija* – the realisation of sense-making and thinking about ICT as they collaboratively accumulated ICT experience and individually internalised its knowledge and skills.

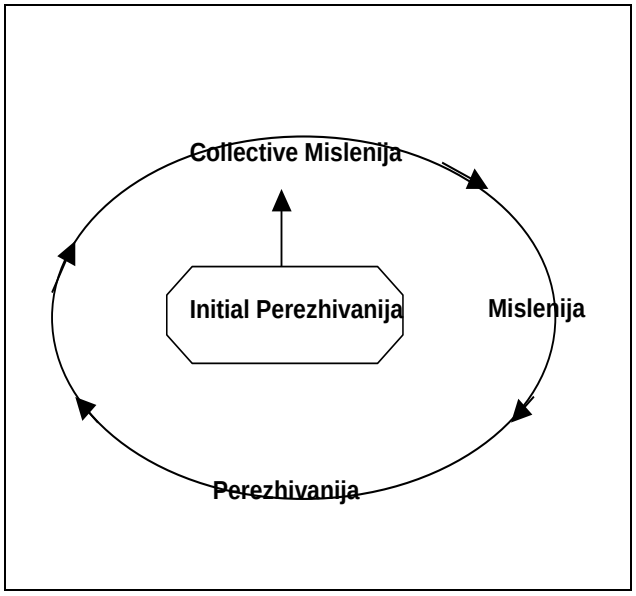

Figure 24: Perezhivanija and Mislenija

Figure 24 expresses the experience of these teachers, as they collectively and collaboratively underwent emotional and intellectual developments during their learning in a connective, supportive and cooperative environment. It illustrates how, at the start of the course, teachers experienced an initial *perezhivanija*. However, in this dynamic and interactive environment they applied a collective making of sense (*mislenija*) as they unravelled the intrinsic elements of this new milieu. As they became more confident, *mislenija* became a personal achievement as the teachers internalised the new elements of the ICT environment. However, *perezhivanija* remained with them in their quest for knowledge and skills, as they deepened their understanding and took the major challenge of applying ICT in their practices.

1. Learning How to Push Buttons (P)

At the beginning of the year, the teachers were uncertain and anxious in this new learning environment. Some of them experimented with the *different icons …* but *they preferred to look on…* They approached the teacher educator and others who *appeared to know more … to reaffirm what they were doing was correct*. They realised that they could solve ICT problems when they were supported by those around them, and when they interacted with their peers.

Initial *perezhivanija*

At this early stage of their learning, as they began their immigration to the information age the participants experienced apprehension and uncertainty; they went through initial *perezhivanija*. Doris, for example, *checked and rechecked with the teacher educator* and *those around her whether she was pressing the right button*. For Doris, the initial *perezhivanija* was an apprehension about the technology: *just in case they might break something.* The participants asked each other *where's the on button?,* especially Dorothy, who entered the university classroom, *looked around the room, looked at the nearest computer and the look on her face was one of horror!* In the first weeks of the course, Dorothy was often heard remarking: *I can't get this… I prefer to look on…* She was observed to be:

> *an older person who would say I've left my glasses at home and can't see what's written here, can you please read this for me! She would often make excuses and avoid sitting too close to the computer!*

In her first interview a few weeks into the course, Dorothy stated:

> *I've avoided learning about computers… I was just terrified of them, even now I've really had a bad start… I think being here and then writing things down all the time and trying to remember what to do, even if I don't think I remember when I go home and start doing it. It seems to just go into place if I don't stress too much. Or even if I try something and it doesn't work I just try another thing and it works. I think, oh, I'll write it down. I think just mucking around with it I learn or I can start doing what I did here. … Up until now, I've relied on kids.*

Like many immigrants, Dorothy often resorted to relying *on kids* (Maydell-Stevens et al. 2007, p. 188) to help her. She used her traditional ways of recording information – *I'll write it down* – and privately, she preferred *to start doing*.

Other teachers responded differently. Ashley said that he *would rather watch… write everything down… before he attempted to do*. He *had problems with logging into the network*. He asked

other participants *to show him how he could open Word*, … he *wrote everything down.* He felt that he *would never get the hang of this stuff!* Ashley *entered, observed* and then *left the chat rooms* without participating. To him, everything about ICT *was intimidating* …, he *didn't know what was going on* and he feared that he *might break something*. This initial apprehension and uncertainty revealed a complex system of "interrelated and interdependent elements including teachers, artefacts, the environment … and the teachers' experience of the interactions within the zone." (Mahn and John-Steiner 2000, p 1).

Nevertheless, this initial *perezhivanija* did disappear. The participants became acquainted with each other and with the technology, as they shared their *perezhivanija*. They could sense that they were not alone in their learning. These digital immigrant teachers were surviving and grouping into communities with other immigrants who had similar pragmatic needs in overcoming their initial *perezhivanija*.

These teachers began to interact and formed a learning community which enabled them to support each other in their *perezhivanija* and *mislenija*. Delia, for example, commented that *even at lunchtime at school we would meet and talk about what we did in class … or how to do something.* Prior to this course, these colleagues had never gathered in their school at lunchtime to exchange ideas and interact about ICT. However, this new university learning environment encouraged them to *gather … to learn and teach each other about ICT*. They found that *this technology stuff wasn't that bad.* They began to make sense of it through interaction and support. They also began to collectively *experiment with the different buttons …* and then *show each other*.

Working collectively to make sense encouraged interaction and the formation of communities that enabled the teachers "to identify with something – a need, a common shared goal and identity" (Hung and Der Thanq 2001, p. 1). The support of the community enabled their learning to begin to mature. The participants collectively made sense of ICT and enhanced their experience when they interacted and discussed the different icons and how to use them. They

also asked for assistance from the digital natives, that is, their students and younger friends and family members of their networks, for example *their younger brother in law, nephew* and *children.*

This new form of learning and teaching challenged the traditional teaching and teacher educator-orientated university methods of recitation and dissemination of knowledge, and increased opportunities for social interaction and reciprocal learning and teaching. The participants, by including other members within their networks who supported each other's learning and teaching, and by exchanging information and skills found that their *perezhivanija* lessened as their collective *mislenija* increased and they became more comfortable with this *technology stuff.*

2. Learning How to Apply Software (A)

The diminished sense of initial *perezhivanija* and its accompanying *mislenija* led to the participants doing, reflecting on, and indeed, knowing how to apply the software in their established practices. They were working in groups, exchanging information, and they would *show one another things* about *the program, its functions and how it worked.* They collectively reflected on how to apply the software in the university classroom and in their school workplaces for different activities. The collaborative culture of the university classroom enabled the teachers to exchange ideas, knowledge and skills about the applications. The teachers were learning from each other and from those in their social and professional networks, simultaneously. On returning to the university classroom, they often brought new information and they taught each other how to apply the software for different activities both in this university classroom and in their established practices.

This social milieu encouraged collaboration, interdependency and co-construction of knowledge. Collectively, the participants were making sense of their new learning (Vygotsky 1987). Within this study, this collective *mislenija* enabled the teachers to support and cooperatively assist the construction of each other's understanding of ICT. They drew on their

mutual knowledge and complemented their learning and teaching about ICT through social interaction (Vygotsky 1975).

They formed a *buddy system:* Ashley and some of the other teachers found this approach challenged them to cooperate and to collaborate in their quest to apply the software. For example, Ashley *showed* David *the morphing program, which he considers great for the preppies, but* David *thinks he can't apply it for his group of students.* However, David and Ashley commented on this sharing of knowledge and skills, that they *would have never learned this way before*. A transformation in the way that they learned when compared to their previous university experience was occurring.

The participants all commented that this university environment was different from their previous experiences of university education. Here, they *grouped together* (Penelope, Patrick and Patricia)*: socialising and showing each other how to do things.* Collective sense making and interaction, and the *doing* of activities allowed the teachers to exchange ideas; to *observe* and *reflect* on the activities; and to become ICT literate, as they immigrated into the ICT environment. Collective *mislenija* involved the assistance of others to create opportunities to think and reflect within a sociocultural experience (Vygotsky 1999; 1987). Ashley commented that although *FrontPage was a nightmare*, he still *learned how to zip files,* he *started to hyperlink* (linearly and in text form) and he *really learned new things with the help of everyone here and I'm still learning! …*He further stated that *the best thing that I've done for myself and my students was to enrol into this course.*

He explained to his colleagues about the interaction – the *doing thing* that occurred in this sociocultural setting that enabled him to develop strategies to transfer his skills into his established practice. Through collective *mislenija*, Ashley, in his collaboration and sharing of knowledge (McLoughlin 2008) especially with David, was no longer a 'lone ranger' (Douglas 1976) in the way he was learning about ICT. He shifted from *figuring things out by* himself to working with David. He *desperately wanted to succeed … and learn how to use this technology*

stuff. He also asked other participants: *how do I use it?* … meaning "How do I apply the software?". Simultaneously, he *showed* them *how to do it*.

Vygotsky (1999) links the idea of collaborative work and *perezhivanija* at the beginning of each activity with the practical shift in a new learning environment. He underlines the tension and emotion involved in collaborative work when learners are confronted with a new activity. In this research, that tension and emotion, centred on the learning of the applicability of new software, brought about a *perezhivanija* somewhat different to initial *perezhivanija*. *Perezhivanija* at this moment of learning comprised a curiosity concerning the participants' quest to know *how do I use it to* construct and share knowledge amongst their peers, rather than being transmitted to them by an authoritative figure such as the teacher educator.

The dialogue between the teachers and the teacher educator had changed in comparison to that of the traditional university classroom, as they confronted problems contextualised in real world activities. Dorothy's *kids had shown her how to use Internet banking* and one evening in class, she explained *the process to the group…who asked questions*. In the meantime, the teacher educator *looked on.* Nevertheless, as the questions from the teachers proceeded, he also *asked questions* that *allowed the teachers to predict the following steps* in their learning. Collectively and collaboratively, they developed strategies that questioned, summarised, clarified and predicted the workings of ICT.

The teacher educator did not give answers to the teacher learners' questions himself. Rather, as Philomena commented, though *he certainly knows a lot… he makes you figure things out...*The teacher educator created an atmosphere (Laird 1985) that encouraged teachers to construct and understand their own learning; they were able to develop and transform from previous learning states and experiences. This type of learning and teaching was crucial for teachers in generating and articulating their newfound knowledge and its application to their potential pedagogical approach.

The teacher educator frequently asked questions and the teachers themselves asked each other questions, especially: *how did you do it?* in order to clarify their own understanding of the ICT activities. The structure and ambience of this university classroom allowed the teachers to interact, ask questions and *do* the activities on the screen. In this cultural setting, the teachers asked questions about the ICT devices to construct a learning process previously unfamiliar to them in a university environment (Rizzo 2003). Their continuous and dynamic learning reconstruction in this interactive and supportive environment allowed them to confer, *do* and come to an understanding of the ICT concrete experience that the teacher educator had initially introduced and which he facilitated. The teacher educator maintained an authoritative presence in the room. He would *bring the class together to explain the features of the program.* The teachers would actively experiment, confer with each other to *confirm what the teacher educator has shown them… and whether* they *understood what he said…* Ultimately though, the teacher learners and the teacher educator collectively reflected on and made sense of the *new knowledge and skills*.

In addition to interpreting, perceiving, experiencing and making sense of their learning about ICT, the participants also, and immediately, taught others. They reinforced their new knowledge and skills and increased their desire to know *how to use this technology stuff.* Penelope found that in sharing her new knowledge with her school class, she also learned from her students and *it certainly was a different way of learning.* On returning to the university classroom, the teachers frequently demonstrated some of *the new things they were doing in their classrooms*. At this point, they also found that *they felt less threatened that* their students knew more than them, as Penelope pointed out to her colleagues. Their learning and teaching had certainly changed since they began the course.

Mislenija

These teacher learners were trying to understand the learning environment in which they were immersed and the devices of technology employed there: they were trying to make sense – *mislenija* – of the new ICT environment. *Mislenija* is the realisation of making sense (Vygotsky

1999) arising from the interpersonal (collective *mislenija*) interaction with the participants and their intrapersonal (individual *mislenija*) reflection on learning (Vygotsky 1999; 1987). Making sense of ICT encouraged teachers to interact further, and to experiment and to reflect in order to solve their learning challenges.

As Ashley began to use ICT more frequently, his confidence, knowledge and skills increased. Additionally, ICT began to make sense to him. He not only experimented with it, he also reflected and talked about what he had learned. He would *try most of the programs* that the teachers used in the university classroom. One evening after class, he commented that:

> *as a group, tonight, in class we learned how to search the web smarter. We had a go at google.com and I found this to be effective and 'idiot proof'. To think I can have a play with this and not go wrong was positive.*

The following week, he commented on his independence: *Hooray, I actually got the web site of the week to the bulletin board …* In that bulletin board script he made recommendations to other teachers on how to use that particular site in their own teaching.

The participants discovered that *mislenija* about ICT application and context built on previous teaching and learning situations. Text-based storybooks took on a new life and text-based portfolios became eportfolios, as evidenced by Phoebe in her school workplace. Phoebe employed eportfolios *with her grade one students and her principal asked her to show her school community the children's work*. Patricia reorganised her school literacy program, while others like Patrick enhanced his art classes by introducing paintings from the Louvre via the Internet.

Perezhivanija

As a result of the teachers making sense of ICT, *perezhivanija* was transformed into a healthy curiosity to know *how to do this stuff*. The participants lost their initial anxieties about the technology and *the fear that* they *might break something.* Their apprehension or *perezhivanija* was initially sparked by a realisation of how little they knew about ICT – for example, Pearl

pointed out that *you start to realise how little you know and how much you have to learn*. Patricia agreed stating *yeah, but you also lose confidence in your own learning* because she was uncertain in her own learning of particular elements of the technology. Patrick remarked, *yeah... but that makes you feel, that you need to learn more...* Penelope replied, with a sense of irony, *yeah right…* and then the group *started to laugh*.

As the teachers learned about a new program, apprehension reappeared, although in a fashion unlike the initial *perezhivanija*. Further into the year *perezhivanija* was concerned with the new knowledge, experiences, learning situations and processes, and the application of ICT in their immediate context. Additionally, they were unsure of their skills, lacked confidence and were not fully comfortable with the technology. They experienced deep tensions of apprehension and even fear (Vygotsky 1978; 1962) connected with living through or living over a new and unfamiliar experience, as they immigrated to the information age.

The participants realised, however, that they *could ask for assistance*, and Ashley wrote in his journal: *besides the preppies didn't really know much…* He became excited about doing a PowerPoint presentation; nonetheless, his *perezhivanija* concerned *whether the slide transition would work… this is something the other grade children can do…* Ashley *had seen the grade six students at his school do all sorts of things with PowerPoint* and he *wanted to show his preps how to do similar activities*. *Perezhivanija* was centred on the practical application of new knowledge and prompted the question *how do* I *do that?* rather than thinking "I am afraid of it!". The practical application of doing in turn led the teachers to a collective *mislenija*.

Collective *Mislenija*

The teachers cherished each other's interactive contribution to their learning. Ashley initially relied on David and Duncan, and he would also *write everything down just in case he might miss something*. Similarly, Delia remarked that *the group's been great… the way we can get together… even at lunchtimes at school; we would meet and talk about what we did in class… or how to do something.* At this point, they realised that through their ICT experience, they were

not alone in their learning. Instead, in the collective *mislenija*, they collaborated, *worked out the program, its functions and how it worked.* There was a *social thinking:*

> Patrick *and* Patricia *worked together and showed each other different strategies to achieve their goals and what they learned. Their collaboration had certainly increased their knowledge and skills as far as they were concerned. Both felt that they are collaborative learners, using visual cues and reinforcing orally what they were learning and confirming their knowledge. They wanted to confirm their skill acquisition and learning strategies by interacting with each other and other teachers in the classroom.*

These teachers made sense of technology through social interaction (Vygotsky 1975; 1962). They supported each other and cooperatively constructed an understanding of ICT. They drew on their mutual knowledge and complemented each other's understanding of the new insights and achievements.

3. Learning How to Change Practice (C)

Things had certainly changed, as Peg pointed out, and she and her fellow classmates were constructing their learning and teaching in a manner different from that of their familiar pre-digital environment. In this university classroom, the teachers made sense of ICT through engagement, *doing* and thinking through the application of ICT. Concurrently, they constructed new knowledge by building upon and joining the "tools and aids … [which in turn allowed learning and teaching to] sometimes run parallel and sometimes merge, each affecting the other" (Vygotsky 1975, p. vii) and began to change their practice.

This "parallel running and merging" occurred when they learned about the software in the university classroom. As Penelope stated, often when they returned to their school classrooms they would *show the kids,* who in turn would reciprocate by showing the teacher some extra features of the application. Initially in this interaction Penelope felt she was *losing control* and she often said to her students: *hold on boy,… I haven't learned that yet.* However, *this did not*

stop her from learning; she internalised what her students showed her and changed her practice to *include these features in her end of year presentation*.

Frequently, on returning to the university classroom, she showed her colleagues the new features of applications she had learned and, with time, she realised that this new form of exchange – where she learned and then taught others – was different to how she had originally learned in her pre-digital days. *Collective mislenija* and the *figuring out how to do the technology stuff* gave these teachers ideas on how to change their practice. They found that their students' activities were not restricted to paper-based activities and that *now they were constructing stories in PowerPoint.*

Perezhivanija

Although they depended on each other, the teachers' participation was accompanied by constant and repeated *perezhivanija* and emotional upheaval. For example, Philomena in her journal wrote about her experience:

> *Today I wanted to use my email and for some reason I sat there for an hour and a half. I sat at home, I couldn't find it, I was so frustrated I could have sworn and I don't usually swear. But I just wasn't sure that it was there and that was frustrating!*

Philomena experienced what Vygotsky notes as the fact that "behind every thought there is an affective-volitional tendency, … in the analysis of thinking" (Vygotsky 1975, p. 150). However, her frustration was alleviated with the help of her *twins* who *showed her how to find the icon for email*.

Another participant, Patricia, in her journal described the upheaval and traced her emotional development (Vygotsky 1999; 1981) in establishing the literacy program at her school. She recorded the impediments, changes and triumphs that she and her colleagues were experiencing in developing their ICT knowledge and skills, as they worked together which could be termed a learning community (Lave and Wenger 2003). At the start of her journal, she took *a photo of how the* literacy *program* was *thrown in different corners of the library!* and drew a picture of

herself: *this is me – frustrated!* However, at the end of the year she took another photo of the team working at bench tops and near the photocopier… *Life has certainly changed … and* she reported that *many hands make light work.* Her initial feelings of *perezhivanija* and her frustrations with technology changed as she discovered that software – in this case Microsoft Excel – could assist her in colour coding the literacy program and keeping track of its various elements. By the end of the year, her frustrations had turned into a positive experience *thanks to the team*.

With the assistance of the community and network, and as teachers felt *less nervous about all this stuff* (the ICT tools), *perezhivanija* took on a new form. It became a healthy curiosity in regard to how they would best apply their knowledge to a new situation. In her second interview, Doris commented:

> *I've lost that apprehensiveness* [*perezhivanija*] *towards computers. I'm willing to try things out… but I still need to write things down, just in case I miss a step… Sometimes I don't know where to look* [meaning on the Internet]*... there's so much there…* At another moment, she asked Duncan, *which program – Paint or that other one – is best when kids need to change this graphic…*

because she was apprehensive about not being certain about the application, she often approached her peers and others in her community to ask for assistance.

As Penelope engaged with technology her practice changed and her *perezhivanija* about ICT and its application also changed to a curiosity how *do I use this technology stuff* for my immediate needs. The teachers initially echoed that they *felt quite nervous* and they *had no incentive at all* to change their practice, but *this way of learning makes you feel quite good working on a computer*.

Nonetheless, even as these teachers began to change their practice and to make sense of ICT, *perezhivanija* was still present. However they lost their initial anxieties about the technology as a whole and *the fear that* they *might break something.* Their apprehension and anxieties resulted

from a realisation of *how little they knew about ICT* and *how much more* they *had to learn*. They knew that they could make sense of ICT and then apply it to their practice but it was the scope of their need for knowledge acquisition that perturbed them. Phoebe learned *about eportfolios in her university classroom* which *at the next professional development day* at her school she *showed her school colleagues*, how she *introduced her grade one's to eportfolios*. Patrick successfully found art sites on the Internet which he showed his students and university colleagues who *discussed the benefits of the Internet in their teaching…* and decided that there were *definite benefits there*…

Collective *Mislenija*

This *sharing and just in time learning,* commented Pearl, encouraged the teachers to ask each other: *show me how you did that…* and she further remarked that the *great thing here is that we learn from each other* and *discover new things that are practical.*

Although, these teachers were "allowed to self-discover and self-appropriate learning" (Renck Jalongo 1991, p. 31), they were simultaneously *discovering new things* to collectively make sense of ICT. During one session, the teachers were exploring the Internet to discover *something about research which was good*. Duncan, like some of the other teachers experimented *with a browser…to discover what* he *could find on the Internet…* He also pointed out to the others that his *friend told* him *there's some good things there* and as he believed that he understood the concepts, he said to Doris:

> *I'll show you. Simultaneously, he turns to the teacher educator and says: I've had problems with the browser … Over the weekend… even my friend who's a wiz on the computer couldn't show me …The teacher educator starts to explain what happens with browsers… but Duncan still maintaining his conversation with Doris, he says to her: I just tried to download another browser …. The teacher educator then explains about the two browsers to the group* [Duncan, Doris, Dorothy and Con] *and what happens.*

In addition to the self-discovery and intrapersonal abilities displayed by the participants, their learning experience as adult learners was social, interpersonal and practical and required participation in functional activities that could be applicable to their respective situations, needs and development (Knowles 1978).

These teachers developed their ICT knowledge and skills and they obtained information in a group learning environment, as they continued to:

> *systematically show the group* [Duncan, Doris, Dorothy and Con] *the other features of the browsers and the pages on the Internet.* Con *talks about the new way of doing research on the Internet… and how he uses the Internet for SOSE* (Study of Society and Environment). *The discussion is on how they individually use the Internet…* Dorothy *explains to the group, that she now can do her banking on the Internet … her kids showed her how…* Duncan *comments that's what my friend does… also he told her that his friend shops there…*

Thus, in collective interaction and sharing of knowledge these teachers connected knowledge and experience to make meaning of real world practices.

Interpersonal interaction and collective sense-making in a social context (Vygotsky 1987) helped these teachers to construct knowledge in a learning community. Their learning community, where social interaction and exchange of ideas occurred, encouraged the teachers to change their practice and activities from pre-digital to digital interaction.

Changes in the Practices of the University Classroom

On the whole, teachers were collectively and independently *engaged in doing*, *experimenting* and *reflecting* on their concrete experience in different ways, as they learned how to PAC; to push buttons (P), to apply (A) and make sense of the software, and change their established practice (C). Although, the teachers experienced anxieties and apprehension about technology, this *perezhivanija* developed into a healthy curiosity about how *to use this technology stuff.*

In summary, once the initial emotional anxieties and uncertainties disappeared, teachers collectively and individually applied the software and made sense of ICT. They began to form learning communities to interact and transform the new dynamic and continuous approach to learning and teaching. They also maintained networks that assisted and enhanced their ICT information. Importantly, *mislenija* and *perezhivanija* remained with the teachers throughout the research, albeit in a different form to the initial *perezhivanija*.

Perezhivanija and *mislenija*, especially *collective mislenija*, were fused as the teachers collaborated and interacted to move into the information age. This research confirms Vygotsky's (1999) claim that there is anxiety when learners are confronted with a new activity. *Perezhivanija*, as a healthy curiosity to know *how to do this technology stuff*, drove these teachers to make sense, resolve and construct new knowledge that was immediately transmitted to others within their immediate environment. As the teachers became more sophisticated in their ICT practice, there recurred a dynamic and continuous movement from *perezhivanija* to collective *mislenija* to individual *mislenija*.

Change occurred as teachers' confidence increased. They began to interact and ask each other *how did you do that?* And then *they would explain, show and do the activity*. *They would bring in and show everyone some of the softwares that they were using at their schools*. Con *brought in his laptop and showed his colleagues a program that* he *had been using with his grade sixes*. Additionally, other teachers were *showing one another how to zip their PowerPoints* for their final presentations. They were willing to learn from each other and teach one another the new ICT knowledge, skills and language.

In the immigration process, these digital immigrant teachers, like many geographical immigrants, experienced emotional elements of apprehension (Blau et al. 1998, p. 33) or *perezhivanija* and, through the establishment of networks and communities, the intellectual development of *mislenija*. That is, like immigrants they used their "cultural knowledge to organize [their] behavior, understand others and [themselves], and make sense of the world"

(Tsai 2006, p. 1). The "formation of a social network is a sociocultural experience" (p. 1) and within this ICT learning environment, in contrast to the traditional university classroom, the teachers. like many immigrants, organised "the very social institutions that were likely to benefit them" (p. 33) and depended on each other in their learning about the ICT devices and the new technological milieu.

Ashley expressed this development by saying that he *has to write everything down … then I go home and try it out… I find it hard here, everyone knows so much and the teacher educator goes so fast*. However, he reconstructed his learning process from being *frustrated* to *experimenting* with the concrete ICT experience. He experimented *with PowerPoint* and other programs, and with time he realised that there was no need to *feel threatened.* The building of confidence from initial *perezhivanija* to collective *mislenija* manifested itself as a confidence to take risks, to share and to mutually come to an understanding of ICT which, individually, these teachers would not have achieved.

The teachers in this collaborative and interactive context became active, engaged, and employed hands-on interaction with the software and collaborative experimentation with their colleagues. They undertook authentic ICT challenges within a collaborative and supportive environment. They also acquired a new language that provided them with new means to think and make sense of the new ICT environment in their problem solving activities.

The data clearly indicated that these teachers felt that they had achieved in learning ICT. They were solving problems and surviving in the digital environment of both the university classroom and their workplace classrooms. They had progressed from initial *perezhivanija* to *mislenija* about ICT. In the teachers' ICT knowledge and skill acquisition, they began to understand ICT and they began to speak the digital language, as they reflected upon their concrete experiences and actively experimented with ICT devices. However, within the span of one year they did not fully acquire the digital language nor could they speak it as do digital natives. Nevertheless, they were aware of the digital language and they bought their *USB stick* without the *kids.* They

no longer were apprehensive about ICT and they were beginning to make sense of it. On the whole, *perezhivanija* and *mislenija* were fused, as teachers were scaffolded into the digital world.

Section Three – Learning Practices

Scaffolding

"The metaphorical term scaffold, though never used by Vygotsky, has come to be used for interactional support, often in the form of … dialogue" (Clay and Cazden 1992, p. 219) on the interpersonal plane (Vygotsky 1987), in order to maximise the growth of intrapersonal ability within a sociocultural environment. Scaffolding entails the setting up of learning support structures for learners during the introduction of new knowledge, which can then be gradually removed as the learner progresses in skill and knowledge acquisition, until they are able to 'stand on their own'. The metaphor was developed by Jerome Bruner to reflect the construction of a building which uses "a temporary framework for construction in progress" (Cazden 1983, p. 6), but which comes to be freestanding as that work progresses and the scaffolds are removed. It is intended to complement Vygotsky's work (Wood et al. 1976) and is usually employed to describe the learning of language by children as mediated by a knowledgeable adult.

Aspects of scaffolding correlated closely with the observed learning process in this university ICT learning environment. For example in this study, the teacher educator and teacher learners interacted. The teacher educator initially introduced a new application and its accompanying language and processes before gradually relinquishing the learning to the teachers, as they moved from initial *perezhivanija* to collective *mislenija* and eventually individual *mislenija*. In the scaffolding, teachers became interested in *how to do* and use the concrete experience of ICT.

In scaffolding the learning of the mechanics of the ICT devices and their related actions, the encouragement on the part of the teacher educator, and the communities and networks the participants constructed, enabled the teachers to embrace ICT. In this study the gradual removal

of the teacher educator's scaffolding increased as the teachers made sense of ICT in their zone of proximal development.

Zone of Proximal Development (ZPD)

The ZPD "is often characterised as the distance between problem solving abilities exhibited by a learner working alone and that learner's problem solving abilities when assisted by or collaborating with more-experienced people" (Lave and Wenger 2003, p. 48). This interdependency is similar in many ways to the learning relationships observed in this study: the digital immigrant teachers were working alone and in collaboration with more-experienced people in their communities and networks. The concept of the ZPD is implicit in Krashen's (1982, p. 21) observation regarding language acquisition that "[we] acquire [knowledge],… only when we understand language that contains structure that is 'a little beyond' where we are now".

Scaffolding within a zone of proximal development (ZPD) happens "through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky 1978, p. 86). While an abstract concept, the ZPD became evident when it was realised that in this new learning and teaching environment, Penelope needed to become involved and interact with the other teachers. *Some of them knew more than her and she could learn from them*. The consequence of Penelope's learning involvement and *doing this course … allowed her to bring more technology into her* [workplace] *class.* Initially, she deemed it necessary that she have control over her learning and teaching. Later she realised that, through collaboration with the other teachers in the course, she had indeed acquired skills and knowledge not yet familiar to her. Such successful learning confirms Hammond and Gibbons (2005, p. 9) contention that classrooms "with high challenge and high support are those where scaffolding is most likely to occur, and where students are most likely to be working within the ZPD".

Penelope introduced PowerPoint, Paint and other applications that she learned in the university classroom into her workplace classroom. *Her own learning has been with the assistance of*

Patrick, Patricia *and* Danielle who jointly shared and problem solved the challenges of the ICT learning environment. They *scaffolded and compared their new ICT skills.* For example, Patricia said: *you see PowerPoint has similar features, so you can use it in the classroom…* or when Patrick, *an Art Teacher* [,] *informed and enlightened the others* with his knowledge of *the Internet and the different sites, such as the Louvre.* Learning occurred through the guidance of more capable or knowledgeable individuals in the ZPD.

Vygotsky originally proposed the zone of proximal development (ZPD) as a metaphor. It refers to the sociocultural activities where what Vygotsky calls the intermental and intramental planes appear. The intermental plane refers to the social interactions where an individual mediates with others, while the intramental plane is where the individual, after mediation with others, internalises learning (Van Der Veer and Valsiner 1994; Vygotsky 1978). For example, Con said:

> *it's OK, when I explain this to you* (Duncan) *I'm also reinforcing my own knowledge and rethinking my learning*

Or as, when it was observed that Ashley explained to David *about*:

> *Hyperstudio's icons, he used a similar program – Kidpix! He felt comfortable because he could scaffold this knowledge … now I'm starting to see some connection (meaning the graphic application).*

That is, these teachers worked together, shared a common purpose and common information, and learned and internalised the different skills and information necessary for further ICT learning in the two planes.

Vygotsky (1962) also referred in the ZPD to a complex chain of activities that is dynamic and consecutively joins individuals from one link, along with all its attributes and knowledge, to the next link. This dynamic learning and enculturating process fuses, and guides the learners through the acquisition of new knowledge. Learners scaffold from previous links and acquire new knowledge and skills that they in turn pass onto other teachers and so continue the chain. For example, Philomena mentioned that Peg's *been a terrific help, very patient, very thorough,*

step by step, and if, [Philomena] *needed any help* Peg *seemed to know the stuff*; she was able to guide her through the learning process. Philomena also mentioned that at her workplace:

> *they're helpful as well, and one in particular who is many years younger than her, he will never do anything for her. He'll say, you know how to do this, so do it yourself. He guides more than actually takes over, he'll say no, you do it yourself, which has actually made her more confident and she has actually remembered and learned it* [technology].

The teachers acquired certain skills; but simultaneously, they also learned to guide other learners. It became obvious that these teacher learners required an extensive network to develop their new knowledge and skill base and so attain their learning objectives and progress to the next transitional period of their learning. Phoebe *asked her younger brother in law, ...* Polly *asked her younger brother, ...* Philomena and Peg *asked* their *children, ...* Patrick allowed his students to assist him. However he was careful to remind them that *there are things that he can do and they can't: like sign a chequebook*(!).

Vygotsky (1987) maintains that learners in an interactive, social and collaborative environment follow each other's examples. They gradually develop abilities to perform certain tasks without the guidance of more knowledgeable learners. They become independent by *grabbing onto what others know and* they *take it from there* as Polly pointed out in her second interview. Ultimately, learners internalise knowledge by appropriately transacting with the assistance of others (Vygotsky 1962).

In summary, through social interaction and in communities of practitioners, the teachers interconnected when the teacher educator, or more capable learners among their own groups, guided them through the task and shared in the problem solving process. The scaffolding in this ZPD encouraged a positive support system that enabled the participants to learn ICT and acquire the appropriate ICT knowledge and language.

The data showed that the participants started the process of socialisation in their communities on the interpersonal plane to maximise their learning and adapt to the ICT culture in the new learning environment in which they found themselves. Patrick and his community provide an example: *as an art teacher,* Patrick *felt comfortable in using Paint now* (half way through the year), *he showed his university colleagues some of the things he was doing…* Patricia *asked him how he introduced this activity to his students* and he explained the process that he had learned in the university classroom. Similarly, Patrick found himself increasingly *using the appropriate language to explain the icons in Microsoft Paint*.

ICT Language

Vygotsky (1999; 1978; 1975; 1962) stresses that language, in the form of speech is a device for social contact and interpersonal communication when shaping and transforming experiences (Morrison and Guenther 2000). These teachers transformed their pre-digital experiences and made meaning of and internalised their experience (Vygotsky 1975; 1962) in the ICT context. Through collective *mislenija* and interpersonal communication, they acquired an understanding of the ICT language. They were beginning to understand the digital language. However, they spoke it with a digital accent, meaning that they had a 'foot in the past" (Prensky 2001a p. 2) in regard to technology. The accent manifests itself in such things as:

> printing out your email (or having your secretary print it out for you – an even "thicker" accent); needing to print out a document written on the computer in order to edit it (rather than just editing on the screen); and bringing people physically into your office to see an interesting web site (rather than just sending them the URL)... [Prensky's] own favorite example is the "Did you get my email?" phone call. Those of us who are Digital Immigrants can, and should, laugh at ourselves and our "accent."

But this "accent" can also become apparent in the language employed by digital immigrants. The designation of 'pushing buttons' as a way of learning in this study, is itself an example of a digital accent in that it refers in part to the activating of functional icons with a software program by the click of a mouse rather than by a physical pushing of a physical button. The digital lexicon is vast and often unfathomable to pre-digital learners. Peg mentioned that she had lots of new words to learn. Philomena pointed out that sometimes *I don't understand them* [the words] *but you get the gist of what's happening*.

Vygotsky (1987) wrote that as learning develops on an interpersonal plane it takes on an intrapersonal dimension as the learner acquires an 'egocentric speech' to create thoughts about the immediate perceived experience. In just this way the teachers in this study began to use and understand ICT and its language. Initially they used limited language: Patrick asked Patricia: *how did you do that?* Her reply was *change the whole thing. Here, look over here, she turns the screen towards* Patrick, *I did this first and she shows him the process.* Although, their language

was limited, they worked together and they *did* the actions. Ashley and David often interacted and:

> Ashley *explained the process to* David – *take yourself to …. Windows… (showing him everything on the screen) For reinforcement* David *says: is this the way?...* Ashley *explains again*…, *Whilst* Con *and* Duncan *check what the teacher educator said… in here, you need to place this section, once you've done that, then return to this part and here you need to copy this line …*

Hence, with the minimal employment of the few words of digital language yet available to them, a bond was created in their common experiences and understanding of their new environment. Regardless of their limited ICT vocabulary they collectively adopted the necessary actions to function effectively in the new environment of ICT. These teachers learned a few words pointed to the objects or icons on the screen and they understood each other in the facilitative and collaborative community they had developed.

Although, Vygotsky (1962) does not refer to immigrants, he does use examples which display comparable features when explaining language acquisition. He states that minimal language is initially used when learning to communicate and action is used to express language needs (p. 26). Similarly, teachers used actions and minimal language in this university classroom. The teachers pointed to the screen when explaining an action or activity. For example, Con explained to Doris the copy and paste process of word-processing applications: *now you go to edit …cut… copy … paste* but in doing so betrayed a digital accent by *pointing to the icons on the screen* rather than using the pointer to indicate their location. Penelope showed Danielle the same process of copying and pasting; *copy this, now place this here … right mouse click*. Notwithstanding their limited initial ICT language, the teachers' ICT communication and language development increased over time. Gradually, the teachers internalised learning and teaching of technology and began the process of enculturation into the ICT environment.

In his "Thought and Language" (1962) Vygotsky makes note of the development of word and thought. Language learning advances from one word to "simple sentences to more complicated

ones, and finally to coherent speech made up of series of such sentences, in other words, he proceeds from a part to the whole… [This process] develops through a slow accumulation of functional and structural changes" (p. 126).

The same process can be equated to these digital immigrant teachers' learning of ICT and is comparable to the three stages in the ways of learning as proposed by this study: P~>A~>C. Learning ICT language for the teachers in this study was just as Vygotsky identifies. In learning how to push buttons, the teachers, collectively, learned about the different icons/buttons of each program. They learned a new language from the small parts towards a larger, more complex whole, from words to simple sentences and finally complex sentences (Figure 25).

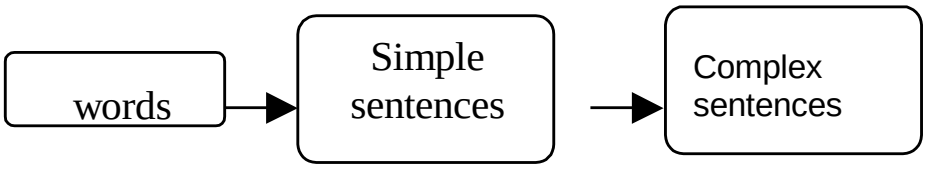

Figure 25: New Language

Adult immigrants learn language in this fashion where they initially learn words to progress to more complex sentences, though they may never reach the fluency of natives. These teachers learned about technology in a similar fashion similarly to immigrants learning a second language. They learned about simple objects such as buttons and software, and this allowed them to collectively realise the power of expanding into the language and thoughts of ICT application in their workplace and lives (Vygotsky 1975; 1962).

Such an observation is informed by, and confirms, an important component of Vygotsky's ZPD and Krashen's (1998) notion of language acquisition; that such learning is active and best achieved in collaboration with others. Vygotsky believes that speech develops from the social to the individual (1987) and learning becomes self-directed and functions on the intramental plane, that is, it displays utilisation of intrapersonal ability.

The teachers in this study pointed to the screen and muttered to themselves the process … *copy ... cut… paste*. These actions and the minimal speech helped them reorganise, plan and achieve focus on their actions by directing themselves to the action. This private speech can also be equated to the Penelope's *thinking out aloud and making sense of PowerPoint* that Penelope stated approximately midway through the course as she was applying the software to her practice. The thinking out aloud enabled her to transform the way she presented material in her library: *Now, I have a kiosk* [PowerPoint] *in the library instead of posters*.

As the teachers' language and knowledge increased, and as their constructed communities provided them with scaffolded knowledge they felt more comfortable *to talk with their ICT coordinators* and were beginning to understand the language. As Krashen (Schutz 2007, p. 1) claims, language acquisition "requires meaningful interaction in the target language – natural communication – in which speakers are concerned not with the form of their utterances but with the messages they are conveying and understanding". They began the immigration process that developed with the assistance of their networks. However, even though they exchanged their newfound knowledge and skills, and could now convey their meanings in an understandable if rudimentary digital language the journey was not completed within the academic year. They did not theorise about the ICT pedagogy nor join the digital natives in their advanced forms of learning.

Acquiring New Language During the Three Ways of Learning

The participants' language and learning evolved during the year, as they learned how to push the ICT buttons (P). During this time of learning how to push ICT buttons, teachers often *pointed to the screen* and *icons*, using their simple digital language to show their actions. The fluency of their language increased to the level of being able to construct sentences as they began to experiment and think through how to apply the software (A) and finally they willingly changed their practice (P) using ICT (Figure 26). The language used by these digital immigrant teachers is displayed in the Glossary at the beginning of this thesis.

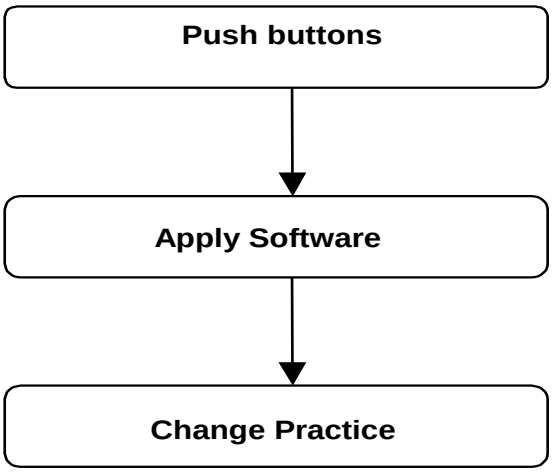

Figure 26: Three Distinct Ways of Learning

1. Learning How to Push Buttons (P)

Initially, the teachers' language was simple (Vygotsky 1962) and they pointed to the various buttons on the screen to indicate and give meaning to their actions. For example, Doris' screen *had fingerprints on it* and often she pointed to a particular icon to imply *what she wanted to do;* she had not *learned the names of the different icons*. Initial *perezhivanija* regarding their lack of ICT knowledge became apparent as they learned the basic elements *just in case ... they did not understand the IT guy … who knew so much*. Philomena told her community of practitioners: *I'd rather take the kids with me when buying this stuff... even if it's a bother taking the twins...* The participants were apprehensive about their new learning experience, the new technology, and the fact that they *did not know things even with the preppies*, as Ashley pointed out. Ashley's personal upheaval subsided when he realised *they really don't know much*. However, within their communities they collectively developed the ICT language, ideas and an awareness of the possibilities, knowledge and applicability of ICT (Laferrière 1997).

These teachers focussed on the collective acquisition of knowledge and skills in their present social and cultural context (Vygotsky 1962). In this new learning context they were placed in an upheaval, analogous to that experienced by immigrants, (Kozulin et al. 2003) arriving in a foreign country. Their upheaval developed out of necessity to attain their qualification and they collectively assisted each other in conceptualising the requirements of attaining their

qualification and learning the language of ICT, so that they could communicate in the new culture in which they found themselves. However, as their circumstances changed and they gained self-knowledge, and confidence they became conscious of the how and why of ICT.

The successful application of some of the ICT devices to their workplaces and in their personal lives stimulated the teachers' confidence. They started to use the digital language. In accordance with Krashen's (Schutz 2007, p. 29) finding of a "consistent relationship between various forms of anxiety and language proficiency in all situations, formal and informal" they learned more successfully in the communities that assuaged their *perezhivanija* confirming "the relationship between low anxiety and language acquisition" (p. 29). They felt comfortable in talking the digital language amongst themselves and increasingly with others as they developed awareness and some understanding of the concrete button pushing ICT experience. For example, Peg told Philomena that *technology is like a second language there are lots of new words…* and Philomena replied: *Yeah, sometimes I don 't understand them but you get the gist of what's happening…*

These teachers, like second language learners began to incorporate, experiment and apply some of the ICT possibilities that previously were foreign to them. They in turn felt that they were becoming part of the 'being digital' population (Negroponte 1995). Ashley in his journal wrote about his experience with a floppy disk that he could not open. However, he experimented and finally turned to *the IT specialist at his school* who showed him *how easy it was once you ask someone!* The IT specialist also showed him *how to insert a picture from a file… Another BIG achievement!* Although, Ashley became frustrated he gained enough confidence and received enough support to experiment with the concrete experience, even read *the material on the Internet*, however his *homepage* was still *organised in a linear fashion*, betraying his digital accent. As Clyne (2002, p. 3) contends of immigrant second language learners: "The more comfortable people are made to feel in their new country, and the more their self-esteem is safeguarded, the more their second language acquisition progresses". Ashley and his university colleagues had entered the digital environment and as their *perezhivanija* dissipated they began

to use simple sentences (Vygotsky 1962). However, they were not, as would have been expected of teacher learners in this environment, "participating in collaborative spaces … and getting actively involved in progressive discourse" (Laferrière 1997, p. 3) about any ICT pedagogical theory.

2. Learning How to Apply Software (A)

Mid way through the year, another distinctive way of learning appeared in this environment. Although the teachers, sporadically and periodically in the first half of the year, showed interest in how to apply the software, their language was still simple. They were no longer merely pointing to the screen and the different buttons on the screen. They were talking about the devices of respective software and how to apply them, even if this was "without total mastery of the basic applications (word processors, spreadsheet programs etc)" (Laferrière 1997, p. 2). And they were willing to experiment with concrete ICT experiences and name the icons when *telling each other how to do*. They were willing *to do* ICT, *tell each other about the* different Internet *sites* and share their knowledge of how they were able *to do the activity* in a particular software program. They collectively thought and exchanged ideas about their work and discoveries.

Patricia was proud of the fact that now she was able to explain how to use Microsoft Excel. She was *telling the others how they were all learning together*. She focussed on issues that concerned her and she was able to utilise the literacy database immediately. She used the language of Microsoft Excel; *rows … cells… etc,* like many of the teachers when sharing her knowledge with colleagues and explaining her insights about this new device. Importantly, Patricia felt that *at long last* she was making sense of *some of the software, especially Excel*.

Other teachers, like Dorothy, talked about their practice and how *they're using the software – like sending emails*. Her practice was related to the technical facts of the technology, and employed reasoning and judging the skills and knowledge of herself and others to create new ways of doing things. However, Dorothy like the other teachers did not expand into the complex

sentence use (Vygotsky 1962) that would correspond to pedagogical examination of the theoretical aspects of ICT learning.

In her second interview, Dorothy described how her life had changed and stated that one of the new possibilities in her life was just *sending emails, something she had never done before*. At the beginning of the course, the *thought of sending emails frightened her* (*perezhivanija*). Now she had *figured it out* (*mislenija*) and was *doing it all the time*.

A change occurred and the teachers began to rely on themselves, their colleagues and others in their community and network. They were collectively making sense of the technology (collective *mislenija*) and *speaking to people* about ICT; they *bought their own USB sticks*, *talked to the ICT technician at their school.* They *bounced ideas off each other*. The teacher educator noted that *they rang* him *less and if they did want some assistance, they emailed* him. They talked the language of the digital world, although it was limited and simple (Vygotsky 1962) and still heavily accented.

Their simple language and classroom management routines of spending "x minutes a day for email, x hours … to learn how to use a specific application" (Laferrière 1997, p. 2) had not changed. At this stage, these teachers were limited in language, time and energy to become dedicated to the task of incorporating a variable classroom management routine. On the other hand, their interest lay in the practical aspects of acquiring ICT knowledge, skills and the concrete experiences. Their learning was 'just in time' and for immediate needs. However, their discourse and collective reflection did not relate to pedagogical theorising but only to concrete technical issues.

3. Learning How to Change Practice (C)

During the year, the teachers became more responsible for their own learning and more receptive to change. They were *learning together* and they did not solely rely on the teacher educator to explain all the features of the software. They collectively and individually connected their knowledge of Microsoft Word to new software. They progressed from *pointing to the*

screen and *icons*, that is the single words on the screen, to simple language about the technical aspects of the software. Next they experimented and thought of ways to utilise their new ICT knowledge and skills. They changed their practices and combined their newfound knowledge "in a variety of teaching and learning strategies, particularly of those calling for a high degree of participation" (Laferrière 1997, p. 3) and *doing with hands-on activities*.

They began to *do activities, show* and compare software applications as well as *think* about the usefulness of particular software, although, they were not always well-informed about the software. For example, some teachers confused PowerPoint and FrontPage, indicating their superficial awareness of applications in this learning environment. Yet, their ICT language and knowledge acquisition expanded their horizons. They were transferring their newfound knowledge and skills into their workplace and their personal lives: Delia and Pearl *during Multicultural Week at their schools organised a PowerPoint kiosk.*

They started to discuss and reflect on the introduction of ICT into their established practice. They started to think of different possibilities: how their projects could be improved, and how their students could use ICT. For example, Patrick *incorporated the Internet* into his grade six students' art projects where they often *visited the Louvre*. Besides, he *liked the idea of sharing* where he *showed the others* (Patricia, Penelope and Danielle) *the different sites about art* and in particular *about the Louvre*. He also *told them that the Internet is really good for research*. As a result of this sharing Patrick and the other teachers attempted to connect their existing professional knowledge to their practice with specific ICT possibilities.

Their approach to technology was transformed and *perezhivanija* became a healthy curiosity to try new things. They were curious to know how to apply ICT to their practice. They began to think about *plan*[ning] *and document*[ing] *guidelines on what teaching in each year should be about*, and they discovered, and Penelope pointed out, that *some of their students lacked basic ICT knowledge and skills*. In fact, they began to expand their thinking on how to change some of the practices in their workplaces by incorporating ICT. Their language expanded and when Patricia introduced and explained her Microsoft Excel database for the literacy program, she

spoke of the *rows, columns and cells* and it was observed that *these are now familiar to her and her colleagues.* Phoebe introduced eportfolios instead of text-based portfolios into he workplace. It was observed that she *talks about the hyperlinks … although they're linear…* The participants were growing to understand the technical aspects of the software programs and when they did not understand a term, they returned to their community and often *asked each other if one of them knew what it meant*. However, they still felt *perezhivanija* and they *needed to be in control… in control* of the teaching and learning in their classrooms.

During this time, some of the teachers showed that they were becoming less apprehensive in speaking the digital language as when they were *explaining to each other about the folders within Windows Explorer*. Many of the teachers explained to their colleagues the benefits of using PowerPoint and graphics programs. For example, Ashley showed a morphing program that he used with his preppies: *this is really good when showing how evolution occurs,* he told his colleagues. The teachers were comfortable in showing their technical knowledge to each other as they made sense of this new environment. As Krashen (1982, p. 31) states: "low anxiety appears to be conducive to second language acquisition, whether measured as personal or classroom anxiety". They began to speak the new language, using the ICT terminology of the digital native, although this language was rather limited and basic.

The participants began to integrate the technology into their professional discourse. They had a practical understanding of the ICT language, although their comprehension was limited. They used the technical language. However, the digital immigrants were not fully aware of all the implications of the technology in comparison to digital natives and often displayed their digital accents. They were not fully enculturated into the information age. Additionally, they were undergoing a practical learning struggle, as they were shifting from one form of learning into the next (Vygotsky 1987). Yet overall, they were successfully integrating and applying ICT in transforming their learning and practice.

Conclusion

These experienced teachers originally learned the words of ICT as they began to push buttons. Their gaining of simple ICT language in explaining the technical aspects is comparable to Vygosky's theory (1962) about the language acquisition of children, who commence with words and develop to using simple sentences and then complex sentences. It bears comparison to the acquisition of a second language by immigrants as they attempt acculturation in their new home. Teachers became acculturated to the world of ICT; however, they did not venture into complex ICT language. These teachers did not reach the stage of doing any theorising about ICT pedagogy. Nevertheless, they did migrate into the digital world and crossed the boundaries of ICT learning by acquiring simple technical language to be able to survive in their immediate environment. However, they did not approach the fluency of digital natives within the academic year. On the other hand, they were working towards obtaining their digital residency, even if digital citizenship was still a distant goal.

During their ICT learning struggle, growth and development, the teacher learners as digital immigrants went through a Vygotskian (1999) process of *perezhivanija* (*переживания*) and *mislenija* (*мышления*). They experienced emotional and intellectual developments as they adjusted to, and had their learning scaffolded within, their ZPD. Initially, teachers entered the ICT environment feeling *perezhivanija*. They were ambivalent about the new experience. However, they knew that they needed the qualification to progress in their careers and to understand the happenings in their students' lives in the ubiquitous ICT environment. In order to make sense about ICT, teachers employed collective and individual *mislenija*, so as to understand software applicability to their practices.

An essential component of learning is the interaction with others and the cooperation with peers as scaffolded learning aids the overcoming of *perezhivanija* and development of *mislenija*. Learning is not a solo activity. It is the interaction with others and the mediation of devices that changes the learning process from earlier didactic, from-the-lectern learning approaches, to collaborative, networked and community-based learning.

Learning for teachers in this instance entailed scaffolding from their previously known learning environment; *doing* and *experimenting* with the ICT *concrete experience* in an *interactive*, *collaborative* and *supportive* sociocultural context. These teachers, as adult learners, were reflecting and thinking about their experiences and in the *doing*, they made sense of ICT. Thus, the participants were observed to have *learned best by doing* where *mislenija*, in a scaffolded learning environment within their ZPD enhanced their personal emotional and intellectual developments.

This chapter examined the emotional (*perezhivanija*) and intellectual (*mislenija*) developments of these experienced teachers in making sense of ICT. It examined the learning transformations, language changes and sociocultural interaction within their teachers' ZPD (Vygotsky 1978; 1962), as they scaffolded from previously known teacher educator-centered learning. In this new digital environment, the teacher educator facilitated learning and teaching and a community of learners became active (Knowlton 2000). In the process, teachers left the shores of the pre-digital world, and began their journey in the new digital landscape of the twenty-first century.

The next chapter seeks to explain how the teachers made progress to a state of digital residency and eventual citizenship, and discusses the findings of the analysis of the participant's' learning and teaching within Vygotsky's framework of *uchit* (*учить*). It examines andragogy with reference to teacher education and teacher professional learning.

Chapter Seven – Residing in the Digital World

Introduction

As the teachers in this study revealed their learning, and reported their experiences in the university classroom, it became obvious that teacher professional learning was indeed a more complex undertaking than simply the learning of new skills or of taking a personal development class. The participants made implicit, and often explicit, connections between their own learning needs, the immediate pressures of their professional work, and the practices of their profession. Their learning was embedded in their own practical experiences and was expressed most clearly in their professional discussions in the university classroom, and by their interactions with students and colleagues in their schools. For some, these discursive connections were very powerful, for others less so.

The previous chapter discussed the ways in which learning had transformed for these digital immigrant teachers, as they pushed buttons, applied software, and changed their practices over the year. It was observed, too, that their emotional and intellectual responses were accompanied by an enhancement in their capacity to speak and understand the language of the ICT environment. These digital immigrant teachers also adopted a range of skills, knowledge and understanding of the ways in which they worked and learned. They were showing leaving the familiar and comfortable shores of the predigital world, and were starting to feel at home and, even, to belong in the digital world. Their communities and networks of practitioners were critical elements in their learning about ICT and its application to their teaching practice. The members of these networks comprised the teacher educator, their fellow teacher learners in the university action research program, as well as their workplace colleagues, the students in their schools, and their friends outside the educational environment. The networks created a collaborative, supportive and scaffolded environment where these digital immigrant teachers acquired and shared information. Through their interpersonal interactions within their communities of practice, the teachers supported each other in a meaningful and appropriate

context (Lave and Wenger 2003) while at the same time, they made their hesitant transitions into the complexity of the information age towards digital citizenship.

This chapter explores how these digital immigrant teachers were leaving the shores of the predigital world and learning ICT to meet their immediate needs for survival in the new world; how they immigrated together to the information age. Further, the chapter outlines how the transition became a deep and rich learning experience for these teachers. The purpose of this chapter is to report on the analysis of the data using Vygotsky's theory of learning and teaching. The study has revealed that the participants' learning and teaching changed as they immigrated and adapted to the new land of ICT. They had been shifted from the traditional didactic university environment to a context in which student-centeredness, diversity, action, reflection, and application of ICT were encouraged, and they were able to change their practices towards obtaining their digital citizenship. And in the struggle towards digital citizenship, new approaches to living and practices were observed.

This chapter proposes a new concept, which encompasses the particular, special, and complex learning arrangements of professional teachers in a collaborative yet unfamiliar process and context. A discussion of the sophisticated roles of teacher learning and the teacher educator is presented to illustrate how these teachers gained what is termed their digital residency and entered the information age. Vygotsky's ideas of learning and teaching play a central role.

Vygotskian Learning and Teaching

Vygotsky's theory of *uchit*, which connects learning and teaching, provides a critical framework for explaining the journey of these digital immigrant teachers. Vygotsky used the term *uchit* (Vygotsky 1999), to describe an integrated learning and teaching practice; one in which a master teaches and apprentices (learners) learn together and pass the information on to less knowledgeable learners within a social context (Lave and Wenger 2003). The social context ensures *uchit* is not an isolated event but consists of the interaction of the master and apprentices. The apprentices, once they are familiar with 'the trade' (i.e., the body of learning) are no longer peripheral members in a community. Instead they become masters themselves and teach younger members of the community. The learning circle displayed in Figure 27 expands and repeatedly unfolds as the amount and complexity of work increases, and these new masters become full participants and, in turn, teach others 'the trade' (Lave and Wenger 2003). Traditional teacher education encourages this approach, as do 'train the trainer' (UCLA 2008; Skeff 2008) and other models in which specific skills are taught and then the participants teach others.

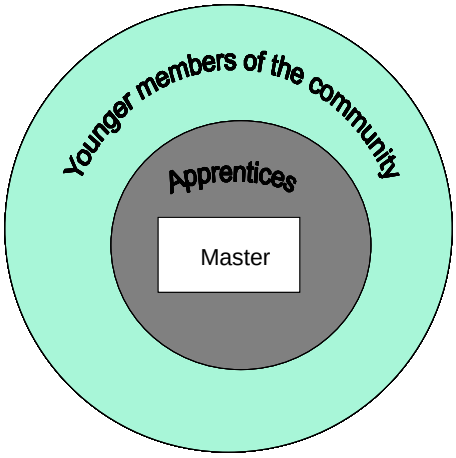

Figure 27: Vygotsky's Uchit

In this study, similar happenings occurred, but also, *uchit* was an interactive process. The learners returned and shared their knowledge and skills. Note has already been made of Patrick, *showing different sites to the others* (Penelope, Patricia and Danielle), pointing out that since *this is the way* he *learns*, and that *when* he *shows others*, he *also learns*. He learnt on two planes: intermental and intramental plans which can be seen to fuse and connect learning and teaching, and in so doing became Vygotskian *uchit* as teachers *figure out how to do this technology stuff*. The two planes did not exist as separate and distinct entities but were entwined as the teachers approached *uchit* through both collective and individual sense making.

Over time, as the teachers learned how to push buttons (P), apply software (A) and change their practice (C), *uchit* was seen to emerge from the process of sense making or *mislenija*. Initially, the teachers were learning from the master (the teacher educator of this class) and more capable individuals (often their own students or family members). Over time, they found that they were not *just observing*, but also were *doing*, *showing* and *sharing* with each other. In this environment, they were no longer uncertain inhabitants merely watching, but were becoming participants in the process of learning and teaching. They were making the transition from a hesitant digital immigrant status to a position approaching the competence and confidence of the digital citizen. In brief, teachers were becoming digital citizens and attempting to acquire their digital citizenship through *uchit* after immigrating to the new land of ICT by following three ways of learning.

Uchit in P~>A~>C

On arrival in the new university environment, these teachers could be compared to immigrants newly arrived in a foreign land which they knew must now become their new home. They had attained their original teacher qualifications in the predigital world, a world where ICT was minimal and played only a minor role in learning. They were not familiar with the new ICT world, but knew that their professional futures were dependent of this journey and so enrolled in a course that applied the principles of action research and conceived learning as social practice. They perceived that they would have to "harness the linguistic and cultural differences [which were] imperative to building [in their case, a digital] citizenship" (Johnson and Kress 2003, p. 9). They realised that they had to develop "a reciprocal relation between [themselves] and practice" (Lave and Wenger 2003, p. 116).

The social practice of this course encouraged the teachers to develop competence in ICT use and over time, to gain confidence in their learning processes. Initially, they had a hesitant digital immigrant inhibition and often *reminisced about the 70s and 80s and what classrooms were like*

then. The social practices of the new classroom supported *uchit*, in which the teacher educator and their more knowledgeable classmates tried *to lead the others and showed icons, breadcrumbs etc in WebCt.* The more able participants remembered the metaphors that they learned from the teacher educator, especially when he explained about the language of WebCt: *remember what* the teacher educator *said about breadcrumbs and Hansel and Gretel?* Such metaphors resonated with a number of the participants, as they expanded their language to enable communication with digital natives and become part of the digital world. They realised that by harnessing the new language and understanding the digital culture, they would be able to participate in the digital world, especially when practical actions in that new world were successfully accomplished: now they could *buy their own USB stick … without the kids.*

They also showed that with time the *perezhivanija* (apprehension) concerning the technology developed into a curiosity, through which they gained knowledge and made sense of the ICT context by *doing and mucking around with the technology.* They were also observing, imitating, and co-operating with each other, and undertook activities in a facilitative and interactive environment. In this interactive and action-packed environment, they scaffolded from previous known activities to the new information. These practices revealed the applicability of Vygotsky's insights about *uchit* as learning and teaching (Vygotsky 1999) in their three ways of learning.

1. Learning how to push buttons (P)

At the beginning of the course, Dorothy *sat back and observed the others.* She stated that she *preferred to watch others ... and listen to what* the teacher educator *had to say*. The teacher educator *gathered the teachers and showed them, on the data show, the different buttons.* He also allowed them to discover how to push buttons: here, they could *just muck around with the technology*. The teacher educator did not dictate instructions or dispense information from the lectern. Instead he encouraged Dorothy, and the others to press *the different buttons in Microsoft Word* ...[and, as a consequence,] *they learned what the buttons did.* They also *asked each other about the buttons/icons on the screen*. Vygotsky speaks of the importance of more

knowledgeable and experienced persons imparting new knowledge (Vygotsky 1962). In this instance, the teacher educator introduced the unit of study and the participants observed the teacher educator and each other, especially their more able classmates, and they passed their newly acquired knowledge to others in their workplace classrooms *the next day.*

2. Learning how to apply software (A)

With time, the participants extended this practice of sharing knowledge about the buttons, to learning about the software. Making sense of the buttons was essential in learning how to apply software and provided a process of scaffolding their learning. They began to *make worksheets in Microsoft Word, especially* Phoebe, who designed *worksheets for her grade ones.* Once the teacher educator had explained PowerPoint, Pearl and Delia *organised a kiosk in PowerPoint for their school's multicultural week*, whilst others used PowerPoint for their students' portfolios. When they had completed these activities, they showed their university colleagues who asked: *how did you do that?* The interactive nature of *uchit,* which was characteristic of the practices observed during the research, encouraged these teachers to respond: *you do this ... and then that*. This intertwining of learning from and teaching others increased and deepened their knowledge and aided the progress of their journey towards digital competence.

Their competence was further extended as they *relaxed in using the ICT stuff* that the teacher educator introduced to them. They began to experiment, and also to reflect both collectively and individually, on how particular software could be applied to their workplace. What eventuated at this stage of learning was that, the teachers were no longer peripheral users (Lave and Wenger 2003) of the software. However they did not graduate to full participation like digital natives who could "twitch switch" the technology (Prensky 2003), that is, react with the lightning reflexes necessary for mastery of the digital formats, switching from one form of learning to another in an ICT where they are not restricted by linear learning. Instead the learners explore interaction with ICT and take ICT opportunities to be engaged in learning (Stevens 2007). Nevertheless in their communities, the teachers exchanged ideas on how the different softwares could be applied and how their practice was changing. They were moving to

'becoming digital' (Negroponte 1995) where "lifestyle and attitude and usage of [the] computer presence moment to moment" (Negroponte in Bass 1995, p. 1) is second nature.

3. Learning how to change practice (C)

These teachers were not "novices who 'should be instructed' [in their practice, but rather they were] teachers in a community engaged in its own reproduction" (Lave and Wenger 2003, p. 76). Like new arrivals planning to stay in a foreign country, these digital immigrant teachers were engaged in becoming familiar with the new milieu in which they found themselves and to which they hoped to adapt their own lives and practices. The participants realised that in the ICT environment, technology was here to stay and they had *to learn this technology stuff*, and teach it. Importantly, they found they could all learn from each other and engage in "a reciprocal relation between persons and practice" (Lave and Wenger 2003, p. 116). In time, they began to change their practices and to learn from, as well as teach, their own students.

Beyond *Uchit*: A Collaboration and Reciprocity

The reciprocity between the digital immigrant teachers, with members of their various communities, and with their networks of practitioners encouraged an extension of *uchit* for the organisation of production and changes in practices. In their collaborative projects, the participants formed "trajectories of persons through different forms of participation" (Lave and Wenger 2003, p. 84) where participants interact with the different masters from whom they acquire a number of differing skills as they leave each learning community and move towards another community to learn other skills (pp. 18-19). They allowed ideas to be developed and information to be classified within collaborative projects (Wilhelm et al. 1998). For example, Delia and Pearl collaborated in a multicultural week project at their school and in the university classroom, they *asked the others for assistance to make sense of the web*. The result was that they learned from each other and their different communities. *Uchit* was extended and together, they all constructed new knowledge and made sense of ICT.

These reciprocities assisted learning and teaching. Lave and Wenger (2003) comment, in their descriptions of apprenticeships, on the access to learning resources and the different degrees of integrating these resources in the forms of production. For Lave and Wenger the community of practitioners shares its knowledge in both formal and informal ways, and participants move from peripheral to full participation over a period of many years. This study was confined to only one year and although the digital immigrant teachers did not move to full participation or digital citizen status, they did share different learning resources. They emailed *urls … that could be useful* in their classrooms and informally; they developed networks of practitioners (such as their school's IT co-ordinator) who *knew so much more…* In the formal settings of the university classroom, they formed their own communities of practitioners to collaboratively decipher and apply their newly acquired ICT knowledge.

Learning and teaching had certainly changed for these teachers. They *were all learning from each other*. Their *learning was so different* to that which they had experienced in their formal education in the predigital era in a traditional didactic university environment. In that environment, the teacher educator was the master and the teacher learners had been the apprentices. In such a traditional educational environment the "master-apprentice relations are diagnostic of apprenticeship; and that learning in apprenticeship offers opportunities for nothing more complex than reproducing task performances in routinised ways" (Lave and Wenger 2003, p. 65). The notion of apprenticeship also incorporates "participation in segments of work [which] increase in complexity and scope" (Lave and Wenger 2003, p. 80). Vygotsky (1962) also notes that the concept of master and learner, which is closer to the schooling concept, creates interdependency in a Zone of Proximal Development (ZPD). The ZPD "is often characterised as the distance between problem solving abilities exhibited by a learner working alone and that learner's problem solving abilities when assisted by or collaborating with more-experienced people" (Lave and Wenger 2003, p. 48). This interdependency is similar in many ways to the learning relationships observed in this study: these digital immigrant teachers were working both alone and in collaboration with more experienced peers and other members of their communities and networks. That is, it was observed that *uchit* extended beyond the master-

apprentice relationship, the apprenticeship notion and the immediate interdependency of the teacher learner with the teacher educator.

In the environment of this study, the teacher educator was no longer the sole transmitter of knowledge and information which the participants were required to internalise. He was not the master seated at the front of the lecture hall, but rather became an active participant within the community of learners. And so the community disseminated information and skills, exchanged and shared the making sense of ICT amongst itself. This kind of support included opportunities for *uchit*, yet the notion expanded to include the participants' own transmission of their learning by their immediately teaching others.

In this immigration process into the information age, *uchit* was seen to expand as these teachers became involved in *doing, speaking,* and *thinking* about their projects together. Ashley and David organised their students' portfolios. They discussed the process of making sure all the files were transferred onto their USB sticks. On one occasion, David *left behind some student files on his school's server.* However, he informally contacted *the IT guy and found out how to transfer the files.* David and Ashley reflected on David's experience. This action proved important for David, as well as for some of the other teachers, as a means of engagement in structured formal and informal social relations with different members of their expanding communities and networks during their accumulation of concrete experiences related to their learning.

Application of Vygotsky's ideas leads to a recognition that the study's digital immigrant teachers learned not only from their attention to the teacher educator, but also from their colleagues and friends, and from their work with students in their school classrooms. This study found that teachers could *acquire* the necessary ICT knowledge and skills, and the *next day,* they *could use it in* their *classroom* and in other situations. In the university program, Philomena *learned to surf the Internet one evening, where she found lots of information on the newspaper*

sites … and the next day, she showed the other librarians the good stuff on [T]*he* [Herald S]*un* [Newspaper] *site*.

The practices of the digital immigrant teachers in the university classroom indicate a new approach to learning and teaching. *Uchit*, in Vygotsky's original conception, is a unilateral and restricted process of learning, and is part of traditional university practice. In this environment, this concept of *uchit* was limiting for these immigrating teachers. At this point, straightforward practical application was not the only representation of Vygotsky's *uchit*. In this research, *uchit* also became evident elsewhere in the reciprocal interactions and collaborations within a network of practitioners as well as a community of practitioners. This reciprocity is a previously unacknowledged dimension of *uchit*. A new concept is needed to denote this newly recognised practice of learning. This study will employ the term *hyperuchit* as a way to convey Vygotsky's original learning/teaching concept of *uchit* with multiple and unpredictable nodes and connections.

Hyperuchit

Hyperuchit describes the learning of these teachers who were immigrating to the information age by experimenting with their concrete ICT experiences. The use of the prefix h*yper* indicates the application of *uchit* beyond (over and above) the unilateral relationship between a master and apprentices (the teacher educator and teacher learners of this study). It indicates multi-dimensionality and interactivity; an encouragement of learning and teaching via multi-dimensional reciprocity and collaboration, within a network and community of practitioners with varied reflexive information and skills. It encourages movement: forwards, backwards, and indeed, in all directions in the learning and teaching approach.

Hyperuchit is a shift from the unilateral function of *uchit* and becomes a decentralised method of information dissemination which "offers different pathways to users, … [and] provides a means of arranging [learning and teaching] in a non-linear manner " (Snyder 1997, p. 126). It

encourages learners to connect, link, and move information and ICT in non-sequential and rapid ways amongst and between people and technologies. As a result, *hyperuchit* begins to blur the boundaries between the learner and the teacher in the network, allowing teachers and learners to navigate, negotiate and incorporate links, ideas and activities, in a manner similar to the decentralised structure of the Internet. In this way many teachers and learners can manipulate learning and teaching concurrently in their networks and communities of practitioners. *Hyperuchit* operates in an environment that encourages simultaneous action and collaboration, in which individuals overcome *perezhivanija* and develop *mislenija*, as they reflect on their actions. *Hyperuchit* represents the observed learning practices of the participant teacher learners in this study, especially in the final stage of their participation, when they explored the integration of ICT into their personal and classroom practices.

By reflecting on their actions, the digital immigrant teachers of this study were learning and teaching in their networks. What they were learning and teaching from and to their networks and communities, they were reflecting upon and then applying the practical knowledge and skills to both their practice and their university learning. They were willingly sharing and collaborating to enhance the information and skill dissemination. Here, each participant learned and immediately passed these further skills and information on to others. They were simultaneously learning and teaching, with emphasis placed on social learning and teaching processes rather than on their receiving didactic instructions.

Building on connections between the analysis of the data using Kolb, Gardner and Vygotsky – most notably the latter's concept of *uchit* – this research reveals a deeper level of learning for the application of ICT. Furthermore, the research identifies the stage at which teachers were able to transfer not only knowledge, but also pedagogical *approache*s, but without actually reflecting on the underlying pedagogical theory of their own teaching with ICT, in their classrooms. Significantly, they were able to also make this connection in the context of the quite different skill set in their digital native students.

Their own learning experience took place in the context of a university classroom with a digital native teacher educator whilst they, the teacher students, are immigrants. This is in sharp contrast to the participants' own workplace classrooms, where their students are digital natives, while they, the teachers in this context, are immigrants attempting to become new citizens in the digital world. Such a scenario requires that they not simply replicate the teaching that occurred in the university context, but rather must develop a specific set of teaching and learning approaches to apply in their own practices.

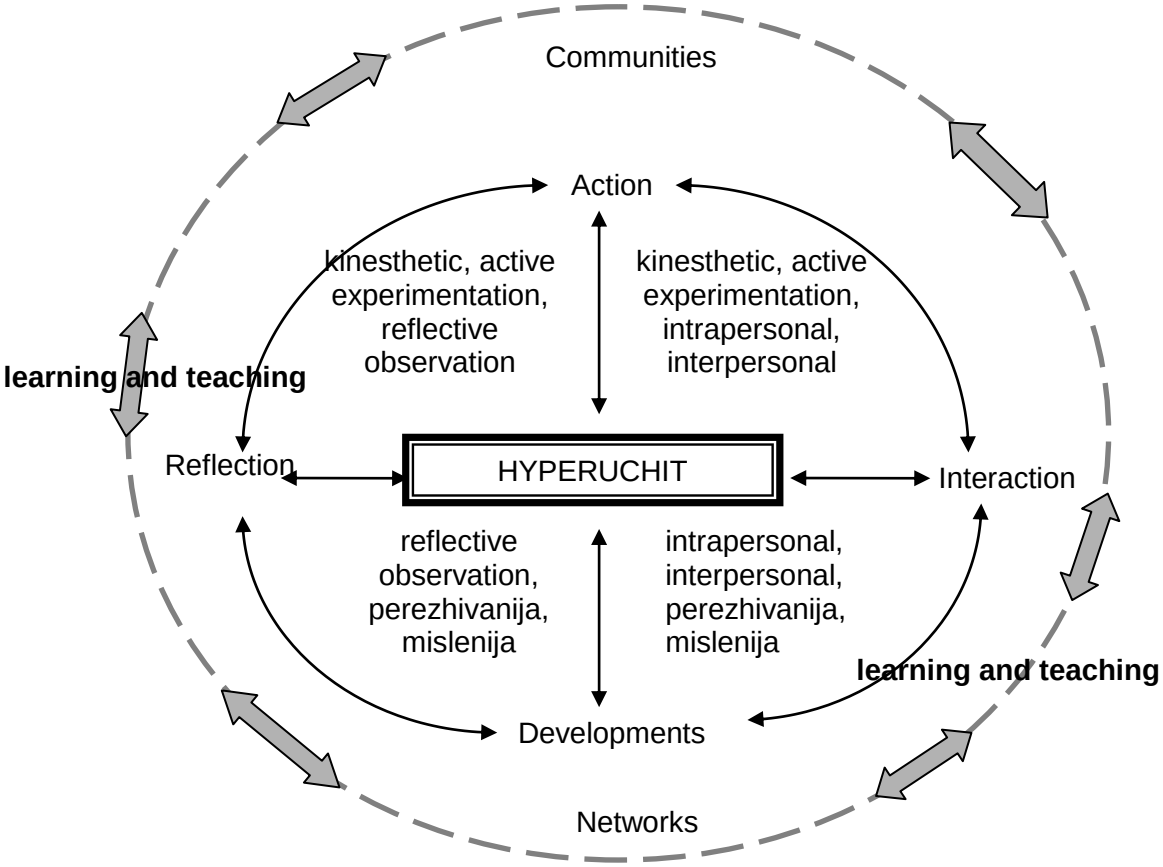

Figure 28: *Hyperuchit*

Hyperuchit consists of reciprocal and continuous learning processes utilising the identified Gardnerian abilities, as well as emotional and intellectual developments (Figure 28*)*. The observed evidence indicates that *hyperuchit* consists of developments involving *perezhivanija* and *mislenija* using collective, individual and kinesthetic abilities. On returning to their community of practitioners, the teachers used the abilities to relay, reflect, and actively experiment. In addition, they began processing the information after intermental and intramental reflective processes regarding the concrete experience to transfer their newly acquired

information and knowledge into their existing practices. Although, they were still struggling with the digital language and spoke with a digital accent, the participants of this study were directing their learning towards digital citizenship and immigrating to the new land. *Hyperuchit* will now be discussed in its relation to the observed three ways of the learning process experienced by the teachers:

1. Learning How to Push Buttons (P)
2. Learning How to Apply Software (A)
3. Learning How to Change Practice (C).

1. *Hyperuchit* and Learning How to Push Buttons (P)

Initially, the participants questioned each other and those in their communities. They *often checked and rechecked with* the teacher educator *to make sure that they understood what he had said.* The participants also referred to their colleagues and students, and to their outside networks. They *asked about the different buttons* but would *often turn to* each other *to show ... what* they *had been shown.* They learned and immediately they *showed one another*.

They were assisted in their endeavours and struggles to understand ICT by this collective and collaborative environment. For example, they collaborated in *showing one another the icons on the screen, they discussed the breadcrumbs in WebCt*. Although *they didn't understand these breadcrumbs* initially, they *were working together and trying to understand what's on the screen.* Finally, Con *worked out ... that's where you went to last.* The teacher educator *watched them,* and *finally gave them the idea of Hansel and Gretal and breadcrumbs.* This metaphor ended their learning struggle and enabled them, through their exchange of learning, to make sense of at least this aspect of the new cultural milieu.

Social interaction was crucial in the learning process. *Hyperuchit* reinforced the interdependence of the participants in internalising and making sense of ICT, whilst they acquired their knowledge and skills in a community of practitioners (Lave and Wenger 2003). The digital immigrant teachers *did not feel isolated… and that they were the only ones, who did*

not know this technology stuff. Through social interaction and increased participation, they gained confidence and felt more competent to use, show one another, and internalise what they were learning in their communities.

2. *Hyperuchit* and Learning How to Apply Software (A)

The social interaction on the intermental plane noted above, encouraged teachers to further internalise their learning, and they began to focus on how to apply the software. Penelope, for example, after showing her workplace colleagues how to push the buttons in PowerPoint, was *one day at recess* asked if she could *demonstrate how to apply some of the features of PowerPoint*. She found this *so exciting … I went home that night and thought all about it … the next day, in the afternoon, I showed an activity using PowerPoint … but you know what,* she told her university colleagues, *the kids had so much more to show me*. She *began to show her* university colleagues, *some of the PowerPoint projects that the kids came up with*. They were delighted and praised her for sharing her knowledge. Patrick said: *yeah, this is what this is all about*. The participants preferred to transfer learning into practice and they demanded that their learning be relevant to "their accumulated experience and wisdom" (Kolb 1984, p. 6).

As adult learners, they had years of experience, and they expected to actively participate and exert some control over their learning (Knowles 1978) and teaching. For example, Phoebe's PAC journey initially consisted of her actively experimenting at the beginning of the year with her new computer. Once she had developed some technical know-how, she asked questions about PowerPoint in the university classroom and of her external social network, especially of her younger brother-in-law. She added value to her practice through these interactions, by learning about eportfolios, for example. Phoebe was another of the participants who anticipated building upon her existing teaching knowledge in learning about ICT, and then applying it to her existing practice.

3. Hyperuchit and Learning How to Change Practice (C)

By applying the software to their practices, the participants also solved problems and were consequently able to transfer knowledge and skills: a component central to adult learning (Knowles 1978). Moreover, these teachers became responsible for their own learning. Besides the incentives and motivations linked to their internal priorities in gaining recognition for receiving a further qualification, for example, learning was relevant (Davis 2005) immediately to their workplace. As a consequence they were willing and able to change their practices. For instance, Delia and Pearl learned about PowerPoint in their university classroom and instead of displaying posters for the multicultural week, as before, they, now, employed a *kiosk in PowerPoint to bring their message about multiculturalism to the pupils and parents* at their school. They found that they were able to learn *one day* and then teach *the next day* others in their communities and networks. Pearl learned *about the Internet one evening in class … came home … and stayed up till 1 am on the Internet* and the *next day … showed her students and* Delia *what she had found on the Internet.* The evidence from this study indicates that the teachers preferred to be involved in learning and teaching, and that the *hyperuchit* model encouraged such a reciprocal participation: they were active, they were interacting with participants in their communities, and they were relating new information to previously learned (scaffolded) information and experiences. This facilitated their understanding of the new concrete information and their ability to utilise it immediately.

With *hyperuchit*, the teachers gathered knowledge and information from multiple sources. Also, they formed "trajectories of persons" (Lave and Wenger 2003, p. 84) through their known networks and communities of practitioners who assisted them towards acquiring the requisite 'twitch-switching' (Prensky 2003) of the digital native. Nevertheless, they were not at the level of mastery of the digital citizens whose sophisticated engagement with ICT enables them to enter into the process of constructing "a more civil society with [these] powerful technologies" (Katz 1997, p. 9) by virtue of their extended connectedness. Instead these digital immigrants remained firmly within their known communities and networks of practitioners and practices but were willing to tentatively explore new ground. They did not venture too far into the

activities of the natives whom they taught. For example, they did not *spend hours on the Internet chatting* like their children, although Peg did comment that *it certainly is fun.* But obviously their approach and attitude towards technology had changed. They now possessed a degree of understanding of the language that their children were using and, as Peg further commented: *I can see why my kids and their friends spend hours doing this stuff.* These teachers had moved from their initial *perezhivanija,* and through participating in *hyperuchit, mislenija* enabled them to participate centrally in some activities, though more peripherally in others.

Development of *Hyperuchit*

This last section reveals how *hyperuchit* developed in this study. The participants' ICT language and experiences, as well as their notions of learning and teaching (especially their understanding of university education), began to expand. They experienced emotional and intellectual developments through their growing reliance on reciprocal actions, reflections and interaction in their communities and networks of practitioners, and experienced a concomitant decline in their reliance on a sole teacher educator dispensing text-based, didactic learning.

In summary, the teacher educator became both a guide and a facilitator, as well as one of the participants and a co-learner. They were *all learning together.* The teacher educator became the consultant and expert, but also interacted and collaborated within the community. He was part of this community of learners. He often actively took the role of a co-learner with the teacher students as when, for example, Con brought *his laptop to class to show everyone KidPix ... a program many had heard about ... but they had not seen.* The teacher educator *said that he had also heard about the program, but he had never used it ...* He *listened to* Con*'s explanations and asked questions ... at the end of the presentation, he got involved in a discussion about the program and how it could be used in the classroom.* In this instance, he was a co-learner while Con took on the role of co-teacher. And the teacher educator facilitated the conversation, rather than giving didactic instructions about the program's use.

Figure 29 represents the concept of *hyperuchit* as the reciprocal interaction which was such an important component of learning and teaching in this environment With the reciprocity of *hyperuchit*, the teachers obtained knowledge and information from multiple sources, including friends, students, younger members of networks, their children, peers and, of course, the teacher educator, who was able to return these benefits in his own teaching and learning role.

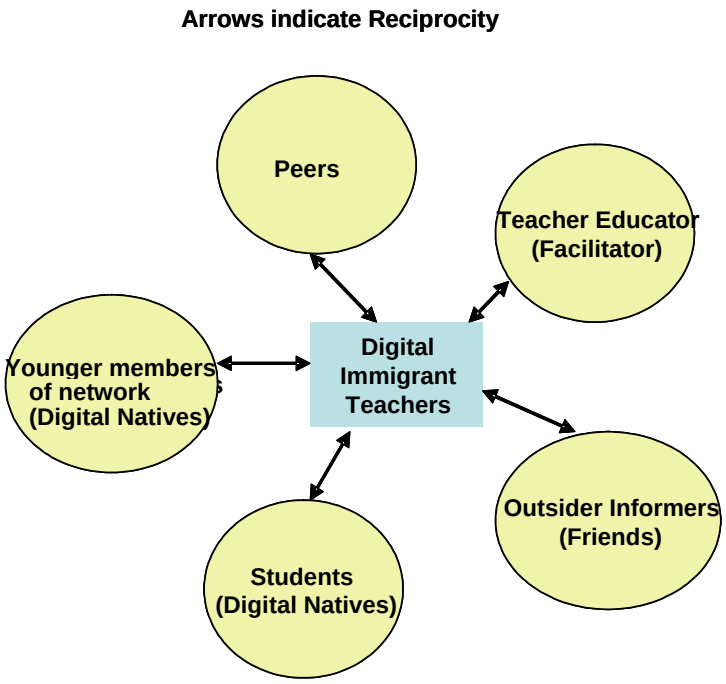

Figure 29: Hyperuchit in the information age

Further to this interaction, and the performance of 'hands-on' activities, the participants were reflecting on how to employ the three ways of learning (PAC) with and within their communities and networks. It should be noted however that the participants were concerned with *how* to employ this process rather than on *why* it was so valuable and should be used. They were linking their experiences of the new technologies and were reflecting on their actions, but not on the pedagogical theories underlying their learning and teaching. The participants' journals became valuable resources as a means to illustrate these reflections. For instance, Phoebe initially wrote in her journal that she wanted to apply *text, effect and pictures* ... and *replace scrapbooks*, however throughout her journal, the reflection is on 'how' she is changing her practice, 'how' she is experimenting with *lots of hands-on activities* and 'how' the activities have become *better than scrapbook*; at no stage does she question 'why' these process may be so effective.

Hyperuchit and the Teacher Educator

This new approach of interacting, doing and reflecting in the learning, application, and teaching of ICT was accompanied by a renewed role for the teacher educator who led the program. The teacher educator's approach changed from being the single individual or master in didactic teaching methods to that of human mediator (Kozulin et al. 2003). He became a kind of knowledge broker, setting learning objectives, and showing and explaining how to use the technology while interacting with the class. Additionally, he mediated between the learners and the symbolic ICT tools (Kozulin et al. 2003), that is, as mediator, he "select[ed], change[d], amplifie[d], and interpret[ed] objects and processes to the" (Kozulin 1998, p. 60) learners. As Polly pointed out: *he picks what software we will learn,* but he no longer was the only *figure of authority* but rather an active member of the communities and networks of practitioners present.

The teacher educator adopted a *different* learning and teaching method to that which was familiar to these predigital teachers. In their initial teacher education, the participants had became familiar with a cultural setting in which the transmission of information was from a single individual – the master – in a didactic method, or as Vygosky has it, *uchit*. Peg who had previously attempted to *do ICT professional development* said: *the* teacher educator in that course *just told us press this …* and *we did everything together, it was all conducted by him, I didn't do anything, I didn't learn anything.* However in the university setting of the current study, she noted that the teacher educator *was there in case we needed him.* He encouraged the teachers to interact and form communities of practitioners, where he *became the knowledge broker who created and sustained the learning environment*. Participants *would seek, find and acquire knowledge from* their community. They saw the teacher educator as the organiser or *the facilitator* of the learning environment as Penelope confirmed in her journal: *I think* the teacher educator*, yeah it's just facilitating, to be there and allowing us to ask… even if the group of us don't know what we're doing we can say to him: "Hey, help"*.

He was also seen as an expert and consultant: he was the teacher. Polly in one of the interview sessions stated, *I wouldn't have been doing it* (PowerPoint) *if he weren't there to guide us just*

as I suppose in any teaching role. That is, he showed that he was the person "in charge of their learning ...[; who] clearly knows, and can do, a lot [; who has] a high level command of content or skills[; who knows] how to deal with questions[; and who is able] to deal with unexpected classrooms events" (Brookfield 2006, p. 59). As Philomena stated: *by making us do it and having to explore it ourselves. Sometimes I've had some things lost and I've felt silly… but he would just find it! … It's an important role because he's basically teaching you*.

In this study, the teacher educator's method changed as the participants began to learn how to learn according to the PAC process over the course of the year. The teacher educator responded to the participants' developing practices and their day-to-day successes in their learning and application of ICT.

1. The Teacher Educator and Pushing Buttons (P)

Initially, the teacher educator, as the master showed his apprentices, the teacher learners the different buttons or icons in the software. He would *gather them around the datashow…* or *draw their attention to the icons … how they functioned* and *what each* did. And then he *gave them time to play*, to experiment, and to reflect on the mechanics of the buttons. Penelope pointed out: *this is so different to when I went to college …*

2. Applying Software (A)

The teacher educator did not direct the teachers in how to apply the software, but instead encouraged them to apply and experiment with their newfound knowledge themselves, and only intervened when they experienced problems; when they *turned to the* teacher educator for help. For example, Peg and Penelope *were having trouble with the datashow*, and Peg *eventually turned to the* teacher educator, who was *answering* Patrick's *question about the multimedia program* that Patrick had seen *one of the kids show another teacher at school*. The teacher educator showed Peg and Penelope *how to set up the datashow*. Peg was then observed to have *turned to* Pearl and Delia *to show them what* the teacher educator had *showed her*. The teacher educator *looked on, as* Peg *explained the process…*

The teacher educator established a secure atmosphere in which teachers could approach him and then, *shared* and *showed*, after considering the individual knowledge, skills and ideas about learning and teaching applicable to the individual participant. For instance, Ashley wanted to *learn about morphing*, since he now *taught the preppies*. In order to address Ashley's individual requirements, the teacher educator and Ashley often *emailed each other about the morphing process*. Once Ashley had learned how to apply the morphing program, he *brought his finished product to uni*, where *he told* David *how he learned the program: this is great, when teaching the kids about evolution.*

The teacher educator's method encouraged participants to introduce different programs into their workplaces. The teachers did not perceive him as the controller of learning and sole disseminator of knowledge (Knowlton 2000). They saw him as a guide, who facilitated, discussed, and encouraged them to learn how to apply and experiment with different softwares. In effect his actions served to dissipate the participants' *perezhivanija* and encourage their confidence and curiosity. He encouraged the teachers to learn by exploring different ICT possibilities, by reflecting on the possibilities, and by encouraging them to share the knowledge. However they remained aware of his mastery of the topic and found that he *always seems to know … how to figure out this IT stuff.*

3. The Teacher Educator and Changing Practice (C)

As the participants' attitudes became more positive and they became more relaxed with ICT, *perezhivanija* was dispelled and manifested itself as a lively curiosity. And, as *mislenija* deepened their understandings of ICT, they began to bring new ideas, from their networks and workplaces, into the university classroom. In these instances, the teacher educator became one of the participants and listened as teachers gathered around each other's screens to listen and discuss the different activities and the new information.

These digital immigrant teachers discussed and made sense of it to try to *fit it into what they already know …* For instance, it was observed that Con:

> *discovered a new program that he installed on his laptop. Con is showing the teacher educator,* Duncan, Peg, Philomena, Doris and Dorothy *the new program. He is explaining the features and how similar they are to Microsoft Word. He points out that it is better than Word* [in combination with] *graphic programs because it's all in one… He shows them how to draw, use the graphics and then make a storyboard with the program…* Doris *comments that it looks easy to use… The group discuss some of the benefits that they can see…*

In this instance, the teacher educator was not the disseminator of information, but was a participant in the community of practitioners, as they all interacted and joined the discussion. The cultural ICT setting of this university classroom was constructed to encourage interaction and participation, rather than the traditional university approach of "verbal disposition by a single individual" (Ekeler 1994, p. 86) or the "traditional 'sit-and-get' training sessions of one-time-only workshops" (Riding 2001, p. 283).

Moreover, the teacher educator's method optimised an atmosphere that allowed communities of practitioners to flourish. He also encouraged the participants to talk within their network: *they're great … you should get to know them …* and the result was evident by the year's end. The participants were required to present their action research projects and they did so successfully, even though, a number of them encountered a few problems. However, this did not deter their learning. Instead they were willing to approach people in their network. For example Patricia *told* Danielle and Penelope, *our IT guy's been wonderful, he knows so much, I just didn't realise how much there is in this technology stuff*. David said that he:

> *couldn't understand what happened to all his graphics, he was sure that they were on his stick! … the IT guy straight away worked out that I left it on the school network… Once the IT guy showed* David *how to make sure all his files were in the correct folder …* he also *showed him how to zip all his files*.

David then *showed* Ashley: *it's so easy.* The teachers were encouraged to share their experiences in a collaborative and reciprocal approach. Additionally, they were encouraged to reflect on the what, why and how of the technical aspects of ICT and how they might learn to meet their goals (Fidishun 2006; Davies 2005) of learning: *how to use technology better … the next day*.

Their reflection shifted to different software packages and how to apply the software. In their communities, they were *thinking and doing, explaining how the software can make life easier for them*. Through social interaction, many of the participants discussed the application of particular software programs and how transferable the programs were to some of their classroom activities (see Chapter Five). The social milieu fostered by the teacher educator encouraged collaboration, interdependency and co-construction of knowledge. In line with the proposals forwarded in this study, the *collective mislenija* enabled teachers to support and cooperatively assist the construction of their understanding of ICT. They felt that they were not alone in their learning (Chapter Six) and were operating in a culture that enabled them to exchange ideas, knowledge and skills about the applications.

From the collected data in this study, it is clear that the teacher educator *created* an environment where he facilitated the participants' learning and guided them, as they took "their foot out of the past" (Prensky 2003, p. 1) and immigrated to the ICT environment of the twenty-first century. The teacher educator oversaw this change in their learning and their immigration, albeit using methods different to those employed in the traditional didactic university learning environment. He was the person who *was there,* just *in case* they *needed him,* as the participants pushed the buttons, applied the software and changed their practice through *hyperuchit* and enabled their immigration to the information age.

Opening the Gates

In this study, *hyperuchit* opened the gates to digital immigration: in the university classroom in which they now found themselves, the teachers' learning had changed. The study indicates that change occurred when teachers were *doing*, interacting and reflecting, individually and collectively, with their communities and networks. The research found that the:

- Doing and action were situated in authentic contexts, in multimedia format; teachers had access to materials and resources in their personal practice;
- Interaction supported the multiple ways and abilities to develop collaboration through communities and networks; that is, one to many, many to many, in synchronous and asynchronous communications;
- Reflection allowed teachers to make sense of the existing teaching and learning situations to incorporate ICT into practice.

Above all, teachers were supported through their *perezhivanija* and consequently *mislenija* developed enabling the teachers to begin to adopt the new form of language necessary for their assimilation into the new digital world.

Over time, the teachers began to understand, and they were not afraid to attempt to speak, the language of computers (Prensky 2001a). Technology had opened new challenges and a new world, in which they could *see so many more things … the Louvre … it was easy to visit the great art places of the world*…

Although initially during the *hyperuchit* process, the teachers began to understand the language, they still reacted and behaved somewhat similarly to newly arrived immigrants in a foreign country. They asked their children to help them; they associated with each other, interacted, collaborated (Jupp 1966) and often took on 'hands-on' activities to achieve immediate and individual goals. However, as Hopper (2006) points out, technology exposes people to different experiences and interconnectedness, and these teachers realised that this experience *certainly was different …* from when they *went to college.* They also grew to realise that in order to survive in the information age, they needed to speak the language of the digital natives and that

they needed to incorporate the new, diverse and uncertain social environment into their workplace practices; their learning and teaching had to accept change.

Finally, the teachers were feeling that they were beginning to belong – from communities of practitioners in the university milieu and workplace users to networks of ICT common knowledge and sharers. These digital immigrants, with their digital accent, were lifting their "foot out of the past" (Prensky 2003, p. 1) and through *hyperuchit*, they were obtaining their digital citizenship.

Digital Citizenship or Digital Residency

Ribble and Bailey (2004) define digital citizenship as requiring action, reflection, awareness and understanding about ICT. They define digital citizenship for digital natives as recognition of and adherence to "the norms of behaviour with regard to technology use" (Ribble and Bailey 2004, p. 2). Ribble and Bailey however concentrate on the action of, and reflection on, ICT use for students. Their definition is similar to Prensky's (2003) views and belief: that action is important. Although action was important for the digital immigrant teachers in this study, reflection on how to PAC in real social interaction was just as significant to their learning and teaching, albeit different from the learning and teaching of digital natives.

Snyder (1997) argues that young people are comfortable in the digital world. They are comfortable with connecting 'virtually' and interacting with other participants in cyberspace (Gibson 1986). They thrive on the use of synchronous and asynchronous communications. Usually, they turn to the Internet first for information rather than to a printed text – to which Webster and Pournelle (2007, p.2) refer as "dead tree books" which are being replaced by e-books and people are reading these books on the internet or on their laptops "about the size of an open paperback book". As one of the digital immigrant teachers in the study, Penelope, reflected: *my students are doing things differently*. *I cannot think in their ways*. In light of these digital immigrants' comments, and considering Ribble's and Bailey's (2004), and Prensky's (2003) advocacy, as well as Snyder's (1997) prescriptions, we need to be aware that prior to

experienced teachers being able to participate in the customs and practices of the natives as digital citizens, they first need to know how to harness the digital tools for their survival. Experienced teachers require a certain level of understanding of ICT language, certain abilities, processes and developments to participate in the digital world and to work towards obtaining their digital citizenship and so be able to maintain their roles as teachers. This research terms this intermediate stage as digital residency.

In this study, digital residency is characterised by learning and teaching that involve learning how to push buttons (P), apply software (A) and change practice (C) over the year, and employing the processes of *hyperuchit*, which extend traditional didacticism beyond the boundaries of a traditional university classroom and Vygotsky's *uchit.* Over time, teachers attained their digital residency by working together and taking part in these processes, rather than by being didactically instructed.

Like all immigrants, these digital immigrant teachers were immersed in a process of assimilation. It is, of course, impossible for any immigrant to achieve the position of native in the new land to which they have journeyed. And to become a citizen of that new land requires familiarity with social "norms of behaviour" (Ribble and Bailey 2004, p. 2) so as to reach an advanced level of engagement in their new home. Before this can occur a certain period of residency within that new land is required.

And so it was with the digital immigrants of this study. While they had made an initial foray into the new digital world, their accumulation of technical skills was not at the sophisticated level necessary for them to be regarded as having achieved digital citizenship, whereby they could be regarded as having mastered the new cultural milieu. Their lack of reflection on the pedagogical theoretical aspects of their learning – necessary in their roles as teachers of digital natives – meant that these digital immigrants were, in effect, serving a period of residency prior to the attainment of digital citizenship.

Conclusion

This research saw a change in the participants' learning, as they immigrated to the ICT environment and learned how to move from pushing buttons (P) to applying software (A) and eventually to changing practice (C). It has been well noted that the participants required support from their communities and networks, as well as from their teacher educator, albeit in the case of the latter, in a different manner to the support offered in the traditional university teaching and learning environment. Like immigrants, who move to a new country and seldom "[blend] immediately into their new environment, they [created] communities [and maintained] contact with their homelands" (Osterhammel and Petersson 2003, p. 78). They applied ICT in their established practices; they formed communities of practitioners to assist them to learn and teach ICT and to scaffold their learning towards digital citizenship. Further, the communities motivated them to solve problems that arose in their practices and transformed the traditional university classroom into an active, collaborative, and interactive community and network of practitioners.

Hyperuchit was proposed as a powerful concept for explaining the teacher learning processes encountered by this study. It was seen to encourage the teachers to reciprocally learn and teach in communities, and to utilise the networks they created. In these networks the participants could reflect on, make sense of, and internalise their newly acquired ICT knowledge into their lives and everyday practices. They became responsible for their own learning and yet, together with their peers and those within their network – which became an intrinsic component in their learning – they supported each other as they extended their learning challenges. By gaining the confidence in their own learning and teaching, the participants enhanced their ICT learning: they learned the information and skills *one day* and *the next day* were teaching others, who reciprocally added to their information and skill storage. Whilst they did not fully participate in activities mainly reserved for digital natives, they became confident in their own ICT learning abilities and knowledge, they began to approach levels of competency that would enable them, over time, to achieve digital citizenship.

The teacher educator challenged them with ICT problems to meet their different and immediate ICT skills and knowledge requirements. He encouraged the teacher learners to perform action research in their workplaces and build a community of inquiry in the university context, where they could construct their own information and knowledge. In this university inquiry community, the teachers gained confidence in their learning processes and stepped out of their comfort zone – extended their Zone of Proximal Development – to develop learning networks. As well as asking each other *how do I do…* they also turned to their *children,* their *brother,* their *younger brother-in-law,* and other members of their network, and so now, they were *not afraid to talk with the IT guy.*

The study observed that the teacher educator, in order to foster learning and teaching, took on the role of facilitator (Laird 1985), rather than being the "sole voice of intellectual authority: the only one who has been endowed with knowledge worthy of dissemination" (Knowlton 2000, p. 7). He supported these teacher learners with guidance and accommodation of their particular needs rather than by didactic instruction. The teacher educator also provided opportunities for the teachers to extend their knowledge and skills by instigating an environment where collaborative problem solving the ICT challenges in a meaningful and relevant context was encouraged. The teacher learners were encouraged to analyse the technology and to experiment with the software for their practical use. Jointly, they reflected on the practical application of the software but, they did not construct and apply pedagogical theory to ICT learning and teaching.

The concept of digital immigration was found to be particularly relevant in terms of the notions of digital citizenship, digital native status, and the proposed transitional stage of digital residency. It can be seen to be allied to the changes that occurred in the learning and teaching process which reflected a shift in technology use from pushing buttons to applying software to changing practice. Vygotsky's *uchit* was helpful in understanding this change but it did not fully encompass the teaching and learning process. This led to the development of the possibility of what has been termed *hyperuchit.*

The following and final chapter provides a more detailed discussion of *hyperuchit* as an asynchronous learning/teaching practice and as an analogue of the decentralised communication network. Additionally, it suggests how *hyperuchit* can be blended into teacher learners' ICT professional learning for the information age. The final chapter summarises the findings, and makes connections between Kolb, Gardner, Vygotsky, and the observations of this study about how experienced teachers learn ICT.

Chapter Eight – No Return?

Introduction

This final chapter presents the transition completed by the digital immigrant teachers of this study as they entered the new ICT land. It appears there is now no return to the predigital world for this group of experienced teachers since they have immigrated to the information age – *things had changed.* The change was marked by apprehensiveness (*perezhivanija*) at the complexity and novelty of the new technologies. However, through collaborative learning processes, they made sense (*mislenija*) of ICT and began to incorporate the new technologies into their learning and teaching. This study argues that a change has occurred in the education of these digital immigrant teachers.

Although numerous conference papers, guidelines and government reports have been published describing initiatives for learning about, and with, ICT since the mid-1990s (Pearson 2003), teacher education literature has been mute on how experienced teachers learn ICT in the university professional development classroom. The literature primarily relates to student learning, as it applies in schools and to pre-service teacher education. Unlike student learning, the learning approach of experienced teachers has seldom been investigated or explained. The absence of research on the development of ICT understanding and competence by experienced teachers is noteworthy, because they represent a substantial sector of the profession. As they age, any reluctance by them to take on ICT-based curricular and pedagogical practices is likely to result in their having an increasingly problematic, and even irrelevant, place in schools. Any assumption that "the same methods that worked for the teachers when they were students will work for their students now... ***is no longer valid***" (Prensky 2001a, p. 3, emphasis in original)**.**

Indeed the literature indicates that not all teachers are attempting to immigrate to the information age. And many who have entered the information age merely learn the technical skills of ICT rather than develop sound pedagogical and practice theory, or ask questions about the nature of learning and teaching; about "the real value and purpose" underlying their

profession (Loughran 2006, p. 4). In this current study, teachers showed their growing competence and confidence in ICT application. However, the research provided little evidence that ICT had become embedded in the teachers' pedagogical practice through any abstract conceptualisation of pedagogical theory. Instead, the digital immigrant teachers were content to learn about the mechanics and the practical application of ICT. This group of teachers, as they took on the new ICT culture, followed a pathway of personal learning for which immigration is an appropriate metaphor through which to describe the changes observed in this study.

An important observation in the teachers' immigration is that this university classroom setting constructed by the teacher educator provided a supportive, scaffolded learning environment for their introduction to ICT. However, the development of teacher educators and their role in the work of teacher education has frequently been underrepresented in the literature (Scwille et al. 2007; Loughran 2006; King 2004; Gibson 2004). And so, knowledge about teacher learning and the role of teacher educators in the teaching and learning process is important for the appropriate design of future professional learning programs, and for the effective immigration of experienced teachers into the pedagogical domain of ICT-rich teaching practices.

This chapter summarises, considers the significance, and discusses the implications of change experienced by a group of experienced teachers as they immigrated to the digital world. Additionally, it makes recommendations and suggestions for future teacher ICT professional learning. The chapter commences with the changes observed in the research; a discussion that leads to the examination of the ICT immigration experience.

Observed Change

These teachers entered the immigration sphere as new arrivals and experienced an initial anxiety concerning the new world of ICT. Their immigration progress was characterised by a year-long shift from the tentative pushing of buttons (P), and progressed to an applying of the software (A). This resulted in a more confident experimentation with ICT in their personal practice, even if it was not yet pedagogically innovative. These digital immigrant teachers worked together in

making sense of ICT so as to establish themselves, and change their practice (C) within a new sociocultural context. They negotiated the practical steps of digital immigration towards digital citizenship which this three ways of learning (PAC) represents. They became residents of the digital world and entered the information age. In the process of entry, the proposed concept *hyperuchit* became important. The term *hyperuchit* is used to describe the observed processes whereby teachers were continuously learning and teaching, experiencing immediate and reciprocal developments, action, interaction and reflection, with the assistance of their peers, communities and networks.

In *hyperuchit*, the teachers began to focus on real life issues and resolve these through action and reflective practice. That is they were challenged to inquire into new knowledge and experience and to use ICT in order to bring change into their workplace classrooms. Here, action learning resulted in their resolving real life problems: in this case, the experience of learning, and of how to teach, ICT. That is, "the quality of action [learning], namely relevance, application and practical utility: its capacity to evoke valuable and workable change" (Phelps 2003, p. 201) as it applied to their understanding of ICT in the real life context of learning and teaching was manifest for the participants of this study. Yet, although these teachers had immigrated successfully, as pedagogues, they were not developing a working pedagogical stance.

Underlying Stance

In progressing knowledge and by utilising the metaphor of immigration for learning about ICT, the underlying stance of this research has its intellectual origins in the work of three key theorists; Kolb (1984), Gardner (1983) and Vygotsky (1999):

1. David Kolb's (1984) experiential learning styles and modes of learning show the process of learning;
2. Howard Gardner's (1983) multiple intelligences definition focuses on the abilities and ways of valuing learning;

3. Vygotsky's (1999) theory centers on understanding the emotional (*perezhivanija*) and intellectual (*mislenija*) development in the continuum of learning and teaching (*uchit*).

The work of Kolb (1984), Gardner (1983), and Vygotsky (1999) allowed the development of a theoretical framework for the observation of these experienced teachers as they learned ICT in an adult sociocultural context.

Figure 30 presents a summary of the three theorists' main concepts as applied to this study (see Chapters Four, Five and Six respectively):

1.	**Kolb's Experiential Learning Framework**			
Learning Styles	accommodative	divergent	assimilative	convergent
Modes of learning	active experimentation concrete experience	concrete experience reflective observation	reflective observation abstract conceptualisation	abstract conceptualisation active experimentation

2.	**Gardner's Multiple Intelligences**					
verbal	logical	musical	kinesthetic	visual	interpersonal	intrapersonal

3.	**Vygotsky's Concepts**	
perezhivanija (anxiety)	mislenija (making sense)	uchit (learning and teaching)

Figure 30: Summary of Concepts

Summary of Findings

Initially, the process of the participants' learning and teaching was observed and interpreted through Kolb's experiential learning framework consisting of two main concepts: learning styles and modes of learning (Figure 33). According to Kolb (1984), the learner 'touches all the bases'— concrete experience, reflective observation, abstract conceptualisation and active experimentation — "in a recursive process that is responsive to the learning situation and what is being learned" (Kolb and Kolb 2003, p. 7). Additionally, Kolb (1984) suggests that teachers

predominantly process learning in an accommodative learning style, in which they apply two modes of learning: active experimentation and concrete experience. However, in this study the results indicate that experienced teachers did not follow Kolb's framework in its entirety. Figure 31 summarises the observed learning process in which teachers actively experimented with and reflectively observed the concrete experience:

Modes of Learning		
active experimentation	concrete experience	reflective observation

Figure 31: Observed Concepts - Kolb (1984)

However, experienced teachers were not theorising and equating their observations and experimentation with their concrete experience in logical pedagogical terms. The abstract conceptualisation towards pedagogical theory relating to ICT which Kolb's theory predicts was absent. Instead, teachers' thoughts, conversations and interactions were creating opportunities and possibilities for them to reflect on the mechanical applications of ICT to their immediate practice. For example, Phoebe in her reflective journal wrote that she needed to *learn how to operate a computer, understand the features of the programs, add text, effects and pictures … and replace scrapbooks*. Patricia *emulated her literacy program in Microsoft Excel.* She often *sat with* Patrick in the university classroom and *they discussed how to improve the spreadsheet: I need some ideas.*

Two other participants, Philomena and Peg, discussed how Philomena *used the digital camera, got the photos from the disk,* and *emailed them to herself. Only now, she needed to put them into PowerPoint. The two reflected on how they had got some stuff from the internet and put it into PowerPoint,* Peg *said: it must be the same and they proceed to figure out how to do it.* They reflected *to figure out* how *to import from the digital camera and the USB stick,* using the same principles that they used when downloading from the Internet. The teachers individually and collectively reflected on, and experimented with, ICT.

Gardner's theory (1983) provided another means for the analysis of the data. His theory recognises that individuals learn in diverse ways within cultural settings. Gardner (2004, p. 141) contends that "any topic of significance can be represented mentally in a number of different ways" and for him, entry into the 'topic' (in this case ICT) occurs within the same conceptual framework that he advocated in 1983. Figure 32 shows the seven distinct categories of intelligences or abilities Gardner proposes:

Multiple Intelligences						
verbal	logical	musical	kinesthetic	visual	interpersonal	Intrapersonal

Figure 32: Gardner's Multiple Intelligences

Gardner (1999) argues that logical intelligence is valued by students, and in particular by students of the future (designated in this study, in line with Presky (2001a; 2002) as 'digital natives'). In Gardner's view logical intelligence should encourage step-by-step sequential learning, such as that traditionally required for mathematics, science, or computer programming. In these areas of study, students work through a problem to unravel and then piece together the thinking associated with solving the problem. In the process, the students examine patterns and relationships to categorise the occurrences to provide warranted assertion and evidence to support theory, convictions and the solving of problems. Prensky (2001a, p. 3) also argues that digital natives are interested in solving problems, but states that their motto is "just do it"; that action is of prime importance; they want to be "right into the middle of things" (Prensky 2002, p. 2).

In the case of the participant teachers of this research it was observed that they were solving problems and they were making sense of ICT. They were indeed *just doing it* and applying what they had done to their practice. As pedagogues however, they were not theorising about their actions and activities in accordance with pedagogical reasoning and theory. This study found that experienced teachers did not reason or theorise, using logical intelligence, to reach an

understanding about their practice. In fact, they preferred and valued the use of kinesthetic, interpersonal and intrapersonal abilities in the cognitive domain (Figure 33):

Multiple Intelligences		
kinesthetic	Interpersonal	intrapersonal

Figure 33: Observed Concepts - Gardner (1983)

The significant use of interpersonal ability, in place of logical ability, indicates that the participants preferred to interact when they learned ICT. These teachers, like immigrants, formed groups in which they could interact and share their experiences when encountering a new situation. This preference for interpersonal ability was observed in the way in which teachers were able to share ideas. For example, Polly *learned how to lasso objects in Microsoft Paint,* Peg *noticed that she had the hang of it and turned to* Polly *for advice.* Polly *liked to reinforce her newfound knowledge and show others what she had learned … she showed* Peg *who for the next 15 minutes played with the lasso and figured out she could also use the cut out in PowerPoint and not only Word.*

The findings of this research showed that Kolb's and Gardner's conceptual models provided a means of understanding the learning practices of the participating teachers. The research has pointed to important differences with the proposals advanced by Kolb and Gardner concerning the preferred learning approaches of teachers working in the digital environment. Importantly, the application of Kolb's and of Gardner's frameworks exposed the absence of any deep abstract pedagogical conceptualisation by the teachers of the application of ICT in educational settings. The frameworks did assist in the understanding of this digital immigration, and how in the new environment, teachers were able to share and do ICT. Neither framework of learning, however, allowed a representation of the changes evident in the teachers' engagement with ICT over the period of the course.

Analysis revealed the teachers as having ICT interests grounded in day-to-day practical work. Even if their development in the course was not accompanied by deeper pedagogical

conceptualisation, their individual achievements attained professional significance when each teacher found a personal, mostly school-based, application for their new-found competencies. Viewed through the frameworks of Kolb and Gardner, the set of learning practices employed by the teachers remained quite static over the year of the ICT professional development course. However, the teachers' observed participation was anything but unchanging. The shift from pushing buttons to applying software, and then to changing their practice was accompanied by an observed reduction in anxiety, enhanced interactions among the participants, and a more confident sense of experimentation with ICT in their practice.

Although there was a sense of achievement and fewer struggles, teachers like immigrants, experienced anxiety in the changes. The changes invited analysis from the perspective of lesser-known elements of Vygotsky's work. Figure 34 lists the three elements employed in this study:

Vygotsky's Concepts		
perezhivanija (anxiety)	mislenija (making sense)	uchit (learning and teaching)

Figure 34: Observed Concepts - Vygotsky (1999)

According to Vygotsky's sociocultural theory, learning and teaching (*uchit*) are continuous processes involving *perezhivanija* – an anxiety or apprehension associated with the struggles of new learning experiences – and *mislenija* - the process of making sense of the experiences. Chapter Six discussed these struggles and changes, and how teachers developed emotionally (*perezhivanija*) and intellectually (*mislenija*) in order to *learn ICT one day and teach it the next day*.

In addition to the identification of the struggles and developments in learning and teaching, Vygotsky, in the context of the European tradition (Loughran 2006), used the term *uchit*, to describe an integrated learning and teaching practice. This kind of social context ensures that *uchit* is not an isolated event, but the ongoing interaction of a master and less knowledgeable

individuals. Here, the master teaches and the learners learn and transfer the information on to less knowledgeable learners in the social context (see Chapter Seven). However, Vygotsky's concept of *uchit* also proved inadequate in the context of this study. *Uchit* conveys a requisite linearity to learning and teaching practices. The present research revealed that the participants' engagement with ICT was characterised by multiple and unpredictable social interactions and by small-scale personal ICT experimentation not directed by the teacher educator. While learning and teaching – *uchit* – was but one part of the participants' practices, the shifting context and time-based complexity of personal practices observed inside and outside the university classroom required a new model with which to portray the learning process adopted by the teachers. This study proposes the term *hyperuchit*.

The Shift

The term *hyperuchit* is applied to describe the shift in practice observed in this research and draws from the research data and the concepts taken from the three authors (Figure 35). A *hyperuchit* model is dynamic in that it contextualises the professional action learning, in which learning and teaching are connected to developments, action, interaction, and reflection within communities and networks that do not exclusively rely on the traditional academic-directed university lecture hall. Instead, learning and teaching involve communication which is interactive and reciprocal, with each interaction containing added shared information. In this research, in the scaffolded *hyperuchit* model, teachers felt safe and they *felt at home*. The research also found that the achievement of digital citizenship requires input from participants in which practicality and pragmatism with *lots of hands-on stuff* are important for their 'survival' in meeting their requirement of having to *use this technology stuff the next day*. Survival, it seems, demanded practical competence and a pragmatic rather than a theoretical orientation to ICT use. In this university classroom, the teacher educator encouraged action learning, and collaborative, hands-on approaches to teaching and learning. In this practical setting, learning consisted of four elements (action, interaction, developments and reflection) as shown in Figure 35:

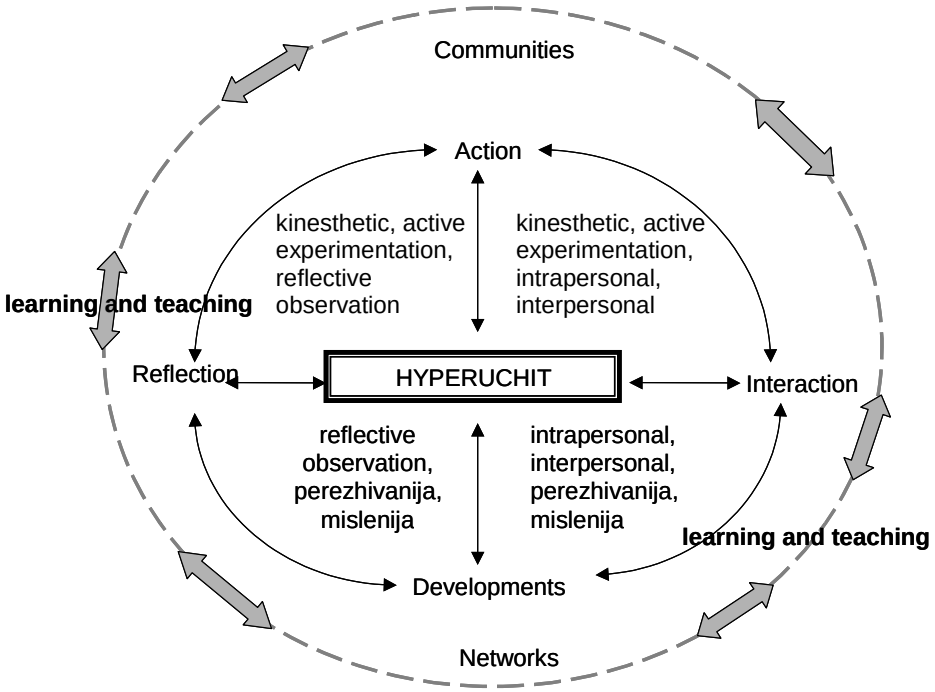

Figure 35: Dynamic Model of Hyperuchit Showing the Four Elements

By reading Figure 35 from the outer circle towards the inner circle, the model presents the four elements of development, interaction, action, and reflection as dynamic rather than static, moving in all directions within learning and teaching. These elements are non-linear, non-hierarchical and non-sequential. The teachers experienced developments that consisted of individual (intrapersonal) and collective (interpersonal) *perezhivanija* and *mislenija*. However, with the support of the communities and networks, consisting of peers, digital natives, the teacher educator and outside informers, the teachers made sense (*mislenija)* about their concrete experiences. They interacted and actively experimented with ICT (kinesthetic), and then reflected on their actions; on how to push buttons (P), apply software (A) and change their practice (C). These actions were dynamic, and as represented in Figure 35, the learning and teaching moved in all directions "meeting with a concrete situation" (Vygotsky 1962, p. 108).

In the study, *hyperuchit* encouraged movement in all directions and Figure 36 further explains and summarises the observation. Four elements of development, action, interaction, and reflection enhanced professional learning in this *hyperuchit* environment:

Elements	Teacher Professional Learning
Developments	• Teachers collectively and individually developed emotionally (*perezhivanija*) and intellectually (*mislenija*); • Teachers, in the facilitative environment, were encouraged and assisted to develop a curiosity to make connections between their practice and ICT.
Action	• Teachers collectively and individually did and worked; • Teachers applied a 'hands-on' rather than didactic approach; • Teachers were encouraged to *do the technology stuff*.
Interaction	• Teachers collectively and individually interacted and collaborated with their communities and their networks in diverse ways to problematise, engage in and change their practice; • Teachers solved problems in collaboration with others; • Teachers connected to the world outside the classroom.
Reflection	• Teachers collectively and individually reflected about their experiences to create opportunities and possibilities to learn and teach ICT, incorporating ICT into their practice; • Teachers were encouraged to formulate and summarise learning and teaching and to evaluate ICT knowledge and skills in regard to their practice.

Figure 36: Elements of Teacher Professional Learning

In this *hyperuchit* environment, the work of Kolb (1984), Gardner (1983; 1999), Vygotsky (1999) and Prensky (2001) proved important. Their work assisted in the understanding of the metaphoric 'immigration' and the changes the teachers experienced in the new land of ICT. Kolb's work assisted in understanding the learning processes. Gardner's work gave rise to the understanding of the application of learning abilities, while Vygotsky's work enabled examination of the emotional and intellectual developments of the participants through the concepts of *perezhivanija* and *mislenija*. However, in accordance with Prensky these teachers did not (nor could they) become digital natives (Prensky 2003; 2001a). Nevertheless, they successfully immigrated to the world of ICT. They learnt how to push buttons (P), apply the

software (A) to their practice (C). They were encouraged to collectively and individually develop a curiosity and to make connections between their practices and ICT. This connection occurred when the teacher educator facilitated teacher learning, either online or in a face-to-face interaction. He supported the questioning of the teachers' thinking about their practices and he encouraged them to contemplate the process of educational change in relation to ICT learning and teaching. This reflecting on and *doing* of ICT resulted in the teachers discriminating between the various softwares for particular and immediate learning and teaching contexts process of change for the digital environment.

Hyperuchit can be seen to resemble a facilitative learning environment in a student- centered learning context, in which teacher educators are not the sole transmitters of knowledge. Instead, teacher educators become facilitators, guides, human mediators, knowledge brokers, consultants and co-learners of the different communities, and sometimes of the different networks, in which teacher learners exchange the information they acquire. The learning resources and activities are constructed to meet specific needs of learners who use an array of material to construct learning and teaching that will inform practice. This approach "offers different pathways to users, … [and it] provides a means of arranging in a non-linear manner" (Snyder 1997, p. 126) their learning and teaching. *Hyperuchit* met specific needs and enabled the teachers to connect, link and move learning and teaching in non-sequential and rapid ways amongst their communities and networks.

Hyperuchit blurred the boundaries between learner and teacher by functioning in communities and networks. Therefore, learning was not confined to the university classroom environment, and instead teachers had access to other resources to navigate, negotiate and from which to incorporate links, people, ideas and activities that enabled them to participate and engage in the global culture. As a consequence of the change, the structure of learning was different from the traditional didactic teacher university approach. *Hyperuchit* drove the cultural change, shifting the form of traditional teacher-centered learning and teaching, and encouraging learning in diverse and different ways.

The participants' learning and teaching had been reconceptualised, and teachers commented that *things had changed*. These responses confirm other research (Romano 2003; Castell 1996) and are supported to Australian government reports, especially the recently updated "Building Australian ICT Skills" (2006), which states that learning is different in the information age. The learning and teaching experienced by the participants in this study reflected the change and differences. *Hyperuchit* changed the culture of this teacher education program; in particular, the way teachers acquired knowledge and skills. In *hyperuchit* teachers learned flexibly at their individual pace and within their zone of proximal development, which was continually extended by the scaffolded socio-cultural nature of the ICT learning environment.

It was expected that the structured inquiry and in particular the action learning and action research process should have given teachers, through their own learning, a chance to "create, constitute their own learning educational theory" (Whitehead 1998, p. 1). Structured inquiry should have allowed teachers to employ ICT and model the process in which abstract conceptualisation and logical ability can be integrated with *hyperuchit.* Yet this did not occur and the inquiry did not lead the teachers to theorise about their values and beliefs towards ICT. They simply became competent in the mechanics of ICT; they achieved digital residency, but fell short of reaching the level of pedagogical sophistication that would have marked them as digital citizens.

This research acknowledges that the immigration and change depended on the teachers' starting points, processes, abilities and developments, and if they were comfortable with and had confidence in the use of ICT. Generally, teachers made connections with ICT and struggled through their doubts to acquire a level of technical competence. They began to speak the new language of the digital natives, albeit betraying a digital accent in their dealings with the new technology.

In this environment, teachers, as adult learners, ideally expect to negotiate their own learning and teaching in response to their personal and professional needs. In their professions, adult learners, including experienced teachers, are self-directed and self-reliant (Knowles 1978). They are interested in the 'why, what and how' of learning (Davies 2005) and they frequently want to understand the process of learning. This research indicates that the experienced teachers did not ask these questions relating to abstract conceptualisation of pedagogical theorising, but were instead satisfied to acquire only those technical skills necessary to perform their professional tasks.

The question for teacher education is how to engage digital immigrant teachers in their pragmatic learning through a non-static *hyperuchit* so that teachers 'touch all bases' (Kolb 1984), including abstract pedagogical theorising and apply Gardner's logical intelligence.

In future teacher professional learning *hyperuchit* can expand to include pedagogical theorising, and especially if the teacher educator provides the scaffolding necessary to link the practical world inhabited by experienced teachers to a logical and theorised environment of abstract conceptualisation.

Cultural Change

Teachers were in the process of *hyperuchit* and becoming 'being digital' (Negroponte 1995), however *hyperuchit* proved limiting and problematic. Teachers were not reflecting and theorising about their working pedagogy. In thinking about teacher learning and with the demands on teachers to actively engage with digital natives, the challenge now is for teachers to move from limited *hyperuchit* to an environment in which ICT is integrated in their working pedagogies. The following section discusses the challenge for further teacher immigration into the realms of digital citizenship and how teacher educators can assist teachers to theorise about ICT through the use of new social digital technologies, for example, Web 2.0. Recent digital innovations such as wikis and blogs enable collaboration, action, intellectual development, interaction and reflection on shared information or content. Simultaneously, by using blogs and

wikis, teacher educators, as facilitators and mentors, can support teacher learners to participate further in the information age and to develop their working pedagogies.

Beyond *Hyperuchit*

The works of Kolb (1984), Gardner (1983; 1999), Vygotsky (1962; 1999) and Prensky (2001a) assisted in explaining the observation and *hyperuchit*, and how teachers learned to push buttons (P), how they applied software (A) and how they learned to change practice (C) in ICT. The concept of immigration further explained the journey from the predigital world. Teachers achieved an entry into the digital land and they understood the language sufficiently to survive, push buttons, apply software and change their practices. However as pedagogues, they did not use abstract conceptualisation (Kolb 1984) to link pedagogical theory to understand ICT. The absence of abstract conceptualisation was also reflected in the lack of evidence that the teachers were using Gardner's logical ability in the exploration of ICT in their practices. Furthermore, teachers, as digital residents, were not obtaining information in a "twitch switched, parallel processed, randomly accessed, graphics first, connected, active" (Prensky 2003; 2001a) manner like digital natives. Therefore, an important extension of this research is to find a way for experienced teachers to move beyond technical competence to pedagogical theorising inclusive of ICT and work towards the status of digital natives.

The virtual environment, structured through logical and sequential steps may be a means of leading experienced digital immigrant teachers to take on deeper educational thinking about the potential that ICT has for learning. What is needed is an ICT environment that enables connections between the practices associated with the conceptual frameworks applied in this research:

Prensky: accounting for the immigration of experienced professionals into the digital world;

Kolb: adopting strategies to promote abstract conceptualisation as teachers apply software in their practices;

Gardner: complementing the kinesthetic, intrapersonal and interpersonal abilities, shown in this research, with the sequential and logical inquiry of the pre-digital educational world;

Vygotsky: encouraging active experimentation by providing opportunities for teachers to advance their professional learning by trialling ICT in their classroom teaching and to report those concrete experiences to teaching colleagues.

The effectiveness of *hyperuchit* in encouraging and facilitating such learning and teaching is not surprising when it is recognised that such a decentralised transmission of shared information through networks of collaborative users can be viewed as an analogue of the Internet itself. *Hyperuchit* mirrors the structure of the Internet in that its "decentralization is reflected both in the choices presented to users, and in the underlying structure that creates those choices" (Gillet and Kapor 1997, p. 1). The Internet itself is a growing repository of digital data whose storage is not confined to a single location, but is distributed amongst various nodes or relationships between networks with few geographical limitations. Since the Internet is comprised of myriad connected Intranets – private networks within individual organisations – it bears easy comparison to the intermental and intramental processes intrinsic to *hyperuchit*. Private knowledge acquisition (the intramental) is disseminated and enhanced through shared access (the intermental) to the knowledge of "more capable peers" (Vygotsky 1978, p. 86). Vast amounts of information become available to those digital immigrants who have gained the requisite skills to navigate through and to the particular networks containing new knowledge they may require. Each participant becomes an information node, in effect a personified Intranet, connected to, and connecting a larger Internet of colleagues, practitioners and other personal networks.

Recent Internet innovations such as the enhanced user interfaces and social communication applications provided by Web 2.0, overlay a more user-friendly, facilitative and contributory potential to Internet technologies. By its very design Web 2.0 "is about connecting people and

amplifying the power of working together" (IBM 2008) in the online, virtual environment. Applications continue to be developed which emphasise the importance of communication, action and collaboration in the digital world.

In the virtual environment, logical ability and abstract conceptualisation in a collaborative and interpersonal context can be achieved in blogs and wikis. In the Web 2.0 context, teacher educators might encourage teachers to use blogs as diaries to record and evidence the practical actions and interactions of their research projects. And since "user-created educational content tends to be developed collaboratively and to encourage sharing and peer-production of ideas, opinions, information and knowledge" (OECD 2007, p. 67), the concept of *hyperuchit* is of particular relevance in this new environment.

Jorn Barger invented the blog or weblog in 1997 (Blood 2000) as a personal online diary "to engage people in collaborative activity, knowledge sharing, reflection and debate" (Williams and Jacobs 2004, p. 232). Blogs perform a role of interpersonal communication, whilst simultaneously being intrapersonal in their representative mechanism of reflection of a particular topic according to the blogger's beliefs and values. Therefore, blogs as personal online diaries could serve to engage teachers in the recording of, and reflection on, their practices.

Another form of online social communication is wikis which also allow participants to create their own virtual environments, by encouraging the contribution to freely accessible information databases compiled by users themselves. Ward Cunningham created the first wiki, a free online encyclopaedia, in 1995. He created server software that allowed any user to edit any page. The asynchronous hypertextual authoring software enables large groups of people to collaborate on a given topic, and it encourages group social interaction. The OECD (2007, p. 63) recognises that "blogs, wikis … and techniques from community and social networking sites can be important tools to improve the efficiency of knowledge worker collaboration", and this social (that is,

interpersonal) software could enable teachers under the scaffolding guidance of teacher educators to discuss and theorise about their working pedagogy.

Teacher educators, through online community building activities, can encourage teachers to access their combined experience, recognise similarities and differences in their practice; to collaboratively exchange ideas; and to critically think, contemplate and theorise about pedagogical issues relating to ICT and their practices. The teacher educator is in a position to prompt and weave the discussion through ICT pedagogical theorisation, and in so doing, to encourage teachers to collaboratively write, discuss the evidence of their work and to develop their working ICT pedagogies based on their practices and theoretical readings. In this practice, their work may be seen as research, which Stenhouse (1985, p. 120) has defined, "as systematic enquiry made public". As a consequence, wikis, as virtual public places, can become information locations where teachers may socially construct their working pedagogies based on the evidence from their practices, their peers and their literature reviews. This public place retains hyperuchit, but simultaneously allows teacher educators to introduce abstract conceptualisation of pedagogical matters into the logical sequence of their action research. The teacher educators can co-ordinate teachers in acting, observing and reviewing their work (Kemmis and McTaggart 1988) in a semi-structured communicative online inquiry. This online asynchronous communication, depending on the skills and knowledge of the teacher educators, can engage teachers in the task of actively, and interactively constructing their working pedagogies in public places for vindication and validation. In effect, the old world of learning, teaching and action research joins forces to assist teachers to immigrate to the digital world.

In a wiki, teacher educators, as in traditional face-to-face learning and teaching environments, would set curriculum goals, and develop syllabus and course guidelines in which teachers can participate and have their learning evaluated and informally peer-reviewed. Through wikis, teachers can collaborate in communities of practitioners to plan, discuss and reflect on the media in relation to their pedagogical views and actions in their practices. In this new social

environment, teachers would collaboratively and reflectively author and develop their working pedagogy.

By the use of blogs and wikis, teacher educators will encourage and present teachers with the opportunities for scholarly, creative and professional projects. Teachers will reflect and discuss their actions, observations, beliefs and values to develop their working pedagogy based on their practice, based on their action research projects' evidence and collective literature reviews.

It is hoped that this research has shown that technology does not drive *hyperuchit*; as with traditional learning and teaching, people are at the centre of *hyperuchit*, their interaction and collaboration are more important than the technology. By utilising the metaphor of immigration it is hoped that attention has been drawn to the common human experience of the processes of change and adaptation to new environments, rather than exclusively to the environment itself.

The role of the teacher educator is of prime importance: in the information age, the teacher educator is the facilitator and mentor. Teacher learners individually and collectively reflect on and construct their working pedagogies. Blogs and wikis can encourage online collaborative and interactive learning for teachers to reflect, evaluate and discuss learning and teaching and develop working ICT pedagogies. They can create an opportunity for teachers, by using familiar strategies from the old world – that "foot in the past" (Prensky 2001a, p. 2) – to begin to blend into the virtual, online sociality of the twenty-first century. In the blending process, teachers and teacher educators need no longer be restricted to didactic university knowledge transfer processes. Instead, the university classroom, which now incorporates the virtual world, becomes a meeting place of ideas and information that are discussed and refined in communities. Therefore, teachers change the way they construct and exchange knowledge for the information age and mingle, initially as digital residents, but in time as digital citizens, in the digital world. Simultaneously, they need not dismiss previous practices of learning and teaching but instead, may integrate the two worlds of predigital and digital learning and teaching.

Figure 37 shows how technology, especially blogs and wikis, can assist teacher educators and teacher learners to move beyond *hyperuchit*:

<table>
<tr><th>Teacher Educator</th><th>Teachers</th></tr>
<tr><td colspan="2">Establishing blogs</td></tr>
<tr><td>Teacher Educator establishes a blog to encourage teachers individually to plan and record observed actions, and reflect on those actions:
1. Teacher educator assists teachers to plan their journey of professional learning and teaching;
2. Teacher educators encourage teachers to observe and record their journey;
3. Teacher educators encourage teachers to recall, describe and reflect upon their observations and experiences;
4. In reflecting and doing, teacher educators introduce relevant literature and online links so that teachers gain understanding of their journey in relation to pedagogical theory.</td><td>Teachers individually plan and record observed actions and reflect on the actions in a public place:
1. Teachers set the purpose of their action research project;
2. Teachers observe and record their professional learning and teaching;
3. Teachers reflect on their personal practice and evaluate what they have learned in their practices;
4. Teachers, as pedagogues, reflect upon pedagogical theory in relation to their experience and journey. They improve their practice and understanding of their practice in terms of pedagogical theory. The changes in their practice are rationalised upon pedagogical theory.</td></tr>
<tr><td colspan="2">Establishing wikis</td></tr>
<tr><td>Teacher educator establishes a wiki to encourage engagement of teachers in collectively and logically reflecting on their practices in terms of pedagogical theory:
1. Sets purpose and tasks for action research project; provide resources, challenges and ask questions relating to teachers’ actions and ICT pedagogy;
2. Sets readings and participates in collaborative production of literature review relating to action research;
3. Teacher educator provides an assessment rubric emphasising the pedagogical literature review in relation to each teacher’s practice and their personal reflections on their practice. Additionally, the rubric allows the teacher educator to examine teacher participation and collaboration in developing a working pedagogy;
4. Teacher educator as a facilitator, collaborator and mentor, participates in the collaborative process of developing a working pedagogy.</td><td>Teachers participate in the wiki to collectively reflect upon their actions incorporating pedagogical theory:
1. Teachers post and discuss their projects;
2. Teachers reflect and comment on the postings;
3. Teachers post their views, beliefs and reflections on their readings related to their practices;
4. Teachers post critical analysis of the literature review on their working pedagogy in relation to their action research projects;
This collaborative approach and exchange forms the basis for a working pedagogy.</td></tr>
</table>

Figure 37: Using Blogs and Wikis

In the process of integrating and moving beyond *hyperuchit*, teachers can be encouraged to logically and reflectively contemplate about the processes and purposes of their practices. The teacher educator can introduce new material and activities by scaffolding in their individual zones of proximal development.

Significance of the Immigration

In this system, learning and teaching are different from the traditional didactic approach in which the teacher educator transfers knowledge unilaterally from the lectern. Instead, interaction and collaboration within a social and interpersonal environment encourages the multi-directional transfer of information. Once again, it is the social and distinctly human developments and interactions that drive successful immigration into the digital age rather than the technology itself.

In this research, the data indicates that teachers prefer to approach learning and teaching through *hyperuchit*, that is through non-linear, non-hierarchical and non-sequential processes. In their professional learning, they prefer to discuss issues with their colleagues and to learn from each other as well as from the 'master'. The research finds that the new learning consists of emotional and intellectual developments, action, interaction and reflection. However, in this research, Kolb's, Gardner's, Vygotsky's and Prensky's work, especially the concept of 'twitch-switching', and *hyperuchit* proved limiting. These works only explained how teachers learned about the practical mechanical issues, and in particular how they learned to push buttons (P) and apply software (A) to change their practices (C). *Hyperuchit* did not in itself encourage teachers to reach higher levels of conceptualisation about pedagogical concepts.

On the other hand, with the rise of new technologies and especially such innovations as Web 2.0 teachers can integrate their pedagogical theorisation with their practice of ICT. With the new technologies, teacher educators, as in the traditional *uchit* found in the zone of proximal development, can scaffold teachers' learning and teaching for the information age. Teachers can

evidence their practice in action research and concurrently document their findings in blogs leading to the logical building of their own pedagogical theories. Purposeful digital immigration, with a view to eventual digital citizenship can be achieved because through teachers' newfound capabilities to integrate their previous practices with the new technologies.

In the sociocultural context of the university classroom observed in this research, the data reveals that teachers' individual immediate requirements are fulfilled and that there is 'no return' to the predigital way of *doing things*. Patricia, referring to her way in setting up a literacy program, *told the group that this is so much easier to manage*. Others, like Patrick felt that *there are so many benefits in using this stuff,* especially *using the Internet.* David and others saw that they *could do so much more* when utilising the new technologies to which he had been inducted. In the process of digital immigration, the majority of these teachers-as-adult-learners, learn the practical skills and know-how of technology to survive and establish a presence as digital residents in the ICT landscape. Such knowledge adds to our understanding about teachers, as adult learners, who "demand that the relevance and application of ideas be demonstrated and tested against their own accumulated experience and wisdom" (Kolb 1984, p. 6).

The teachers, as adult learners, had taken the step towards becoming digital (Negroponte 1995) and moved into the information age. For teachers, this movement was important, and from the perspective of this study, the findings fill a gap in the body of literature about experienced teacher professional ICT learning and teaching, and andragogy in higher education. It is hoped that the results gained from this research will further inform learning and teaching in different university contexts.

This research has identified that, at this stage of digital immigration, there was for such adult learners, no initiation into abstract conceptualisation. Usually, abstract conceptualisation is the arena of digital citizens and digital natives, who can be expected to develop "a dialogue between theory and practice, as well as between learning and teaching, which draws consciously on"

(Beetham and Sharpe 2007, p. 3) the traditions of pedagogy. Therefore, the study has gone some way towards enhancing our understanding that in the future teachers, as pedagogues, should be required to explore their values and beliefs about the underlying pedagogy of ICT to further enhance their students' learning.

This research also points to the significant need for further exploration into teacher education. Such exploration must cross private and reflective inquiry, as well as collaborative processes, in which each participant brings metaphors and stories (Jagielo 1998) from their own learning and teaching experiences and knowledge. Such inquiry will stimulate teachers to develop a curiosity aimed towards gaining an understanding of new technologies, encouraging them to apply it in their practices, and simultaneously researching actions to develop their working pedagogies.

Moreover, and of particular note in this research is that the findings add to our understanding that teachers require ongoing immigration opportunities that empower them to become self directed, independent and *have a go at this technology stuff.* The results of this study indicate that *hyperuchit* is significant although limiting in empowering teachers as digital immigrants and adult learners for the information age. As pedagogues, teachers need to progress beyond the *mislenija* of technical application and pushing buttons. They need to have the opportunities to make pedagogy explicit which the predigital world of action research/learning has the potential to stimulate.

Implications for Teacher Professional Learning

The practical implication of this research for teacher professional learning indicates that teachers prefer to function in an environment of *hyperuchit*, which allows them to communicate, reflect on and act upon the technology. Learning and teaching are not limited to the ways of the traditional university classroom and a lone teacher educator and in the future, there will be a requirement to rethink the approach to experienced teacher ICT education. This study then, opens avenues for further investigation into teacher education by research communities, and in particular into the formation of an ICT pedagogy.

The practical reality of this research shows that many teachers are willing to experiment to create formative opportunities to obtain knowledge and disseminate effective practices. However, the question arises as to whether many practising teachers are willing and able to theorise about pedagogical issues to unlock the knowledge and nature of their practice and develop the pedagogy of their practice "that has been lacking for far too long" (Loughran 2006, p. 10). Similarly, it is important to know whether teachers are simply willing to formulate opportunities to incorporate ICT into their work, utilising only their practical wisdom. These questions present important implications for future teacher university ICT learning and teaching, and for research into teacher education.

A further implication of the findings concerns teachers' abilities to cross the cultural boundaries from their previous university settings into the ICT environment. In crossing into this environment, as stated in the literature, learners have the right and responsibility to discover and tap into resources (Longworth 2003) with the assistance of a community of practice (Rue 2006; Hargreaves 2003; Brookfield 1995). In the case of teachers observed in this study, their communities enabled them to explore questions and reflect on their actions (Brookfield 1986), and actively engage in meaningful discussions about the practical application of ICT in changing their practice. The indication then is that, in crossing cultural boundaries to enter the information age, teachers learn in communities and networks that can sustain inquiry, through interaction and reflection into the evolving ICT changes.

Intertwined with teachers' immigration into the digital age is the implication for teacher educators that their role is changing. There is a need for them to take on the simultaneous roles of facilitator, guide, consultant, expert, co-learner and didactic instructor in order to convey new information in the adult active learning environment. Therefore, as mentioned earlier in this chapter and in Chapter Seven, the expectations are greater for teacher educators in the digital environment, than in previous traditional university environments.

Educators are expected to comprehend and support teachers' learning and teaching for the information age. In comprehending the needs, and supporting the learning of teachers, they need to make themselves aware of the emotional shifts that learners experience in new situations. Consequently they need to "value the learner's emotional … engagement in the learning process" (Baker et al. 2002, chapter 5, p. 3) rather than merely examining the extent of their learning. This reflective value will allow educators to understand teachers' development of the intellectual knowledge and skills for metacognition in the information age. Metacognition, that is "knowledge concerning one's own cognitive processes" (Flavell 1976, p. 232), is relevant for experienced teachers, since they "demand that the relevance and application of ideas be demonstrated and tested against their own accumulated experience and wisdom" (Kolb 1984, p. 6).

As teacher educators come to an understanding of teacher learners' *perezhivanija* and *mislenija*, this will require them to ensure that an environment is established in which teachers are confident and comfortable with ICT metacognition. Moreover, an environment that can connect ICT, practical experiences and pedagogy will be required to create new knowledge within a professional learning program. The program will need to not only respect teachers' years of teaching experience, but also their goals and expectations to utilise ICT productively and efficiently.

A further challenge for teacher educators lies in their need to ensure that teacher learning in universities encourages practising teachers to analyse, discriminate and classify ICT and emerging technologies according to their working pedagogies (Loughran 2006). Here, teacher educators need to shift from emphasising the driving of ICT competency and obtaining of citizenship, to blending the two worlds of digital natives and immigrants into an intermediary stage of digital residence, thereby encouraging the utilisation of an underlying ICT pedagogical theory.

And so this research can be used as a reference point to improve future professional learning practices. Teacher learners and teacher educators, in response to the findings and the above implications, need to develop a new digital literacy to engage in the global technological sphere and become part of the new digital landscape.

Recommendation for Enhancing Professional Learning

The findings from this study suggest several courses of action. Firstly, in order to enhance professional learning of teachers immigrating to the information age, a change is required wherein teacher education shifts from traditional didacticism to a *hyperuchit* model; one that supports action, interaction, collaboration and reflection. Secondly, teachers need to move beyond the observed PAC ways of learning towards the development of a working pedagogy. Thirdly, there need to be connections between these three ways of learning, *hyperuchit*, emerging technologies, and teachers' development of working pedagogies.

Consequently, the recommendation of this research is that teacher professional learning moves beyond pushing buttons and applying software to change their practice. Teacher learning should change and expand to cope with the proliferation of multidigital and emerging technologies: Web 2.0 (O'Reilly 2005); e-learning (Jochem et al. 2004); m-learning (Corbeil and Valdes-Corbeil 2007); and the virtual learning environment. Through *hyperuchit* in Web 2.0 technologies, such expansion will provide for multiple experiences according to different learning abilities, and the processes of learning in different technologies. Professional learning in virtual and face-to-face social interaction in communities and networks can enable teachers to survive, group and establish self-service lifelong learning and teaching practices, in which they might acquire the ability, know-how and appreciation of the developments of ICT in any context for any situation, and be able to perform professionally and relevantly in their interactions with digital natives both locally and globally.

A reasonable approach to support teachers in their attempts to actively research and solve technological problems, and consequently move into systematically considering and reflecting

on their working pedagogies will be the encouragement teachers to move beyond *hyperuchit* in learning about ICT technologies through participation in such collaborative technological environments as blogs and wikis.

To immigrate and succeed in the information age, teachers and teacher educators are required to use information and communication technologies, and they need to understand that both they and the technologies are subject to continuous change. This research suggests the need for a cultural shift in the university teaching and learning context for future teacher professional learning; one in which the focus is on making appropriate use of technology as a tool: as a means to an end, rather than the end itself. Teachers should be encouraged to articulate a working pedagogy for their classrooms, and teacher educators encouraged to construct a theory of ICT learning in teacher education.

Like immigration, however, the shift is not total. Experienced teachers who cross over into the digital world will not leave their old worlds behind entirely; they will always retain a digital accent. Yet this need not be seen in a negative light since all immigrants bring valued cultural practices and commitments with them. This research has shown that experienced teachers, in taking on the pedagogical potential of ICT in education, will need to bring with them the enduring reflective practice and action research inquiry strategies of the 'old world' of education.

Impact of Research Design

This study, like other qualitative research, was governed by certain limitations which need to be considered when generalising about experienced teachers' learning and teaching. Firstly, the timeframe of one year could be considered limiting, since in that time the teachers only acquired knowledge and skills to push buttons (P), apply software (A) and change practice (C), and they had not progressed towards critical thinking as pedagogues in relation to their ICT learning and teaching. Secondly, the teachers might be considered as not a true representation of all experienced teachers. Thirdly, the study size could be seen to be a limiting factor. Fourth and

finally, as the study was contextualised in an ICT action research university classroom with a group of sixteen experienced teachers, it is not possible to generalise about the learning experiences of all experienced teachers. Care has been taken throughout this thesis to emphasise the pertinence of this research to this particular learning and teaching milieu over the time allotted for their study, and to these particular teacher learners over the time allotted for their particular professional development course. Their value as representative subjects for study should not be unduly diminished by these factors.

Criticism could be made that the researcher allowed things to unfold naturally and did not at any stage attempt to reflexively influence the situation or the learning processes with information gleaned from the ongoing observation. The naturalistic approach to the participant observation dictated that there be no deliberate researcher intervention in the environment.

The problem of anecdotalism (Silverman 2001) where the research summarises a few examples to describe the general could be seen by some as a possible limitation of this qualitative research. Yet inductive principles of this kind form the very basis of scientific inquiry and the "spirit of openness in the presentation of qualitative research methods" undertaken by this study, along with the "richness, breadth, and depth" (Chenail 1995) of the reported data, and its internal validation by multiple sources of collection from numerous participants should dispel such doubts. Perhaps future research could increase the number of participants studied in testing the *hyperuchit* model and so negate these possible limitations. Yet in spite of these possible shortcomings, it is contended that the information gained remains valid, useful and enlightening, and provides a sound, and valuable basis for further research.

Conclusion

In summary, the findings from this study identify that these experienced teachers learned ICT through *hyperuchit* – a proposed model based on Vygotsky's teaching and learning synthesis that encompasses collaborative and interactive process within a socio-cultural context. However as pedagogues, teachers were not theorising about the abstract pedagogical concepts of ICT as

predicted by Kolb (1984) nor were they utilising the logical abilities which, according to Gardner (1999), should have been evident. Despite these missing elements in the teachers' learning as pedagogues, the research indicates that teachers did in fact, successfully learn ICT through *hyperuchit*.

The results gleaned from the application of this new model contribute to knowledge and teacher learning literature, and more specifically ICT learning and the teaching of experienced teachers. The findings are valuable for teacher educators as they seek to make a link between teacher practice and ICT, and support the contention of the need for change in learning and teaching for the information age by fusing the new world of digital practice with the semi-structured inquiry of action research. The results also indicate that these digital immigrant teachers involved in this study did move into the digital landscape. They achieved, at least, a presence characterised as digital residency, if not indeed their digital citizenship. Digital residency is seen as an initial stage of teacher ICT practice building as teachers approach ICT expertise and incorporate attempt working pedagogy suited to the global world. Digital citizenship refers to that more advanced stage of digital literacy which is characterized by engagement with the more sophisticated and, in this case pedagogical potentialities of the technological world. The facilitative adult learning environment valued teachers' experiences and encouraged them to develop their self-esteem in, and confidence with, ICT, in order to function in a technologically rich society and integrate ICT into their existing practices.

This study showed that it is possible for experienced teachers with limited ICT exposure to at least appreciate and begin to understand the language and culture of the information age. Furthermore, while these digital immigrant teachers may never become digital citizens (Snyder 2005), they are moving towards 'being digital' (Negroponte 1995) and they have successfully immigrated to the information age. They have achieved a position as residents and are poised to progress towards digital citizenship through their observed ways of learning: pushing buttons (P), applying software (A) and changing practice (C) and *hyperuchit.* It is also important to

value these teachers' experiences and attitudes: these teachers are a shining example to others in the way they flexibly approached, explored and adapted to the ICT environment.

This study examined 'how' teachers were learning and 'how' ICT was being used, that is, it examined the 'what' of their knowledge (Chapter Four) and in so doing, the practice informed a theory of knowledge (Loughran 2006). The theory that teachers learn ICT through the operation of *hyperuchit* is novel and ripe for further investigation. This research documented the emotional struggles and intellectual changes which the participants underwent, through the lens of little known, but nevertheless valuable concepts derived from the work of Vygotsky: *perezhivanija* (*переживания*) – apprehensiveness resulting from the challenge of new learning; *uchit* (*учить*) – the entwined practice of teaching and learning: and *mislenija* (*мышления*) – the sense making process that leads to the internalisation of new knowledge (Chapters Six and Seven). In this context, the internalisation occurred by learning how to push buttons (P), apply software (A) and change practice (C). However, the challenge remains to move teacher learners beyond the limits of *hyperuchit* to the development of strategies that foster a more structured effort at understanding technology to encourage teachers to develop their working ICT pedagogies.

Appendices

Appendix A – Permission letter and Approval for Project

Victoria University of Technology
PO BOX 14428 Telephone
Melbourne City (03) 9688 4844
MC 8001 Australia Facsimile
(03) 96884646

19th February, 2003

Dear Natalie,

It is with pleasure that I support your PhD research *Digital Immigrant Teachers learning for the Information age*. I also support your work with the teachers enrolled in the Bachelor of Education (Post-Registration) (Year 4) in the School of Education at Victoria University, Sunbury Campus.

I am sure your previous collegial work with Peter Thomas, the Course Co-ordinator and teacher educator in the program will mean for a productive and rich exploration of issues and practices.

Sincerely,

Brenda Cherednichenko
Head, School of Education

Prof Carol Morse
Dean, Faculty of Human Development

LETTER OF PERMISSION (Appendix A continue)
Head of School

My name is Natalie Senjov-Makohon. I am a doctoral candidate student of Doctor of Philosophy in Education at Victoria University.
My research ***Digital Immigrant Teachers learning for the Information age***
is focussed on the learning process of pre-digital trained teachers learning about ICT (Information and Communication Technologies) in the Bachelor of Education (Post-Registration) (Year 4) at Victoria University. The aim of my project is to improve the understanding of the learning process of experienced teachers in the Information age. My research will attempt to understand how research into adult Learning Styles and Multiple Intelligences theory can assist experienced teachers to process, accommodate and demonstrate their understanding of particular ICT knowledge or skills as adult teachers in the Information age.

I will be taking 'field notes', whilst observing and interacting with the enrolled students, working with them to reflect on and evaluate their learning. Also, I will arrange to meet with them at a mutually convenient times and places for half an hour, so that three semi-structured Interviews can take place:
At the beginning of the course to obtain information on their understanding and expectations of the course
At the end of first semester to evaluate their progress through the semester in a face-to-face interview, possibly also on-line
At the end of the university program, another interview will need to take place to assess the learning process, and whether or not the expectations had been met

I will examine the transcripts of the taped interviews, the emails and online discussions. They will be able to read the transcript of the interviews and make any changes that they would like.

Additionally, I will invite the participating students to submit their written records, of action research as set by them, their online discussions, emails and other material related to this course in order to construct patterns and relationships in order to better understand their learning. Their participation is voluntary, and is in no way connected to the requirements of the course. The data collection process will in no way influence nor affect their grades. Data will be analysed at the end of the semester once their grades have been submitted.

Furthermore, I will invite them to participate in this research in the hope that they will be able to further understand their personal learning processes and enhance their learning processes in the Information age. All the data collected will be confidential and it will only be accessible to them and the researcher. Furthermore, they will be able to withdraw from the research at any time without penalty or impediment to their courses of study and academic program.

At the end of course, I will arrange to meet with the teacher educator at a mutually convenient time and place for half an hour, so that a semi-structured Interview can take place to collect additional data and compare it with the students' data as a method of verification of the collected data.

I would be pleased to discuss any questions you may have regarding my research. You can contact me any time at the following:

Tel Office: (03) 9216 8227
Email: Natalie.Senjov-Makohon@vu.edu.au

Thank you for taking the time to consider my request.

Natalie Senjov-Makohon
Doctoral candidate student

Appendix B – Participant's Consent Form

Victoria University of Technology
PO BOX 14428 Telephone
Melbourne City (03) 9688 4844
MC 8001 Australia Facsimile
(03) 96884646

CONSENT FORM

We would like to invite you to be a part of a study into teacher education. The aim of this research is to improve the understanding of the learning process of experienced teachers in the information age.

CERTIFICATION BY TEACHERS

I, _____

of _____

certify that I am at least 17 years old and that I am voluntarily giving my consent to participate in the research entitled: ***Digital Immigrant Teachers learning for the Information age***
being conducted at Victoria University of Technology by: Natalie Senjov-Makohon

You are invited to an interview to discuss your learning process and to submit your written records of action research as set by your teacher educator, your online discussions, emails and other material related to this course. Furthermore, permission is being asked for me to observe and interact with you, and to work with you in reflecting on and evaluating your learning process in a mixed-mode learning environment. The mixed mode delivery entails face-to-face interaction for a designated time during the academic year at University and the other component of the delivery when you transfer to an online mediation, WebCt.

The researcher will be using participant observation – taking field notes and interviewing, because it is believed that these approaches can produce useful and more in depth understanding of the learning process taking place in the University classroom. It frees the researcher from the complex situation of the classroom and allows her together with you to reflect upon the learning process.

The Aim of this project is to:
To improve the understanding of learning of the pre-digital trained teachers in the Information age
To develop a theoretical framework to support the understanding of the effect of ICT (Information and Communication Technologies) on further developments in learning and ICT applications in education
To construct a framework for the learning of the pre-digital trained teacher in the Information age
To open up the potential of lifelong learning for teachers through the use of ICT in their professional development

Procedures:
The researcher will maintain a journal on the learning of the teachers and the teacher educator will verify the work.
Three digitally audio-recorded semi-structured Interviews will be conducted:
At the beginning of the course to obtain information on the teachers' understanding and expectations
At the end of first semester to evaluate the teachers' progress through the semester in a face-to-face interview, possibly also on-line
At the end of the university program, another interview will take place to assess the learning process, and whether or not the expectations had been met.

I certify that the objectives of the research, together with any risks to me associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by: **Natalie Senjov-Makohon** and that I freely consent to participation involving the use on me of these procedures.
I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this research at any time and that this withdrawal will not jeopardise me in any way. I have been informed that the information I provide will be kept confidential.

Signed: **.....**Witness other than the researcher:**……Date.....** Any queries about your participation in this project may be directed to. Associate Professor Tony Kruger on 9747-4786, Dr. Brenda Cherednichenko on 9688 4875 or Natalie Senjov-Makohon on 9747 7484. If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University of Technology, PO Box 14428 MCMC, Melbourne, 8001 (telephone no: 03-9688 4710).

Appendix C – Teacher Educator's Consent Form

Victoria University of Technology
PO BOX 14428 Telephone
Melbourne City (03) 9688 4844
MC 8001 Australia Facsimile

CONSENT FORM

We would like to invite you to be a part of a study into teacher education. The aim of this research is to improve the understanding of the learning process of experienced teachers in the Information age.

CERTIFICATION BY TEACHER EDUCATOR

I**,** _____

of _____

certify that I am at least 17 years old and that I am voluntarily giving my consent to participate in the research entitled: ***Digital Immigrant Teachers learning for the Information age***
being conducted at Victoria University of Technology by: Natalie Senjov-Makohon

You are invited to an interview to discuss your students' learning process as set by you. Furthermore, permission is being asked for me to observe and interact with you and your students, and to work with you in reflecting on and evaluating their learning process in a mixed-mode learning environment. The mixed mode delivery entails face-to-face interaction for a designated time during the academic year at University and the other component of the delivery when they transfer to an online mediation, WebCt.

The researcher will be using participant observation – taking field notes and interviewing, because it is believed that these approaches can produce useful and more in depth understanding of the learning process taking place in the University classroom. It frees the researcher from the complex situation of the classroom and allows her together with your students to reflect upon the learning process.

The Aim of this project is to:
To improve the understanding of learning of the pre-digital trained teachers in the Information age
To develop a theoretical framework to support the understanding of the effect of ICT (Information and Communication Technologies) on further developments in learning and ICT applications in education
To construct a framework for the learning of the pre-digital trained teacher in the Information age
To open up the potential of lifelong learning for teachers through the use of ICT in their professional development

Procedures:
The researcher will maintain a journal on the learning of the teachers and will ask you to verify the work.
Three semi-structured Interviews will be conducted:
At the beginning of the course to obtain information on the teachers' understanding and expectations
At the end of first semester to evaluate the teachers' progress through the semester in a face-to-face interview, possibly also on-line
At the end of the university program, another interview will take place to assess the learning process, and whether or not the expectations had been met.
I certify that the objectives of the research, together with any risks to me associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by: **Natalie Senjov-Makohon** and that I freely consent to participation involving the use on me of these procedures.
I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this research at any time and that this withdrawal will not jeopardise me in any way. I have been informed that the information I provide will be kept confidential.
Signed: **.....**Witness other than the researcher:**……Date:.....**
Any queries about your participation in this project may be directed to. Associate Professor Tony Kruger on 9747-4786, Dr. Brenda Cherednichenko on 9688 4875 or Natalie Senjov-Makohon on 9216 8227. If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University of Technology, PO Box 14428 MCMC, Melbourne, 8001 (telephone no: 03-9688 4710).

Appendix D – Observation *18/3/03*

http://staff.vu.edu.au/hypermedia

Penelope-I'm a frustrated learner, if it doesn't happen now I will leave it alone
Pheobe – Show me I can't get into this…

Duncan – I'll show you (**Doris**) but (turns to teacher educator) I've had problems with the browser over the weekend… Even my friend who's a wiz on the computer couldn't show me…
The teacher educator starts to explain what happens with browsers… but **Duncan**- I just tried to down load another browser…. The teacher educator then explains about the two browsers and what happens

Doris – Can you show me how to open my email and how I attach it and send it to you… You can walk me through this, no… show me… The teacher educator talks her through the process and she tries the process, "I'll need to try this a number of time…"

The teacher educator brings the class together:

Some Ls are watching the teacher educator, however Carol, **Con**, **Dorothy** and **Peg** are screen scrolling…
Dorothy - listening to teacher educator, mouse clicking and trying to keep up Janice turns to **Con** for confirmation about the instructions and whether she has fully understood what has been said…

David and **Ashley** start to assist L with the activity…L "You know last week I was completely thrown out…I just didn't understand anything…" Now she has the assistance of **David** and **Ashley**. However, P10 doesn't feel that confident about computers, he still feels that he can assist L

Class talks about their research and what they have written on the discussion board in WebCt
Con – talks about his learning- I need to do these things before I can teach the children- how to publish the school magazine, scanning, digital camera and web pages

Peg – 'where is the posting…- discussion board - what about the others (show all), **Con** comes over and says – you'll find the stuff there – showing her what to click

Con shows **Doris**, **Duncan** and **Dorothy**, **Con** seems to be the reference point in this group

The teacher educator explains about the discussion board, pdf files and jPegs. Doc arrangements
Melanie-I need to know how to record assessments

Heromachine **Patricia** helps **Pearl** and **Delia** with Heromachine, cropping etc. Teacher educator asks **David**. **Ashley** joins in and Teacher educator and **Ashley** start to lean on **David** and ask him questions

Penelope Patrick and **Patricia** group working especially **Penelope** and **Patrick** through socialization start to work together, showing each other how to do things, Janette looks on and listens

Heromachine could be used for story line – crop the picture and place word and start a storyline – great idea tells the rest of the class

Rakia and Carol tell each other how to crop and about different icons

Print screen novelty and right mouse action especially for **Phoebe** and **Peg Dorothy -** watching, trying to understanding where the other two are driving their mouses, trying to look at the situation form different perspectives, she's trying to see heromachine and its application for her little ones!!!

Teacher educator talks about embedded graphics. **Phoebe** needs assistance but prefers teacher educator's assistance rather than peers

Dorothy and **Philomena**; **Philomena** willing to help – but this is all I know….

Appendix E - Interviews

Three taped semi-structured interviews of half hour duration will be conducted at three points with the teachers:

Beginning of Research (Describing)	**Middle of Research (Interpreting)**	**End of Research (Theorising)**
Can you think of time when your learned something really well? What happened? What did you do? What did the teacher do? What did your peers do? Can you give examples?	Tell us what happened when you really learned something well.	What's the best thing you learned during the course? Can you give examples?
What did you do when you were learning?	What did you do when you were learning in the University classroom?	What did you do when you were learning in the classroom? What about online?
Tell me about the successful/unsuccessful learning experiences that you've had with ICT? What did the teacher do? What about your colleagues?	Tell me about the successful/unsuccessful learning experiences that you're having online? What role did the teacher educator play? What about your colleagues?	What was the best thing that you learned in the course?
What is the purpose of you doing this course? What do you expect of the course? What motivated you to do the course? What do you hope to achieve from the course?	What have you achieved in the course to date? What have you done so far?	Did you enjoy the course? What parts in particular?
How do you use ICT in the classroom? What about at home or for your personal use?	How have you been using ICT in your classroom? What about with your personal needs?	What are the outcomes? What do you intend doing with the acquired knowledge and skill? What are your future goals? Tell me what have you achieved?
Think about your own learning experiences, how do you think teachers learn best?	Think about your learning experiences to date with ICT, how to do believe teachers learn best?	Think about your learning experiences with ICT in the course, how to do believe teachers learn best?

Appendix F – Participant 's Partial Transcript Example of an Interview

1st Interview – March, 2003

Can you think of a time when you learned something really well? It doesn't have to be in IT or in your education. It can be like even when you learning how to drive and you felt as though you had really achieved something.

It is probably related to computers and my education. I, up until Christmas, time, I had never owned a computer and I had never really used one and I knew I was starting a new school year at the end of January and I knew I had to have some basic knowledge because the children would be using computers in the classroom and so I bought a computer over the Christmas break and I sat down and I read the manuals and I played with it and really gave myself a basic understanding of computers. I drew on the knowledge of my brother in law and nephew who are both teenagers and seem to know a lot about computers and they were around showing me bits and pieces and so I think now I have a basic knowledge of computers with which I am quite happy with things such as being able to do signs and things like that which are now in my room and which I wouldn't have been able to do before because I had no idea and so it was something I learned very quickly. I taught myself and read manuals and asked questions of people who knew and I learned quite a lot in a short space of time.

So what did you actually do when you were learning the technology?

Reading manuals. I was asking personally lots and lots of questions from people who I think will know and be able to help me. And I also tried and played around and I went so that how you do that. So a lot of trialing, trial and error, asking questions and reading manuals.

Did you ask any colleagues?

I've got a couple of friends, who are teachers. I was speaking to them about the types of things, such as drawing up tables, that's something my nephews who are teenagers, haven't done before and what types of things do I have to have in my classroom and how do I do these on the computer. And when I first started here, the other teachers had things on disks and they actually copied them onto disk for me. So I played around with them, so I did go to them for help, which was forced.

So they were the successful learning things that you did. And so what were some of the unsuccessful learning experiences you've had during that time?

Wiping discs, erasing material that was on disc because I didn't understand saving and erasing. So that was a bit of trial and error. I'd save something and I would wipe the disk clear, it would disappear because I didn't realise what I had done. Probably hands on, things on trial and error. Like when I'd read something and think I understood it but it didn't work so I would have to go back and do it again or ask somebody. So it was mostly trial and error. Ah, that's a real experience.

Did you go to a course somewhere?
No, I didn't go and do a course at all.

The interview continues……

Appendix G – Exerpts from Patrick's Journal – Written Documentation

During the photo session we decided to include photos and I took photos of the children. They assured me "We all know how to use a digital camera, we're good at it, you've never used it". This is the result, an indicator of often with cad on focus with a group like this who jump in and out of their learning and needs, they want to take a photo and talk and then use it next time. Other times they work as individuals, other times we would stop and learn together, where I was doing the learning and one of them demonstrating. It's also good to be a learner, with that group; one kid would do one thing and then demonstrate it to the others. This was something…, it sort of worked out. The head part was Wendy she knew it when she saw it, all the other very simple produced a complex product with jacks liable in the overall presentation. So part of their job is to produce the plan first and then sit and use that as their plan for their power points, much more than what we have here as I knew where I was going before I started. Just a very intelligent girl the aim is to this means on where its going to carry on to
These are another planning sheet, but these altered the plan and deleted all the graphics, which is got here picture, picture, picture, picture. She had to be persuaded, she's not easy to be persuaded, to use the paint program she use to say I can't do it, I can't do anything, so we had this big discussion about how she could. Later in her reflections with me when she finished her power point, this was last week or week before, she talked about what she learned in regards to the importance of planning and thinking about it more carefully when she had it first time round. She ended up with a power point she wasn't happy and then she had to go re-visit it again.
This is the whole group in the lab, nearly everyone who completed their homework task was enabled in full to work on the computer. Its proven some of the skills of planning and organisation I mentioned will bear reflection with me. When I say talk to me, that came up all the time it proves about our planning and organisation. When the photo was taken I don't think they really realised the importance of planning I thing they thought it wasn't really necessary with the computer. You just go in and use it.
… to yes it's a good idea to do more organisation rather than just going in and doing stuff.
This is us working in the second lab in the school we went to the newer one. My …. Was never a problem, they came to … my concession and they work till nine o'clock even if I wasn't there, and virtually they'd go in and I'd say get going, and they would get going and do it.
The boys were interesting; you can see it's shot to see a play on paper before starting. This shows… of the boys is great, especially this student Michael, who is a very quiet student who gained a lot of confidence. Travis, over here, very confident with his relative teachers is another word for it, because he is very competent in IT, not in reading, but I'll come back to that, he's considered a child of extended learning. Scanners up the top, some students used them in their work. The boys shared their ideas with each other and worked together more than I expected. The learning tended to go the other way.

Appendix H - Discussion

Message no. 21 [Branch from no. 1]

posted by P1 (s3632502) on Wed Mar 12, 2003 17:47

Subject Re: HellOoOo!

who everyone wanted to

Message no. 80 [Branch from no. 1]

posted by P9(s3638923) on Fri Apr 04, 2003 19:58

Subject Re: HellOoOo!

There once was a guy... Who smellt reallt bad

Message no. 3 posted by Peg (s3632495) on Wed Mar 12, 2003 17:42

Subject Integrated project

My project idea was something to do with Microworlds,
Powerpoint and web page design using Frontpage. I would
like all of the children to design their own web page
and then link to all of their I.C.T. work that they do
during the year.

Message no. 4 [Branch from no. 3]

posted by CW (s3636444) on Wed Mar 12, 2003 17:43

Subject Re: Integrated project

sounds great...its great you already have an idea!!

Message no. 5 posted by Delia (s3632499) on Wed Mar 12, 2003 17:45

Subject How to use computers better in my classroom

I've only got two decent computers in my room, so it's
hard to make the best use of them. I want everyone to
have access at some time in the week, but that's pretty
hard, especially as kids type so slowly. Besides, how
do we use them? Set program like for literacy? We're
already doing that. Internet? What? How do you get

The Discussions continue…..

Appendix I – Chats

New session has begun in 03S1_HEB4170_Room1.
Wed Mar 12, 2003 17:26
*^**********

*+***** CW entered 03S1_HEB4170_Room1. Wed Mar 12, 2003 17:26

C W>>hello

*+***** Danielle entered 03S1_HEB4170_Room1. Wed Mar 12, 2003 17:26

*+***** Delia entered 03S1_HEB4170_Room1. Wed Mar 12, 2003 17:26

*+***** Penelope entered 03S1_HEB4170_Room1. Wed Mar 12, 2003 17:26

*+***** Pearl entered 03S1_HEB4170_Room1. Wed Mar 12, 2003 17:26

CW>>heh heh i in the wrong one

*+***** Student--Guest--HEB4170--B entered 03S1_HEB4170_Room1. Wed Mar 12, 2003 17:26

*+***** Student--Guest--HEB4170--A entered 03S1_HEB4170_Room1. Wed Mar 12, 2003 17:26

CW>>nah i actually in here now

CW>>u all smell

CW>>talk to meeeeee

Danielle>>Hi well what do you think about all of this

Student Guest--HEB4170--B>>hello

CW>>wooo someone else!!

Penelope>>Hi guys how's it going?

Danielle>>Having fun or what

CW>>not too bad, HOT

Appendix J - Teacher educator's Verification

November, 2003

Teacher educator - I'm doing phone conversations now from people and these people and the major way they know this course is working out, somebody else has done the course and recommended it to them. Including past students at parent/teacher nights, telling the parents of their students, and they're little primary school kids. They say 'Oh I'm three year trained and they say oh there's this course out at Victoria Uni, ring up P, and they're like "oh 1 don't want to do theoretical" " oh no he is very practical, very hands on". So they self select for that already, and I think that's the same with L M before me so. The ones who are doing the course now, they had often heard about it. So he is very much practical, so that's what 1 have inherited. So there might be this element of not going into the abstract world, so that's a thought to have.

Researcher - Well that's a variable in the course, isn't it?

Teacher educator - Mm, they self select along the way. One of the ladies today said she told me, that she wanted hands on stuff..

Researcher - Well that's an important variable, because what I've been observing is that they really want to do hands on and they're not really interested. Except for that time when Helen got up and showed them that stuff. They're like yourself, they are just interested in how am I going to use this, more than anything else.

Teacher educator - You might like to use a quote from Seymour Papert, when he was teaching logo to the primary school teachers, he sensed that everything wasn't quite gelling properly and eventually one of them said: "I keep trying to work out how to use this in the classroom, this is fun!" That's what one of the people in the activity said, and that was it, the rest of them all clicked again away from it. They stopped trying to force it into a practical sense and perhaps didn't go quite as far as an abstract conceptualisation. But close to that, as you think I'm doing this for it's own sake, because this is somehow beneficial to me. It's called "Mind storms" by Seymour Papert (some paper he brought out from his book). Seymour Papert was quite a guru at it. **…** It's good to read every now and then, it teaches you a lot about things. He's got the three visions. I was talking with your mate, Eva, I had a coffee with her a couple of weeks ago, and I was telling her about, something about Seymour Papert, and she knew him. He describes the teachers and the scholars.

Researcher-They've got, I've actually got it here, and they talk about the boosters and the anti-boosters in school. There's Chris Bigum, talks about people who are so keen on getting involved that they bombard everything and everyone's got to fit into a pattern.

Teacher educator-There weren't any boosters in our group. What are they; they are reluctant!

Researcher-See they start off reluctant and you see that at the beginning. And when they talk about their own learning, they talk about their own learning and there's concern. Whereas someone like Pearl, who says, I come home on a Wednesday and I'm up till one working out things that I've done in class.

Teacher educator-Gee, Right

Researcher-Yeah she says, yeah I'll get on the internet, I'll get the kids off the internet. And when Peg was talking about being in the chat room, "this is what my kids do. So it's a really new experience for a lot of them". When all these about the UVS memory stick, they went out and got bigger ones. I actually got an email from Peg which said; where's that place you said had cheap sticks and all this stuff. So you know there's like a different atmosphere and Pearl was saying how she gets really excited about it, where as before she was petrified of it. So there's been that progression. It's that grading, Fabio talked about being aware of it and all that, transcript all of that and she said 1 was really scared.

Teacher educator- I don't know what the tension of the presentation is going to be like.

Researcher - Well that will be interesting.

Teacher educator - Because I've got 16 of them.....

Researcher -Who sits next to David and Ashley, etc etc …

Appendix K – Kolb's Learning Styles

(Kolb 1984, p. 69; Kolb et al. 1995, p. 52)

Accommodator

This style depends mainly on active experimentation and concrete experience; it has great advantages in doing things, implementing plans, and engaging in new tasks. Therefore, persons with this style focus on risk taking, opportunity seeking, and action; they tend to be superior in adapting themselves to changing immediate situations in which the plan or theory does not fit the facts; they also tend to intuitively solve problems in a trial-and-error manner, depending mainly on other people for information rather than on their own thinking. Therefore, persons with this style tend to deal with people easily; they tend to specialize in action-oriented jobs, such as teaching

Diverger

This style depends mainly on concrete experience and reflective observation; it has great advantages in imaginative abilities and awareness of meaning and values. Therefore, persons with this style tend to organise concrete situations from different perspectives and to structure their relationships into a meaningful whole; they focus on adaptation by observation instead of by action; they are superior in generating alternative hypothesis and ideas, and tend to be imaginative, people- or feeling-oriented.

Assimilator
The assimilative learning style depends mainly on abstract conceptualisation and reflective observation. This style has great advantages in inductive reasoning, creating theoretical models, and assimilating different observations into an integrative entity. They tend to be more concerned about abstract concepts and ideas, and less concerned about people. However, persons with this style tend to focus more on the logical soundness and preciseness of the ideas, rather than their practical values; they tend research and spend time planning.

Converger

The convergent learning style depends mainly on the dominant learning capacities of active experimentation and abstract conceptualisation. This style has great advantages in decision making, problem solving, traditional intelligent tests, and practical applications of theories. Knowledge is organised in a way of hypothetical-deductive reasoning. Therefore, persons with this style are superior in technical tasks and problems and inferior in social and interpersonal matters (Kolb, 1984).

Appendix L - Modes of Learning

(Kolb 1984, p. 69; Kolb et al. 1995, p. 52):

"An *orientation toward* ***concrete experience*** focuses on being involved in experiences and dealing with immediate human situations in a personal way. It emphasizes the perception of feeling, focusing on the uniqueness and complexity of present reality as opposed to theories and generalizations, an intuitive, "artistic" approach as opposed to the systematic, scientific approach to problems. People with a concrete experience orientation enjoy and are good at relating to others. They are often good intuitive decision makers and function well in unstructured situations. People with this orientation value relating to people, being involved in real situations, and an open-minded approach to life".

An *orientation toward* ***reflective observation*** focuses on understanding the meaning of ideas and situations by carefully observing and impartially describing them. It emphasizes understanding as opposed to practical application, a concern with what is true or how things happen as opposed to what is practical, and an emphasis on reflection as opposed to action. People with a reflective orientation enjoy thinking about the meaning of situations and ideas and are good at seeing their implications. They are good at looking at things from different perspectives and at appreciating different points of view. They like to rely on their own thoughts and feelings to form opinions. People with this orientation value patience, impartiality, and considered, thoughtful judgment.

An *orientation toward* ***abstract conceptualisation*** focuses on using logic, ideas, and concepts. It emphasizes thinking as opposed to feeling, a concern with building general theories as opposed to understanding intuitively unique, specific areas, a scientific as opposed to an artistic approach to problems. A person with an abstract conceptual orientation enjoys and is good at systematic planning, manipulation of abstract symbols, and quantitative analysis. People with this orientation value precision, the rigor and discipline of analysing ideas, and the aesthetic quality of a neat, conceptual system.

An *orientation toward* ***active experimentation*** focuses on actively influencing people and changing situations. It emphasizes practical applications as opposed to reflective understanding, a pragmatic concern with what works as opposed to what is absolute truth, an emphasis on doing as opposed to observing. People with an active experimentation orientation enjoy and are good at getting things accomplished. They are willing to take some risk to achieve their objectives. They also value having an impact and influence on the environment around them and like to see results".

Appendix M – Gardner's Multiple Intelligences

Gardner divided intelligence into seven distinct categories (1983) within his model. However this study used the following six:

Verbal/Linguistic intelligence is the ability to use with clarity the core operations of language. People with linguistic intelligence have a sensitivity to the meaning of words and are proficient in convey information.

Logical/mathematical intelligence is the ability to handle chains of reasoning and recognize patterns and orders as in a science. Activities are performed that involve abstract symbols/formulas, outlining, graphic organisers, numeric sequences, calculation, deciphering codes and problem solving.

Musical intelligence is the ability to appreciate musical patterns, compose musical tones, pitches, and rhythms, and perform musically.

Bodily/Kinesthetic intelligence is the ability to use the body skilfully and handle objects adroitly. Use activities that involve physical activities, using one's hands.

Visual/Spatial intelligence is the ability to perceive the world accurately and try to re-create or transform aspects of that world. Use activities that involve art, pictures, sculpture, drawings, doodling, mind mapping, patterns/designs, colour schemes, active imagination, imagery and block building.

Interpersonal intelligence is the ability to understand people and relationship. Learners think by bouncing ideas off each other. Use activities that involve group projects, division of labour, sensing others' motives, receiving/giving feedback, and collaboration skills.

Intrapersonal intelligence is the ability to access one's emotional life as a means to understand oneself and others exhibited by individuals with accurate views of themselves. Use activities that involve emotional processing, silent reflection methods, thinking strategies, concentration skills, higher order reasoning, "centering" practices and meta-cognitive techniques.

Appendix N – Vygotsky's Terminology

Perezhivanija- an anxiety, apprehension or frustration about a new learning experiences (Vygotsky 1999).

Mislenija - the reflection and making sense of the learning environment.

Uchit - social and cultural growth (Vygotsky 1999) that facilitated social interaction, collaboration and mutual dependence to internalise and make sense of an environment. Uchit is the fusion of emotional (*perezhivanija*) and intellectual (*mislenija*) development in a participant's zone of proximal development.

Zone of Proximal Development - "the distance between the actual development level as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky 1981, p. 86).

Scaffolding - "The metaphorical term scaffold, though never used by Vygotsky, has come to be used for interactional support, often in the form of … dialogue" (Clay and Cazden 1992, p. 219) on the interpersonal plane (Vygotsky 1987) to maximise the growth of intrapersonal intelligence (Gardner 1983) in a sociocultural environment.

Examples of terminology
Perezhivanija **-** Dorothy watches others around her and takes notes about the explanations, Judy asks Chris for reassurance 'Am I doing this the right way?" David helps Dorothy and Con who feel that they haven't learned anything…

Penelope asks Patrick "Am I doing this the right way?" Patrick reassures her that FrontPage is similar to Word and that "it's just practice…"

They are finding it frustrating, they are uncertain and they are asking questions, but find it difficult to follow directions.

Polly is asking questions about the procedure and checks that she has understood everything, she's never sure and often feels that everyone else has understood the explanations and she's the only one who has to ask so many questions.

2nd interview – Danielle - I'm not quite as afraid, I'm not quite there but I'm not quite as afraid to have a go and to twiddle around myself and see what I can do before I ask for help.

Mislenija - Patrick and Patricia are working together and showing each other different strategies to achieve their goals and what they have learned. Their collaboration has certainly increased their knowledge and skills as far as they are concerned, both feel that they are collaborative learners, using visuals and reinforcing orally what they are learning, confirming their knowledge and they want to confer their skill acquisition and learning strategies by interacting with other teachers.

Duncan – "how me how that zipping is done" he goes through the motion however, he needs to reinforce the new learning and asks again… and then shows Doris whilst explaining the steps

Uchit - Patrick - "oh that's what Penelope is trying to do…", the two of them (Penelope and Patrick) break into conversation about constructing their new knowledge, sharing their knowledge and how its developed their confidence and how they are empowered to understand ICT and extend their students' knowledge of ICT.

"After each class, I can show my students something, not only do I learn, but I can pass something onto my students…" Penelope tells other DITs about her passing on information to her students and of course "There has to be a smart kid/…. Who wants to tell me and all the other kids ; you know Miss, you can… 'hold on…. I haven't learned that yet!…" Penelope as the teacher wants to sustain her classroom control, she has not quite grasped the idea of facilitating, This idea to the DITs seems to be quite foreign as they have been taught to have full class control!!! "You know, the researcher, I can't have those kids run riot…!"says Doris

Patrick – explains his PowerPoint activity – "then I did it this way, it was easy once you got the hang of it…"
Penelope – " oh my God…you've learned so much and linked it to the Internet…! Referring to his PowerPoint and the amount he has learned in this short time and all his links to the internet. Everyone is praising Patrick on his achievements. Meanwhile Danielle says, "mine's got all these buttons, should they look like this?" In the corner, Con to Duncan – "show me how you did that?" Referring to the method of sending attachments.
Penelope tells everybody how during the week she showed her class how to use PowerPoint and that next term "I'll get one of the kids to facilitate PowerPoint learning! Well this will be an experience for me and them!… This will be the first time I'll try this stuff with the kids…(turns to Patrick) You know I've never tried this type of teaching… it certainly will be different…"

The teacher educator is showing PaintShop Pro, Duncan and Doris are listening and taking notes, Penelope who has followed the sequential process and feel confident to show others, show Patricia the process, who praised Penelope – "Good girl!" Patrick gets involved and shows Patricia, an easier way of doing the process. Patricia is being shown the process in PaintShop pro, she tries to adjust the image. Laughter; this is different and fun…!

Zone of Proximal Development - Ashley is explaining to David about the Hyperstudio icons, he's used a similar program – kidpix! He's feeling comfortable because he can scaffold this knowledge as he says … The feeling of achievement, a sense of being able to talk, create and communicate about this program, gives Ashley the confidence that ICT has possibilities.

Philomena – Peg's been a terrific help, very patient, very thorough, step by step and if I need any help at my work place, they're helpful as well, and one in particular who is many years younger than me will never ever do anything for me. He'll say, you know how to do this so do it yourself and guide more than actually takes it over, he'll say no you do it yourself which has actually made me a lot more confident and actually I remember and that how I learn it.

Scaffolding - Patricia and Patrick are scaffolding and comparing their new ICT skills. Patricia says "you see PowerPoint has similar features, so you can use it in the classroom…"

Danielle talks about her out of class experience and how she made these flyers because she picked up the skills in class, she felt confident and comfortable to make these flyers for her church function, … I would not have ever done that before…

Con says "its ok, when I explain this to you I'm reinforcing my own knowledge and rethinking my learning…"

Bibliography

Abarbanell, L and Gardner, H 2003, "Teaching our children well", *CIO - The Resource for Information Executives*, USA.

ACODE (Australian Council on Open, Distance and elearning), 2006, *Benchmarking for the Use of Technology in Learning and Teaching in Universities*, viewed 24/3/2006, <www.acode.edu.au>.

'ADEC Guiding Principles for Distance Learning and Teaching', 1999, *American Distance Education Consortium*, viewed, 22/6/2002, <www.adec.edu/admin/papers/distance-teaching-principles.html>.

Adler, PA and Adler, P 1987, *Membership Roles in Field Research*, Sage, Newbury Park, USA.

Agostinho, S Lefoe, Geraldine and Hedberg, J *Online Collaboration for Learning, A Case Study of a Post Graduate University Course*, viewed 21/9/2005, http://ausweb.scu.edu.au/proceedings/agostinho/paper.html.

Akdere, M 2003, 'The Action Research Paradigm: An Alternative Approach in Negotiation' in *Systematic Practice and Action Research*, vol. 16, no. 5, pp 339-354.

Allan, K 2005, 'Online learning: constructivism and conversation as an approach to learning', in *Innovations in Education and Teaching International*, vol. 42, no. 3, pp. 245-256.

Allport, GW 1937, *Personality: A psychological interpretation*, Holt and Co, New York.

Ally, M 2004, 'Foundation in Educational Theory for online learning' in Anderson, T and Elloumi, F *Theory and Practice of Online Learning*, Athabasca University, Canada.

Ally, M and Fahy, P 2002, 'Using students' learning styles to provide support in distance education' in the *Proceedings of the Eighteenth Annual conference on distance teaching and Learning*, Madison, WI.

Altrichter, H Posch, P and Somekh, B 1993, *Teachers investigating their work: an introduction to the methods of action research*, Routledge, London.

Anderson, T 2004, 'Toward a Theory of Online Learning', in Anderson, T and Elloumi, F *Theory and Practice of Online Learning*, Athabasca University, Canada.

Anderson, T 2004, 'Something Old – Something New', *The International Review of Research in Open and Distance Learning*, vol 5, no 2.

ANTA (Australian National Training Authority) 2001, *Flexways*, developed by the Canberra Institute of Technology's Teacher Education and Learning Solution Group 9, viewed 7/3/2002, <http://flexways.flexiblelearning.net.au>.

ANTA (Australian National Training Authority) 1993, *Workplace Learning in the Learning of Teachers*, viewed 7/3/2002, <http://www.anta.edu.au>.

Argyris, C and Schön, D 1978, *Organisational learning: A theory of action perspective Reading*, Addison Wesley, Mass*:*

Argyris, C and Schön, D 1974, *Theory in practice: Increasing professional effectiveness*, Jossey-Bass, San Francisco.

Arts, Education and Human Development Handbook, 2006, *All the details at your fingertips*, Victoria University, Melbourne.

Atherton, J S 2002, *Learning and Teaching: Learning from experience*, UK, viewed 6/9/2004, <http://www.dmu.ac.uk/~jamesa/learning/experien.htm>.

Atkinson, S 1998, *Cognitive Styles and Computer Aided Learning (CAL): Exploring, Designer and User Perspectives*, viewed 8/9/2004, <http://www.iteawww.org/PATT11/Atkinsondef.pdf>.

Australian Curriculum Studies Association, 2007, *Australian Government Quality Teacher Programme (AGQTP)*, viewed 23/2/2007, <http://www.quallityteaching.dest.gov.au>.

Australian Department of Communication, Information Technology and the Arts (DCITA), 2004, *Australia's Strategic Framework for the Information Economy*, Australian Printing Press, Canberra.

Australian Department of Communication, Information Technology and the Arts (DCITA), 2006, *Building Australian ICT skills – Report of the ICT skills foresighting working group – June 2006*, viewed 5/2/2007, <www.ag.gov.au.cca>.

Australian Department of Education, Science and Training (DEST), 1999, *In Backing Australia's Ability*, viewed 29/6/2002, <http://www.dest.gov.au/schools/Publications/2000/learning.htm>.

Australian Department of Education, Science and Training (DEST), 1999, *Adelaide Declaration on National Goals for Schooling in the 21st Century*, viewed 29/6/2002, <http://www.dest.gov.au/schools/Publications/2000/learning.htm>.

Australian Department of Education, Science and Training (DEST), 2000, *Teachers for the 21st Century*, viewed 23/2/2003, <http://www.dest.gov.au/sectors/school_education/publications/resources/profiles/teachers_21st_century.htm>.

Australian Department of Education, Science and Training (DEST), 2000, *Learning for the knowledge society*, viewed 29/6/2002, <http://www.dest.gov.au/schools/Publications/2000/learning.htm>.

Australian Department of Education, Science and Training (DEST), 2000, *2010 Queensland State Education: a Future Strategy*, viewed 12/4/2003, <javascript:OpenJahiaScrollableWindow('/sibling/displaypolicy?policy=465076&print=1', 'PolicyData465076', 650,550)>.

Australian Department of Education, Science and Training (DEST), 2001, *Making better connections Models of teacher professional development for the integration of information and communication technology into classroom practice*, viewed 25/4/2004, <http://www.dest.gov.au/sectors/school_education/publications/resources/profiles/making_better_connections.htm>.

Australian Department of Education, Science and Training (DEST), 2002, *Higher Education at the Crossroads*, viewed 30/6/2002, <http://www.dest.gov.au/crossroads>.

Australian Department of Education, Science and Training (DEST), 2002, *Raising the Standard: A Proposal for the Development of an ICT Competency Framework for Teachers*, viewed 23/5/2003, <http://www.dest.gov.au>.

Australian Department of Education, Science and Training (DEST), 2006, *The Career Education Lighthouse Schools Project*, viewed 5/9/2006, <http://www.careerlighthouse.dest.gov.au/background.html>.

Aviram, A and Eshet-Alkalai, Y 2006, 'Towards a Theory of Digital Literacy: Three Scenarios for the Next Steps', *European Journal of Open Distance and E-Learning (EURODL)*, viewed 12/6/2007, <http://www.eurodl.org/materials/contrib/2006/Aharon_Aviram.htm>.

Baker, A Jensen, PJ and Kolb, DA 2002, *Conversation Learning; An Experiential Approach to Knowledge Creation*, viewed 8/9/2004, <http://www.learningfromexperience.com/chpt5.pdf>.

Baker, B 1990, 'Planning, using the new technology in classrooms', *National Association of Secondary School Principals* (NASSP), no. 74, pp. 31-37.

Bawden, D 2001, 'Information and Digital Literacies', *Journal of Documentation",* vol. 57, no. 2, March 2001, pp. 218-259.

Bawden, D and Robinson, L 2002, 'Promoting literacy in a digital age: approaches to training for information literacy', *Learning Publishing*, vol. 15, no. 4, pp. 297-301.

Bayne, S and Ross, L 2008, *Digital native and digital immigrant discourses: a critique*, viewed 10/12/2008,http://www.malts.ed.ac.uk/staff.sian/natives_final.pdf.

Beauchamp, G 2004, 'Teacher Use of the Interactive Whiteboard in rimary Schools: towards an effective transition framework', *Technology, Pdeagogy and Education*, Vol. 13, No. 3, pp. 327-348.

Beetham, H and Sharpe, R 2007, *Rethinking Pedagogy for a Digital Age*, Routledge, London, England.

Bennett, BB 1987, *The Effectiveness of Staff Development Training Practices: A Meta-Analysis*, Dissertation, Division of Teacher Education and Graduate School of the University of Oregan, USA.

Bennett, S Maton K and Kervin L 2008, 'The digital native debate: A critical review of the evidence', *British Journal of Educational Technology*, Vol. 39, issue 9, pp. 775-786.

Benyei, L 1961, *An Interation Study of Migrants in Australia*, 2nd edition, Melbourne.

Berge, Z 2000, 'Components of the Online Classroom' in Weiss, RE Knowlton, DS and Speck, BW (eds) 2000, *Principles of Effective Teaching in the Online Classroom*, Jossey-Bass, San Francisco.

Bertram, B 2003, *Literacy in the information age: Inquiries into meaning making with new technologies*, International Reading Association, Newark, DE.

Best Practice, viewed 20/9/2003, <http://www.tafe.sa.edu.au/vet_div/irsi/best_prac/htm/undrstnd/undst.html>.

Beynon, J and Mackay, H (eds) 1991, *Technology literacy and the curriculum*, Falmer, London.

Biggs, J 2003, *Teaching for Quality Learning at University*, SRHE and Open University, Buckingham, UK.

Bitter, G and Pierson, M 2002, *Using Technology in the Classroom*, 5th Edition, Allyn and Bacon, Boston.

Bjarnason, S 2004, 'Borderless Higher Education', in King, R 2004, *The University in the Global Age*, Palgrave-Macmillan, Great Britain.

Blanck, G 1992, 'The man and his cause' in Moll, L 1992, *Vygotsky and Education Instructional Implications and Applications of Sociohistorical Psychology*, Cambridge University Press, Cambridge,UK.

Blau, JR, Thomas, M, Newhouse, B and Kavee, A 1998 'Ethnic Buffer Institutions: The Immigrant Press: New York City, 1820-1984', *Historical Social Research*, vol. 23, no. 3, pp. 20-37.

Blood, R 2000, *Weblogs: A History and Perspective. Rebecca's Pocket*, viewed 24/3/2008, <http://www.rebeccablood.net/essays/weblog_history.html>.

Bogdan, RC and Biklen, SK 1992, *Qualitative Research for Education – An introduction to Theory and Methods*, Allyn and Bacon, Boston.

Boheman, N 2003, 'Collective Professional Knowledge', *Medical Education 2000*, 34, pp. 505-506.

Bonk, CJ and Cummings, JA 1998, 'Searching for Learner-Centered, Constructivist and Sociocultural Components of Collaborative Learning tools', in Bonk, CJ and King, KS (eds) *Electronic Collaborators: Learner-Centered Technologies for Literacy, Apprenticeship, and Discourse*, Lawrence Erlbaum Associates, Mahwah, NJ.

Bonk, CJ and Reynolds, TH 1997, 'Learner-centered Web-based instruction for higher-order thinking, teamwork, and apprenticeship'. In Khan, BH (ed) *Web-based instruction*, Educational Technology Publications, Englewood Cliffs, NJ.

Bonk, CJ Cummings, JA Hara, N Fischler, RB and Lee, SM 1999, *A Ten Level Web Integration Continuum for Higher Education*: *New Resources, Partners, Courses, and Markets*, viewed 23/7/2002, <www.php.Indiana.edu/~cjbonk/paper/edmdia99.html>.

Bordini, RH and Campbell, JA 1995, *Towards an Anthropological Approach to Agent Adaptation*, University College, London, viewed 21/10/2005, <http://www.dur.ac.uk/rbordini/publications>.

Boud, D 2006, 'Aren't we all learner-centred now?: the bittersweet flavour of success', in Ashwin, P (ed.) *Changing Higher Education*, Routledge, Great Britain.

Boud, D Cohen, R and Walker, D 1993, 'Introduction: Understanding learning from experience' in Boud, D Cohen, R and Walker, D (eds) *Using experience for learning*, The Society for Research into Higher Education and Open University Press, Buckingham, England.

Boud, D Keogh, R and Walker, D, 1985, 'Introduction: What is reflection in learning', in Boud, D Keogh, R and Walker, D (eds) *Reflection: Turning experience into learning*, Kogan Page, London.

Boulton-Lewis, G 1998, 'Applying the SOLO Taxonomy to Learning in Higher Education' in Dart, B and Boulton-Lewis, G *Teaching and Learning in Higher Education*, ACER, Australia.

Bowles, MS 2004, *Relearning to E-Learn*, Melbourne University Press, Australia.

Bowles, P and Veltmeyer, H 2007, 'Introduction' in Bowles, P Veltmeyer, H Cornelissen, S Invernizzi, N and Tang, K *National Perspectives on Globalisation*, Palgrave Macmillan, New York, USA.

Bozhovich, LI 2004, 'LS Vygotsky's Historical and Cultural Theory and Its Significance for Contemporary Studies of the Psychology of Personality' *Journal of Russian and East European Psychology*, vol 42, no 4, pp 20-34.

Bransford, JD Brown, AL and Cocking RR (eds) 1999, *How People Learn Brain, Mind, Experience and School*, National Academy Press, Washington, DC.

Breck, J 2002, *How we will learn in the 21st century,* Scarecrow Press, USA.

Brookfield, S 1986, *Understanding and facilitating adult learning*, Jossey-Bass, San Francisco.

Brookfield, S 1995, *Becoming a Critically Reflective Teacher*, Jossey-Bass, San Francisco.

Brookfield, S 2005, *The Power of critical theory for adult learning and teaching*, Open University Press, Maidenhead.

Brookfield, S 2006, *The Skilful Teacher, On Techniques, Trust, and Responsiveness in the Classroom*, 2nd edition, Jossey-Bass, San Francisco.

Brosnan, MJ 1998, *Technophobia: the psychological impact of information technology***,** Routledge, New York.

Broudy, J 1977, *The real spin on tennis: grasping the mind, body, and soul of the game,* ICS Books, Merrillville.

Brualdi, AC 2002, *Multiple intelligences: Gardner's Theory*, Eric Digest, ERIC Clearinghouse on Assessment and Evaluation, Washington DC. viewed 25/2/2002. http://.

Brudnell, I and Carpenter, CS 1990, 'Adult learning styles and attitudes towards computer assisted instruction', *Journal of Nursing Education*, 29, pp. 79-83.

Bryman, A and Burgess, RG (eds) 1994, *Analysing Qualitative Data*, Routledge, London.

Burgess, R 1988, *Strategies of Educational Research Qualitative Methods*, Falmer Press. London.

Burgess, RG 1984, *In the Field: An Introduction to Field Research,* Allen and Unwin, London.

Burkhardt, G Monsour, M Valdez, G Gunn, C Dawson, M Lemke, C Coughlin, E Thadani, V and Martin, C 2003, *Literacy in the Digital Age*, viewed 20/6/2007, <http://www.ncrel.org/engauge>.

Campbell, N McGee, C and Yates, R 2000, 'It is not out with old and in with the new', *The challenge to adapt to online teaching,*

Competition, Collaboration, Continuity and Change Conference Papers, Adelaide, 11-13 Sep 2000, viewed 24/7/2001, <http://www.com.unisa.edu.au/cccc/papers/non_refereed/campbell.htm>.

Carlson-Pickering, J 1999, *Multiple intelligences and Technology, A Winning Combination! The University of Rhode Island and The Rhode Island Foundation Teachers in Technology Initiative*, viewed 8/6/2004, <http://www.ri.net/RITTI_Fellows/Carlson-Pickering/MI_Tech.htm>.

Carr, W and Kemmis, S 1986, *Becoming Critical: education, knowledge and action research,* Deakin University Press, Australia.

Carrucan, T Crewe, T Mathews, E and Mathews S 1996, *The Internet Manual for Teachers*, MacMillan, Melbourne, Australia.

Cassidy, O 2003, *I can try it: utilizing Multimedia Stimulation as an aid to Experiential Learning-Literature Review,* viewed 5/10/2003, <LitReview/litreview.htm>.

Castells, M 1996, The Information Age: Economy, Society, and Culture, *Volume 1: The Rise of the Network Society*, Blackwell, Oxford.

Castles, S and Miller, MJ 1993, *The Age of Immigration – International Population Movements in the Modern World*, Macmillan, London.

Cazden, CB 1983, 'Adult assistance to language development: Scaffolds, models, and direct instruction'. In R. P. Parker & F. A. Davis (Eds.), *Developing literacy: Young children's use of language* (pp. 3-17). Newark, DE: International Reading Association.

Chase, SE 2003, 'Taking Narratives Seriously: Consequences for Method and Theory in Interview Studies' in Lincoln, YS, and Denzin, NK *Turning points in Qualitative Research-tying knots in a handkerchief*, Rowman and Littlefield Publishers, Inc, USA.

Checkland, P 1981, *Systems Thinking, Systems Practice,* John Wiley and Sons, New York.

Chenail, RJ 1995, 'Presenting Qualitative Data', The Qualitative Report, vol. 2, no. 3, December, viewed 26/07/2008, <http://www.nova.edu/ssss/QR/QR2-3/presenting.html>.

Chere-Masopha, J and Bennett S 2007, "Using Teacher Professional Identity to Understand Classroom ICT Practices", *The International Journal of Learning*, Vol 14, Issue 7, pp. 75-82.

Chickering, AW and Ehrmann, SC 1996, 'Implementing the Seven Principles: Technology as Lever', *American Association for Higher Education (AAHE), Bulletin*, viewed 14/3/2002, <http://www.aahe.org/technology/ehrmann.htm>.

Chickering, AW and Gamson, ZF 1987, 'Seven principles for good practice in undergraduate education', *AAHE Bulletin*, vol. 39, no. 7, pp. 3-7.

Clare, J and Hamilton, H 2003, *Writing research: transforming data into text,* Churchill Livingstone, Edinburgh.

Clark, D 2000, *Learning styles - Or, How We Go From the Unknown To the Known,* viewed 20/5/2002, <http://www.nwlink.com/~donclark/hrd/styles.html>.

Clarke, A 2005, 'Towards an e-inclusive society' in *Adult Learning*.

Clay, M and Cazden, C 1992, 'A Vygotskian interpretation of reading recovery', in Moll, Face-to-face *Vygotsky and education :Instructional implications and applications of socio-historical psychology,* Cambridge University Press, Cambridge.

Clyne M 1982, *Multilingual Australia*, Trade Lino, Meredith, Melbourne.

Cohen, E 2004, 'Teaching Demanding Strategies for Cooperative Learning: A Comparative Study of Five Teacher Education Programs' in Cohen, E Brody, CM and Sapon-Shevin, M (eds) *Teaching Cooperative Learning - The Challenge for Teacher Education,* State University of New York Press, Albany, USA.

Cohen, L Manion, L and Morrison, K 2004, *A Guide to Teaching Practice,* Routledge, UK.

Cohen, V 1997, 'Learning styles in a technology-rich environment', *Journal of Research on Computing in Education*, 29 (4).

Cohen, V 1998, 'Multimedia and cognition: Training teachers on the use of technology'. *Proceedings of Society for Information Technology and Teacher Education (SITE) 98,* Washington D.C.

Cohen, V 2000, *Looking at the Big Picture in Technology Assessment: What Questions Should We Ask?* Dickson University, Fairleigh.

Colaizzi, PF 1978, 'Qualitative Research as the Phenomenologist Views IT', in Vaile, R and King, M (eds), *Existential-Qualitative research Alternatives for Psychology,* Oxford University Press, New York.

Cole, M and Wertsch, JV 1996, *Beyond the Individual-Social Antimony in Discussion of Piaget and Vygotsky* viewed 31/8/2005, http://www.des.emory.edu/mfp/VygColeWer.pdf.

Condie, R and Livingston, K 2007, 'Blending Online Teaching with Traditional Approaches: Changing Practices', *British Journal of Educational Technology,* v. 38, n. 2, pp. 337-348.

Cope, B Castle, S and Kalantzis, M 1991, *Immigration, ethnic conflicts and social cohesion*, Australian Government Publishing Services, Australia.

Cope, B and Kalantzis, M 1998, 'Multiliteracies: meeting the communication challenge in TAFE' *Australian TAFE Teacher,* vol. 32, no. 2.

Cope, B and Kalantzis, M 2000, *Multiliteracies: Literacies Learning and the Design of Social Future,* Routledge, London.

Cope, B and Kalantzis, M 2001, *Putting multiliteracies to the Test*, viewed 12/06/2007, <http://edoz.com.au/educationaustralia/archive/features/mult1.html>.

Cooper PA *Computer-Mediated Communication, The Infosphere and the Virtual Learning Community,* viewed 18/10/2004, <http://www.shsu.edu/~csc_pac/site%202000.doc>.

Corbeil, JR and Valdes-Corbeil, ME 2007, 'Are you ready for Mobile Learning?', *Educause Quarterly*, No. 2, 2007.

Cringely, RX 1995, *The Triumphs of the nerds,* viewed 4/7/2005, <http://www.pbs.org/nerds>.

Cropley, AJ 1981, 'Lifelong Learning: A rationale for teacher training', *Journal of Education for Teaching*, 7, pp. 57-69.

Cross, PK and Steadman, MH 1996, *Classroom Research – Implementing the Scholarship of Teaching*, Jossey-Bass Publishers, San Francisico.

Cross, PK 1982, *Adults as Learners,* Jossey-Bass Publishers, San Francisco.

Cunningham, W 2006, *Wikipedia*, viewed 25//2006, http://en.wikipedia.org.com/wiki/Wik/Ward_Cunningham.

Daniels, H 2003, *Vygotsky and Pedagogy*, Routledge Falmer, London.

D'Antoni, S 2007, *The Virtual University Models and messages*, viewed 11/5/2007, <http://www.unesco.org/iiep/virtualuniversity/overview.php>.

Darlington, Y and Dave, RH (eds) 1976, *Foundation of Lifelong Education*¸ Pergamon Press (for UNESCO Institute of Education, Oxford).

Darlington, Y and Scott, D 2002, *Qualitative Research in Practice: Stories from the field,* Allen and Unwin, Australia.

Davies, AC 2005, *A New Democracy for Professional Development and Research Learning to Find the Future,* A PhD Dissertation, Victoria University, Australia.

DeBello, TC 1990, 'Comparison of Eleven Major Learning Styles Models: Variables, Appropriate Populations, Validity of Instrumentation and the Research Behind Them', *Journal or Reading, Writing, and Learning Disabilities*, vol 6, pp. 203-22.

Dee Fink, 1999, *Active Learning,* viewed 20/5/2003, <http://www.hcc.hawaii.edu/intranet/committees/FacDevCom/guidebk/teachtip/active.htm>.

Denzin, NK 1978, *Sociological methods: a sourcebook*, McGraw-Hill, New York.

Denzin, NK and Lincoln, YS (eds) 1994, *Handbook of Qualitative Research,* Sage Thousand Oaks, CA.

Derry, J 2004, 'The Unity', *Educational Review*, vol 56, no 2, June 2004.

Dewey, J 1974, *Democracy and Education: an introduction to the philosophy of education,* Macmillan, New York (Originally published 1910).

Dewey, J 1963, *Experience and Education,* Collier Books, New York.

Diaz, RM Neal, CJ and Amaya-Williams, M 1992, 'The social origins of self-regulation' in Moll, LC 1992, *Vygotsky and Education,* Cambridge University Press, Cambridge.

Dick, B 1997, *Action Learning and Action research,* viewed 4/9/2006, www.scu.edu.au/schools/gcm/ar/arp/actlearn.html.

Dickson, D 1998, 'Technology That Enhances Kinesthetic Intelligence' in *New Horizons for Learning*, April, 1998, viewed 24/7/2005, http://www.newhorizons.org/.

Dillion, P 2004 'Trajectories and tensions in the Theory of Information and Communication Technology in Education', *British Journal of Educational Studies*, vol. 52, no. 2, pp. 138-150.

Dondi, C and Moretti, M 2007, "Discover: Helping teachers to discover the pleasure of learning and teaching", *British Journal of Educational Technology*, Vol. 38, Issue 3, pp. 519-522.

Douglass, B and Moustakas, C 1985, 'Heuristic Inquiry: The Internal Search to Know', *Journal of Humanistic Psychology*, vol. 25, no. 3, pp. 39-55.

Douglas, J. 1976 *Investigate Social Research: Individual and Team Field Research,* Sage, Beverly Hills.

Dow, G 1982, *Teacher Learning*, Routledge and Kegan Paul Ltd, London.

Dowling, C and Lai KW 2003, *Information and Communication Technology and the Teacher of the Future*, Kluwer Academic Publishers, Boston/Dordrecht/London.

Duffy, TM and Cunningham, DJ 1996, 'Constructivism: Implications for the design and delivery of instruction' in Jonassen, DH (ed) *Handbook of research for educational communications and technology,* Simon and Schuster Macmillan, New York.

Dunn, R and Griggs, S 1995, *Multiculturalism and learning styles: teaching and counselling adolescents,* Praeger, USA.

Eickmann, P Kolb, A and Kolb, DA 2002, 'Designing Learning', paper presented at the Conference *Managing as Designing: Creating a New Vocabulary for Management Education and Research,* Weatherhead School of Management, Case Western Reserve University, Cleveland, Ohio.

Eisner, E 1988, 'The primacy of experience and the politics of method', *Educational Researcher*, vol. 17, no. 5, pp. 15-20.

Ekeler, WJ 1994, 'The Lecture Method', in Prichard, KW and McLaran Sawyer, R (eds) *Handbook of College Teaching – Theory and Application*, Greenwood Press, London.

Elder, L and Paul, R 1994, 'Critical thinking: why we must transform our teaching' *Journal of Developmental Education*.

Ely, M Anzul, M Friedman, T Garner, D and Steinmetz A 1991, *Doing Qualitative Research: Circles within Circles,* The Falmer Press, London.

Ely, M Vinz, R Dowling, M and Anzul, M 1997, *On Writing Qualitative Research Living by Words,* Falmer Press, London.

Engelbrecht, E 2003, 'A look at e-learning models: investigating their value for developing an e-learning strategy', *Progressio*, vol. 25, no. 2, pp 38-47.

European Round Table of Industrialists, 1995, *Education for Europeans: towards the learning society,* ERT, Belgium, viewed 20/12/2005, <http://www.ert.be/doc/0061.pdf>

Eysenck, HJ 1998, *Intelligence; a new look*, Transaction Publishers, New Brunswick, NJ.

Fastrak Consulting Ltd, 1999, *Ways of looking at style*, viewed 15/09/02, http://www.fastrak-consulting.co.uk/tactix/Features/lngstyle/style03.htm.

Feenberg, A 1989, 'The written world: On the theory and practice of computer conferencing', in Mason, R and Kaye A (ed), *Mindweave: Communication, computers, and distance education,* Pergamon Press, Toronto.

Feenberg, A 1993, *Building a Global Network: The WBSI Experience*, viewed 20/3/2003, <http://www-rohan.sdsu.edu/faculty/feenberg/wbsi3.htm>.

Feenberg, A 1999, *Distance Learning: Promise or Threat?*, viewed 20/3/2003, <http://www-rohan.sdsu.edu/faculty/feenberg/TELE3.HTM>.

Fenwick, TJ 2001, *Experiential Learning: A Theoretical Critique from Five Perspectives*, ERIC Clearinghouse on Adult, Career, and Vocational Education, Ohio.

Fidishun, D 2006, *Andragogy and Technology: Integrating Adult Learning Theory As We Teach With Technology*, viewed 1/02/2006, <http://www.mtsu.edu/Eitconf/proceed001/fidishun.htm>.

Field, PA and Morse, JM 1985, *Nursing research: the application of qualitative approaches*, Chapman and Hall, London.

Fielding, NG and Fielding, JL 1986, *Linking data***,** Sage Publications, Beverly Hills.

Fillmore L 1995, EDMedia conference speech, reprinted in revised form in *on the Internet*, vol. 1 no. 4, September/October, 1995, pp 37-42.

Fisher, K. 2003, 'Designs for Learning in the Knowledge Age', in *SA Architectural Journal*, South Australia.

Flavell, J 1976, 'Metacognitive aspects of problem solving', in Resnick, L (ed) *The nature of intelligence*, Erlbaum, Hillsdale, NJ.

Fleming, N 1992, *Introduction to VARK* Lincoln University, New Zealand, viewed 12/2/2001, <www.vark-learn.com>.

Fogarty R and Stoehr, J 1995, *Integrating Curricula with multiple intelligences, teams themes and threads*, Hawker Brownlow Education, Australia.

Fox, D 2007, 'Teaching through Technology: Changing Practice in Two Universities', *International Journal on E-Learning*, vol. 6, n. 2, pp. 187-203.

Frechette, J 2002, *Developing Media Literacy in cyberspace: Pedagogy and Critical Learning for the Twenty-first Century Classroom*, Greenwood Publishing Group, Westport, CT, USA, viewed 3/3/2005, <http://site.elibrary.com/lob/victoriauni/Doc?id=10040715andpage=147>.

Frederick, PJ 1994, 'Clasroom Discussions' in Prichard, KW and McLaran Sawyer, R (eds) *Handbook of College Teaching – Theory and Application*, Greenwood Press, London.

Friedman, A Watts, D Croston, J and Durkin, C 2002, 'Evaluating Online CPD Using Educational Criteria Derived from the Experiential Leaning Cycle', *British Journal of Educational Technology*, vol. 33, no. 4, pp. 367-378.

Fullan, M 1997, *Successful School Improvement*, Open University Press, England.

Fullan, M 1993, *Change Forces – Probing the Depths of Educational Reform*, The Falmer Press, London.

Fullan, M 1990, 'Staff Development, Innovation, and Institutional Development', in Joyce, B *Changing School Culture through Staff Development*, Association for Supervision and Curriculum Development, Alexandria, VA.

Fullan, M et al. 1998, *The rise and stall of teacher education reform***,** AACTE, Washington.

Funderstanding, *Piaget*, viewed 31/8/2005, <http://www.funderstanding.com/piaget.cfm>.

Gale Encyclopaedia of Psychology: *Gardner, Howard Earl (1943-)*

Gardner, H 1981, *The Quest for Mind*, The University of Chicago Press, USA.

Gardner, H 1983, 1984 and 1993, *Frames of Mind: The theory of multiple intelligences,* Basic Books, New York.

Gardner, H 1991, "Intelligence in Seven Steps", *New Horizon for Learning*, viewed 16/5/2008, <http://newhorizons.org/future/Creating_the_Future/crfut_gardner.html>.

Gardner, H 1993, *Multiple intelligences: The Theory in Practice*, Harper and Collins, London.

Gardner, H 1994, *Reinventing Our Schools*, viewed 8/6/2004, <http://www.ed.psu.edu/insys/ESD/Issues.html>.

Gardner, H 1995, 'Reflections on multiple intelligences', *Phi Delta Kapppan*, vol. 77, no. 3, pp. 200-208.

Gardner, H 1997**,** *Extraordinary Minds: Portraits of Four Exceptional Individuals and an Examination of Our Own Extraordinariness,* Basic Books, New York.

Gardner, H 1998, *The Complete Tutor*, Harvard University Cambridge Mass.

Gardner, H 1999, *Intelligence Reframed Multiple intelligences for the 21st Century,* Basic Books, New York.

Gardner, H 2000, *The Disciplined Mind: Beyond Facts and Standardized Tests, The K-12 Education that Every Child Deserves*, Penguin, New York, USA.

Gardner, H 2003, *Multiple intelligences After Twenty Years*, Paper presented at the American Educational Research Association, Chicago, Illinois, viewed 23/9/2003 <http://www.pz.harvard.edu/Pls/HG_MI_after_2o_years.pdf>.

Gardner, H 2004, *Changing Minds - The Art and Science of Changing Our Own and Other People's Minds*, Harvard Business School Press, Massachusetts.

Garrison, D R and Anderson, T 2003, *E-Learning in the 21st Century-A Framework for Research and Practice,* Routledge Falmer, London.

Gee, J 2002, 'New Times and New Literacies', in Kalantzis, M and Cope, B *Learning for the Future: New Worlds, New Literacies, New Learning, New People,* Common Ground, Australia.

Gibbs, G 1987, *Learning by doing: A guide to teaching and learning methods*, FEU Birmingham Polytechnic, Birmingham.

Gibson, W 1986, *Burning Chrome,* Arbor House, New York.

Gibson, M 2004, 'Globalisation, Innovation and Socially Robust Knowledge', in King, R 2004, *The University in the Global Age,* Palgrave-Macmillan, Great Britain.

Giest, H and Lompscher, J 2003, 'Formation of Learning Activity' in Kozulin, A and Gifford, BR 1996, *Mediated Learning: A new model of networked instruction and learning*, viewed 25/5/2003, <http://www.academic.com/library/article/Educom96/index>.

Gillard, J 2008, 'A Higher Education Revolution: Creating a Productive, Prosperous, Modern Australia', *Australian Financial Review Higher Education Conference*, Sydney, viewed 20/3/2008, http://mediacentre.dewr.gov.au/mediacentre/Gillard/Releases/AHigherEducationRevolutionCreatingaProductiveProsperousModernAustralia.htm.

Gillet, S E and Kapor, M 1997, "The Self-Governing Internet Coordination by Design," in Brian, K and Keller, J (ed), *Coordinating the Internet* MIT Press, Cambridge, MA.

Gilster, P 1997, *Digital literacy*, Wiley, New York.

Gindis, B Ageyev, V and Miller, S *Vygotsky's Educational Theory in Cultural Context*, Cambridge University Press, United Kingdom.

Giri, P 2002, 'Lunch American-style: macaroni, tomato sauce and garam masala', *SFGate – The San Francisco Chronicle,* July 31, viewed 10/7/2008, http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2002/07/31/FD41136.DTL&hw=INDIAN+CUISINES&sn=077&sc=128.

Glesne, C and Peshkin, A 1992, *Becoming Qualitative Researchers: An Introduction,* Longman, New York.

Gold, A and Evans, J 1998, *Reflecting on School Management,* Falmer Press, London.

Goodyear, P 1990, 'Computers and Education'**,** *Selected papers on A European conference of technology and education*, Vol. 16, Issue 1, Pergamon Press, Inc.

Goodyear, P and Steeples, C 1998, 'Creating shareable representations of practice', *Association for Learning Technology Journal*, vol. 6, no. 3, pp. 16-23.

Gordon, D 2001, 'The Digital Classroom – how technology is changing the way we teach and learn*', The Harvard Education Letter*, Cambridge, MA.

Greeno, JG and Hall, RP 1997, 'Practicing Representation Learning with and About Representational Forms', *The Professional Journal of Education,* vol. 78, no. 5, pp. 361-367.

Grow, G 1990, 'Writing and multiple intelligences', *Presentation given at the annual meeting of the Association for Educators in Journalism and Mass Communication*, ERIC Document Reproduction Service No. ED 406 643, viewed 25/7/2005, http://www.longleaf.net/ggrow.

Grundy, S 1995, *Action Research as Proferssional Development*, Occasional Paper, No. 1, Innovative Links Project, Western Australia.

Guba, EG and Lincoln, Y 1989, *Fourth Generation Evaluation,* Sage, Newbury Park, CA.

Guskin, C Peng, YJ and Simon, M 1992, 'Do Teachers React to "Multiple Inteligences"? Effects of Teachers' Stereotypes on Judgements and Expectancies for Students with Diverse Patterns of Giftedness/Talent', *Gifted Child Quarterly*, January 1, 1992; vol 36, No. 1, pp. 32-37.

Hacker, J and Niederhauser, DS 2000, 'Promoting Deep and Durable Learning in the Online Classroom' in Weiss, RE Knowlton, DS and Speck, BW (eds) *Principles of Effective Teaching in the Online Classroom*, Jossey-Bass, San Francisco.

Harasim, L Hiltz, SR Teles, L and Turoff, M 1995, *Learning networks: A field guide to teaching and learning online*, MIT Press, Cambridge, MA.

Hargreaves, A 2003, *Teaching in the knowledge society Education in the age of insecurity*, Open University Press, Philadelphia.

Hargreaves, A 1994, *Changing Teachers, Changing Times – Teachers' Work and Culture in the Postmodern Age*, Cassell, London.

Hargreaves, A and Evans, R 1997, *Beyond Educational Reform Bringing Teachers Back in* Buckingham, Open University Press, England.

Hargreaves, A and Fullan, MG 1992, *Understanding Teacher Development* Teachers College Press, New York.

Hargreaves, L Comber, C and Galton, M 1996, 'The National Curriculum: can small schools deliver? Confidence and competence levels of teachers in small rural primary schools', *British Educational Research Journal*, vol. 22, no. 1, pp. 89-99.

Harris, J and Hanley, B 2004, 'Cooperative Learning in Teacher Education: A Four Year Model' in Cohen, E Brody, CM and Sapon-Shevin, M (eds) *Teaching Cooperative Learning*, State University of New York Press, Albany.

Haslett, T Mollineux, JO Sarah, R Stephens, J Tepe S and Walker, B 2002, *Collaborative Learning in PhD programmes: a model from the Department of Management and Faculty of Business and Economics*, Monash University, Melbourne.Held, D McGrew, A Goldblatt, D and Perraton, J 'People on the Move', in *Global Transformation*, Polity, Cambridge.

Hatton, TJ and Leigh, A 2007, 'Immigrants Assimilate as Communities, not just as Individuals' *The Australian National University Centre for Economic Policy Research Discussion Paper No. 547*, March, viewed 10/07/2008, <http://econrsss.anu.edu.au/pdf/DP547.pdf>.

Hoban, G 2002, *Teacher Learning for Educational Change*, Open University Press, England.

Hoerr, T 2000, *Becoming a multiple intelligences school*, ASCD, USA.

Holstein, JA and Gubrium, JF 2003, *The Active Interview*; Sage, London.

Holzman, L and Newman, F 1993, *Lev Vygotsky: Revolutionary Scientist*, Routledge, Hoboken.

Honey, P and Mumford, A 1986, *Using your learning styles*, Maidenhead, Berkshire.

Hopper, P 2006, *Living with Globalisation*, Berg, Oxford.

Howard, R 1991, *All about intelligence: human, animal and artificial*, New South Wales University Press, Australia.

Huberman, A 1993, *The Lives of Teachers*, Teachers College Press, New York, USA.

Hughes, M Ventura, S and Dando,M 2004 “On-line interprofessional learning, introducing constructivism through enquiry-based learning and peer review” in *Journal of Interprofessional Care*, Vol 18, No 3, August 2004.

Hung, DWL and Der Thunq, C 2001, ‘Situated Cognition, Vygotskian Thought and Learning from the Communities of Practice Perspective: Implications for the Design of Web-Based E-Learning’ in *Educational Media International*, London.

Hunt, L 2006, ‘A community development model of change The role of teaching and learning centres’ in Hunt, L Bromage, A and Tomkinson, B *The Realities of Change in Higher Education*, SEDA, London, UK.

IBM 2008, ‘Web 2.0 Security’, *IBM Research*,viewed 26/07/2008, <http://domino.research.ibm.com/comm/research_projects.nsf/pages/web_2.0_security.index.html>.

ISTE, 2000, *NETS, students, viewed 15/3/2007,* <http://cnets.iste.org/students/pdf/netss.pdf>.

ISTE, 2000, *Educational Technology Standards and Performance Indicators for All teachers*, viewed 15/3/2007, <http://cnets.iste.org/teachers/t_stands.html>.

Jagielo, LM 1998, ‘Qualitative Life History Interview Methodology with Computer Assisted Analysis: Lessons Learned from the Study Poster’, presented at the *National Head Start Research Conference* 4th, Washington, DC.

Jamison, P Taylor, PG Fisher, K Trevitt, ACF and Gilding, T 2000, ‘Place and Space in the Design of New Learning Environments’ in *Higher Education Research and Development,* vol 19, no. 2.

Jarvis, P 1987, *Twentieth century thinkers in adult education*, Routledge, London.

Jarvis, P 2004, *Adult Education and Lifelong Learning*, Routledge, London.

Jarvis, P and Griffin, C 2003, *Adult and Continuing Education*, Routledge, London.

Jarvis, P Holford, J and Griffin, C 1998, *The Theory and Practice of Learning*, Kogan Page, London.

Jochem, W Van Merriënboer, J and Koper, R 2004, *Integrating E-learning Implications for Pedagogy, Technology and Organisation*, Routledge Falmer, London.

Johnson, AP 2005, *A Short Guide to Action Research*, Pearson, USA.

Johnson, D and Kress, G 2003, ‘Globalisation, Literacy and Society: redesigning pedagogy and assessment’, *Assessment in Education*, vol. 10, no. 1.

Jonassen, D Peck, KL and Wilson, BG 1999, *Learning with technology: A constructive perspective*, Prentice-Hall, NJ.

Jonassen, D Davidson, M Collins, M Campbell, J and Bannan-Haag, B 1995, ‘Constructivism and computer-mediated communication in distance education’, *The American Journal of Distance Education* (2), pp. 7-26.

Jonassen, DH 1994, ‘Thinking technology: Towards a Constructivist Design’, *Educational Technology*, vol. 34, no. 4, pp.34-37.

Jonassen, DH and Grabowski, BL 1993, *Handbook of Individual Differences, Learning and Instruction*, Lawrence Erlbaum Associates, Publishers, New Jersey.

Jones, A 2006, *Dictionary of Globalisation*, Polity Press, Cambridge.

Jones, WF 1994, 'Workshop Methods' in Prichard, KW and McLaran Sawyer, R (eds) *Handbook of College Teaching – Theory and Application*, Greenwood Press, London.

Jorgensen, D 1993, 'Participant Observation: a methodology for human studies' *Applied Social Research Method.* vol. 15, Sage Publications, Thousand Oakes, London.

Joyce, B Murphy, C Showers, B and Murphy, J 1989, 'School renewal as Cultural Change', *Educational Leadership*, vol. 47, no. 3, pp. 70-77.

Jung, CG 1933, *Modern Man in Search of A Soul*, Harcourt, Brace New York.

Jupp, J. 1966, *Arrivals and Departures*, Landsdowne Press, Melbourne.

Kalantzis, M and Cope, B 2005, *Learning By Design*, Victorian Schools Innovation, Melbourne, Australia.

Kalantzis, M Cope, B and Harvey, A 2003 'Assessing Multiliteracies and the New Basics', *Assessment in Education: Principles, Policy and Practice*, vol. 10, no. 1, pp 15-26.

Kajder, S 2007, 'Bringing New Literacies into the Content Area Literacy Methods Course', *Contemporary Issues in Technology and Teacher Education*, vol. 7 no. 2, pp. 92-99.

Kaufman, A 2006, Assessing *adolescence and Adult Intelligences*, Wiley, New Jersey.

Katz, J 1997, 'The digital Citizen', *Wired News*, I 5.12, Dec 1997, viewed 24/7/2008, <http://www.wired.com/wired/archive/.12/netizen_pr.html>.

Kember, D 2000, *Action Learning and Action Research: improving the quality of teaching and learning***,** Kogan Page, London.

Kemmis, 1986, *Becoming Critical: Education, Knowledge and Action Research*, Falmer Press, Lewes.

Kemmis, S and McTaggart, R 1988, *The action research planner* (3rd ed.), Deakin University Press, Australia.

Kemshal-Bell, G 2001, *The Final Report prepared for the Project Steering Committee of VET Teachers and Online Learning Project*, ITAM, ESD, TAFE NSW Dept of Education and Training, NSW.

King, R 2004 'Globalisationand the University' in King, R *The University in the Global Age*, Palgrave-Macmillan, Great Britain.

Klein, PD 1998, 'A response to Howard Gardner: Falsifibality, empirical evidence, and pedagogical usefulness in educational psychology' *Canadian Journal of Education*, Vol. 23, No. 1, pp. 103-112.

Knowles, M S 1998, *The Adult Learner-The Definitive Classic in Adult Education and Human Resource Development*, Gulf Publishing Co., USA.

Knowles, MS and Associates 1984, *Andragogy in Action*, Jossey-Bass Inc. San Francisco, California.

Knowles, MS 1980, *The Modern Practice of Adult Education: From Andragogy to Pedagogy*, Cambridge Adult Education, Englewood Cliffs, NJ.

Knowles, M 1978, 1973, *The Adult Learner, A neglected species*, Gulf Professional Publishing, Houston, Texas, USA.

Knowles, MS Holton, EF and Swanson, RA 1998, *The Adult Learner*, Gulf Publishing, Houston.

Knowlton, DS 2000, 'Theoretical Framework for the Online Classroom: A Defense and Delineation of a Student-Centered Pedagogy' in Weiss, RE Knowlton, DS and Speck, BW (eds) *Principles of Effective Teaching in the Online Classroom*, Jossey-Bass, San Francisco.

Knuth, R Amenta-Shin, G and Ciesemier, K. 1999, *NCREL framework for supporting effective technology staff development*. Unpublished manuscript.

Knutt, and Jones, 1991, in *Learning Theories*, viewed 8/9/2004, <http//:www.cdli.ca/~dsulliva/technology/new_page3.htm>.

Ko, S and Lieberman, J 2000, *An integrated model of training and support for online teaching*, viewed 2/2/2002, <http://www.flexiblelearning.net.au/nw2000/talkback/p03.htm>.

Kock Jr., NF McQueen, RJ and Scott, JL 1997, *Can action research be made more rigorous in a positivist sense? The contribution of an iterative approach*, viewed 20/9/2006, <http://www.scu.edu.au/schools/gcm/ar/arr/arow/kms.html>.

Kolb, AY and Kolb, DA 2003, *Learning Styles and Learning Space: Enhancing Experiential Learning in Higher Education*, [On-line] US, viewed 9/8/2004, <http://www.learningfromexperience.com/Research Library.htm>.

Kolb, D Boyatzis, R A and Mainemelis, C 2000, 'Experiential Learning Theory: Previous Research and New Directions' In. Sternberg, R. J and Zhang, L. F. *Perspectives on cognitive, learning and thinking styles*, Lawrence Erlbaum, New York.

Kolb, D 1984, *Experiential Learning – Experience as The Source of Learning and Development*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Kolb, D 2000, "Learning places: building dwelling thinking online", In the *Journal of Philosophy of Education*, Vol 34, No. 1, pp. 121-133.

Kolb, D 2004, 1996, *david a. kolb on experiential learning*, viewed 4/9/2004, <http://www.infed.org/biblio/b-explr.htm>.

Kolb. D and Fry, R 1975, 'Toward an applied theory of experiential learning', in C. Cooper (ed.) *Theories of Group Process*, John Wiley, London.

Kolb, D and Goldman, M.B 1973, *Toward a typology of learning style and learning environment*, Institute Tech, Cambridge: Mass.

Kolb, D Kolb, A Kayes, A and Kayes, C 2004, *Team Building* viewed 6/9/2004, <http://www.learningfromexperience.com/Team_Learning.html>.

Kolb, D Osland, JS and Rubin IM 1995, *Organisational Behaviour: An Experiential Approach*, Prentice Hall, New Jersey.

Kolb, D Rubin, IM and McIntyre, J 1971, *Organizational Psychology – An Experiential Approach to Organizational Behavior*, (4th ed), Prentice-Hall, New Jersey.

Kornhaber, M Fierros, E and Veenema, S 2004, *Multiple intelligences Best Ideas from Research and Practice*, Pearson, Boston.

Kornhaber, M and Gardner, H 2006, 'Multiple intelligences: Developments in implementation and theory' In Constas, R and Sternberg, R J. (eds) *Translating theory and research into educational practice*, Mahwah, Lawrence Erlbaum Associates, NJ.

Kovacs, M L and Cropley, A J 1975, *Immigrants and Society: Alienation and Assimilation*, McGraw-Hill, Sydney.

Kozulin, A 1998, *Psychological Tools – A sociocultural approach to education*, Harvard University Press, USA.

Kozulin, A Gindis, B Ageyev, VS and Miller, S 2003, *Vygotsky's Educational Theory in Cultural Context*, Cambridge University Press, UK.

Krashen, SD 1982, *Principles and practice in second language acquisition*, Pergamon, Oxford, UK.

Laferrière, T 1997, 'A six-phase tentative general model of professional developmen', *Proceedings of The 14th International Conference on Technology and Education*, pp. 556-558.

Laferrière, T and Breuleux, A 2004, "Knowledge building, Innovative practice in network-enabled classrooms", Poster session at SITE, Atlanta, USA.

Laferrière, T Breuleux, A and Erickson, G 2004, 'Telecollaborative communities of practice in education within and beyond Canada'. In A. Brown and N. Davis, *World Yearbook of Education 2004*, Kogan Press, London.

Laird, D 1985, *Approaches to training and development*, Reading, Addison-Wesley, Mass.

Lantolf, JP 2000, *Sociocultural Theory and Second Language Learning*, Oxford University Press, UK.

Larsen, SN 2002, *Interview with Steen Nepper Larsen*, Version June 5.

Laurillard, D 2006, 'E-learning in higher education', in Ashwin, P (ed) *Changing Higher Education*, Routledge, London.

Laurillard, D 2002, *Rethinking University Teaching. A conversational framework for the effective use of learning technologies*, 2nd edition RoutledgeFalmer, London.

Laurillard, D 1997, *Rethinking University Teaching – a framework for effective use of educational technology*, Routledge, London.

Lave, J and Wenger, E 2003, *Situated learning-legitimate peripheral participation*, Cambridge University Press, Cambridge, UK.

Law, N Lee, Y and Chow, A 2002, 'Practice characteristics that lead to 21st century learning outcomes', *Journal of Computer Assisted Learning*, vol 18, Issue 4.

Learnativity, 2000, *Learning Styles*, viewed 27/2/2002, <http://www.learnativity.com/learningstyles.html>.

LeCompte, WL Millroy, and Preissle, J (eds) 1992, *The handbook of qualitative research in education*, San Diego: Academic Press.

Lefoe,G and Corderoy, RM 1998, *Tips for Effective Online Teaching and Learning,* viewed 13/11/2001, <http://www.kcc.hawaii.edu/org/tcon98/paper/lefoe.html>.

Leibernam, A and Grolnick, M 1996, 'Networks and reform in American education', *Teachers College Record,* vol. 98, no.1, pp. 7-45.

Lester, S 2007, *Technology, Literacy and MySpace Generation,*viewed 10/07/2008, <http://www.techlearning.com/showArticle.php/€articleID=196604312>.

Lewin, K 1946, 'Action research and minority problems', *Journal of Social issues,* vol. 2, pp. 34-6.

Lewins, FW 1978, *The Myth of the Universal Church,* Australian National University Press, Canberra.

Lim, CP 2001 'A Holistic Approach towards the use of an Integrated Online Delivery and Management System', *Journal of Educational Media*, vol. 26, no. 1.

Lincoln, YS 1993, 'I and thou: Method, voice, and roles in research with eh silenced', in McLaughlin, D and Tierney, W (ed), *Naming silenced lives: Personal narratives and the process of educational change*, Routledge, New York.

Lincoln, YS and Guba, EG 1985, *Naturalistic Enquiry*, Sage, Beverly Hills, CA.
Liu, Y 1999, *Cognitive Styles and Distance Education*, viewed 20/3/2003, <http://www.westga.edu/~distance/liu23.html>.

Ling, H 2004, *Chinese St. Louis: From Enclave to Cultural Community*, Temple University Press, Philadelphia.

Longworth, N 2003, *Lifelong Learning in action,* Routledge Falmer, London.

Loughran, J 1996, *Developing reflective practice; learning about teaching and learning through modeling***,** Falmer Press, London.

Loughran, J 2006, *Developing a Pedagogy of Teacher Education – Understanding teaching and learning about teaching*, Routledge, London.

Loughran, J 2007, 'Teachers as Leaders*:* Building a Knowledge Base of Practice through Researching Practice', in Townsend, T and Bates, R (eds) 2007, *Handbook of Teacher Education – Globalisation, Standards, and Professionalism in times of Change*, Springer, The Netherlands.

Mahn, H and John-Steiner, V 2002, *The Gift of Confidence: A Vygotskian View of Emotions,* viewed 26/12/2004, <http://people.ucsc.edu/~gwells/CHATBook/Ch4.MahnJSteiner.html>.

Mahn, H and John-Steiner, V 2000, *Knowledge – Right to knowledge and modes of knowing, new conditions, Developing the affective ZPD*, viewed 23/11/2005, <http://www.fae.unicamp.br/br2000/trabs/1410.doc>.

Manen, Van M 1990, *Researching Lived experience: Human Science for an Active Sensitive Pedagogy,* Aithouse, Ontario.

Manen, Van M 1991, *The tact of teaching*: *The meaning of Pedagogical Thoughtfulness,* New York Press, State University of Albany.

Map Data Sciences P/L, 1998-2004,viewed 14/7/2004, <http://www.mapds.com.au/>.

Mason, J 2002, *Qualitative researching,* Sage Publications, London.

Mason, R 1998, *Globalising Education: Trends and Applications*, Routledge, London.

Mason, R and Romiskowski, A 1996, 'Computer-mediated communication', in Jonassen, D (ed) *Handbook of Research for Educational Communications and Technology*, Macmillan, New York.

Maydell-Stevens, E Masgoret A-M and Ward, T 2007, 'Problems of psychological and sociocultural adaptation among Russian-speaking immigrants in New Zealand', *Social Policy Journal of New Zealand,* 30, pp. 178-198.

Mayer, E 1992, *Key Competencies*, Australian Education Council and Ministers of Vocational Education, Employment and Training, Canberra, Australia.

Mayes, T and de Freitas, S 2007, 'Learning and e-learning: the role of theory', Beetham, H and Sharpe, R (ed) *Rethinking Pedagogy for a Digital Age,* Routledge, England.

McConnell, D 2006, *Developing and Sustaining Online Learning Communities*, viewed, 12/12/2006, <http://www.wun.ac.uk/elearning/seminars/seminars/seminar_six/McConnell.pdf>.

McDermott, R 1995, 'Learning in action: Designing collaborative knowledge work teams', in Beyerlein, MM Johnson, DA and Beyerlein, ST *Advances in Interdisciplinary Studies of Work Teams,* vol. 2, JAI Press, Greenwich, CT, pp. 35-39.

McKay, J and Marshall, P 2001, 'The dual imperatives of action research', *Information Technology and People*, vol. 14, no. 1, pp. 46-59.

McKenzie, J 2007, 'Digital Nativism Digital Delusions and Digital Deprivation', *From Now on – the educational technology journal,* Vol 17, no. 2, November 2007.

McKenzie, J 2000, *Beyond Technology – Questioning, research and the Information Literate School*, FNO Press, USA.

McKenzie, J 1999, *How Teachers Learn Technology Best,* FNO Press, USA.

McKenzie, J 1998, *Creating Learning Cultures with Just-in-Time Support,* viewed 28/9/2002, <http://staffdevelop.org/adult.html>.

McLaughlin, M and Marsh, D 1978, 'Staff Development and School Change', *Teachers College Records*, vol. 80, no. 1, pp 69-94.

McLoughlin, C 2008, "Creating a web-based knowledge-building team: Design of tasks, scaffolds and social affordances", a paper presented at the *EdMedia Conference, Vienna.*

McNiff, J January 2001, "Action Research and the Professional Learning of Teachers", a paper presented at the *Qattan Foundation Conference,* Palestine.

McNiff, J 2001, *Action Research: Principles and Practice,* 2nd edition, Routledge, Florence, KY.

McNiff, J Lomax, P and Whitehead, J 1996, *You and Your Action Research project*, Routledge, New York.

McNiff, J and Whitehead, J 2005, *Action research for Teachers – A Practical Guide*, David Fulton publishers, London.

McTaggart, R 1997, 'Reading the collection' In R. McTaggart (ed) Participatory Action Research, Suny Press, Albany, NY.

Meloy, JM 2002, *Writing the Qualitative Dissertation – Understanding by Doing*, 2nd edition, Lawrence Erlbaum Associates Publishers, New Jersey.

Mertens, DM 1998, *Research Methods in Education and Psychology - Intergrating Diversity with Quantative and Qualitative Approaches*, Sage Publications, London.

Meyer, B and Sorensen, 2006, 'Remediation and redidactisation in language learning with ICTs', *Engaging Pedagogies*, AARE, Adelaide, Australia.

Mezirow, J 1991, *Transformative Dimensions of Adult Learning,* Jossey Bass, San Francisco.

Microsoft, 2004, "Preparing Teachers for the 21st Century", viewed 30/5/2004, <http://www.microsoft.com/education/KavianiFeature.aspx>.

Miles Grant, C 2000, Professional Development in a Technological Age: New Definitions, Old challenges, New Resources, viewed 23/4/2003, <http://ra.terc.edu/publications/TERC_pub…ch-infusion/prof_dev>.

Miles, MB and Huberman, M 1984, *Qualitative data analysis: a sourcebook of new methods*, Sage Publications, Beverly Hills.

Mirandanet, 2004, *Learning to Use ICT in Classrooms: Teachers' and Trainers' Perspectives,* viewed 2/12/2008, <http://www.mirandanet.ac.uk/tta/>.

Moll, L 1992, *Vygotsky and Education Instructional Implications and Applications of Sociohistorical Psychology,* Cambridge University Press, Cambridge,UK.

Morgan, H 1996, 'An analysis of Gardner's theory of multiple intelligence', *Roeper Review*, 18, pp. 263-270.

Morrison, GR and Guenther, PF 2000, 'Designing Instruction for Learning in Electronic Classrooms' in Weiss, RE Knowlton, DS and Speck, BW (eds) *Principles of Effective Teaching in the Online Classroom*, Jossey-Bass, San Francisco.

Mossberger, K Tolbert, CJ and McNeal, R 2007, *Digital Citizenship: The Internet, Society, and Participation*, MIT Press, USA.

Moustakas, C 1990b, *Heuristic Research: Design, Methodology, and Applications.* Sage, Newbury Park.

Myers Briggs, 1997, viewed 27/9/2003, <http://www.teamtechnology.co.uk>.

Nader, JC 1995, *Prentice Hall's Illustrated Dictionary of Computing* 2nd edition, Prentice Hall, Sydney, Australia.

Naidu, S 2003, *Learning and Teaching with Technology- principles and practice,* Kogan Page, London.

NEAToday: Extra! Extra! – March, 1999, *Interview with Howard Gardner,* National Education Association, viewed 23/9/2003.

Negroponte, N 1995, *Being Digital,* Alfred Knopf, New York.

Neo, M 2003, 'Developing a Collaborative Learning Environment using a web-based design', *Journal of Computer Assisted Learning,* vol. 19**,** no. 4, pp. 462-474.

Newstead SE 1992, 'A study of two "quick-and-easy" methods of assessing individual differences in student learning', *British Journal of Educational Psychology*,part 3, p. 299-312.

Nias, J 1989, *Primary Teachers Talking: A Study of Teaching as Work,* Routledge and Kegan Paul, London.

O'Connell, M Benson, R and Samarawickrema, G 2007, 'Professional development for professional developers: Who's learning about e-learning from whom?' *Who's Learning? Whose Technology?,* 23rd annual ASCILITE conference, Sydney, Australia.

Oosterheert, IE and Vermunt, JD 2003, 'Knowledge Construction in Learning to Teach: the role of dynamic sources', *Teachers and Teaching: theory and practice,* vol 9, no 2.

O'Reilly, T 2005, *What is Web 2.0 Design Patterns and Business Models for the Next Generation of Software,* viewed 22/2007, <http://oreillynet.com/pub/a/oreilly/tim/news/2005/09/03/what-is-web-20.html>.

O'Rourke, M 2003, *Technology and Educational Change-Making the Link,* A PhD Dissertation presented at Victoria University, Australia.

Osterhammel, J and Petersson, N 2003, *Globalisation a short history,* translated by Dona Geyer, 2005, Princeton University Press, New Jersey.

O'Sullivan, E 1999, *Transforming Learning Educational Vison for the 21st Century,* Zed Books, London.

Oubenaissa-Giardina, L 2007, 'ICT Integration in Education: Limits, Concerns and Recommendations to Improve Teacher Professional Development Programs', *The Third International Conference on Technology, Knowledge and Society,* Cambridge, UK.

Over the shoulder learning, viewed 21/9/2005, <http://w3.ed.uiuc.edu/courses/edpsy317/sp03/challenge-reports/kurt.htm>.

Owen, M 2004, *The myth of the digital native,* viewed 10/12/2008, <www.futurelab.org.uk>.

Owston, RD 1997, 'The World Wide Web: A technology to enhance teaching and learning?', *Educational Researcher*, vol. 26, no. 2, pp. 27-33.

Panich, C 1988, *Sanctuary?: remembering postwar immigration*, Allen and Unwin, Sydney.

Papert, S – quote, viewed 14/5/2003, <http://www.thelearningcollaborative.org/quoteindex.htm>.

Papert, S 1980, *Mindstorms: children, computers, and powerful ideas*, Basic Books, New York.

Park, P 1993, 'What is Participatory Research? A Theoretical and Methodological Perspective', in Park, M Peter, BM Hall, B and Jackson, T *Voices of Change Participatory Research in the United States and Canada*, Greenwood Publishing Group, USA.

Park, P Brydon-Miller, M Hall B and Jackson T 1993, *Voices of Change*, Bergin and Garvey, London.

Patton, MQ 2002, *Qualitative Research and Evaluation Methods*, (3rd Edition) Sage Publication, USA.

Patton, R 1980, *Qualitative Evaluation Methods*, Beverley Hills, Sage Publication, USA.

Pearson, J 2003, 'Information and Communications Technologies and Teacher Education in Australia', *Technology, Pedagogy and Education*, vol. 12, no. 1.

Peralta, H and Costa, F A 2007, Teachers's competence and confidence regarding the use of ICT. *Sísifo*. *Educational Sciences Journal*, 3, pp. 75-84. viewed 27/11/2008 <http://sisifo.fpce.ul.pt>

Perelman, L J 1992, *School's Out: Hyperlearning, the New Technology, and the End of Education*, William Morrow, New York.

Phelps, R 2002, *Capability versus Competency in Information Technology Education: Challenging the Learning Context for Lifelong Technological Literacy*, viewed 22/8/2007, <http://ids.lis.net.au/renata/greece.htm>.

Phelps, R 2003, *Mapping the Complexity of Computer Learning: Journeying beyond Teaching for Computer Competency to Facilitating Computer Capability*, PhD thesis, Southern Cross University, viewed 24/8/2007, <http://www.scu.edu.au/schools/edu/staff/pages/renata/phd>.

Phelps, R and Ellis, A 2002, 'A Metacognitive Approach to Computer Education for Teachers: Combining Theory and Practice for Computer Capability', *Linking Learners*, Hobart, Tasmania.

Phelps, R Graham, A and Kerr, B 2004, 'Teachers and ICT: Exploring a metacognitive approach to professional development' *Australasian Journal of Educational Technology*, 2004, vol. 20, no. 1, pp. 49-68.

Piaget, J 1970, *Science of education and the psychology of the child*, (D. Coltman, trans), Orion, New York.

Pickles, T 2007, *Experiential Learning articles and critique of David Kolb's theory*, viewed 20/2/2008, <http://reviewing.co.uk/research/experiential.learning.htm>.

Portella, E 2003, *Introduction: Indications of the Knowledge Society*, *Diogenes*, 50(1): 116-120, viewed 24/11/2006, <http://sagepublications.com>.

Potomac Knowledgeway, 1999, *Citizenship in the Digital Age*, viewed 1/12/2006, <http://www.knowledgeway.org/works/citizenship/homepage.html>.

Postman, N and Weingartner, C 1971, *Teaching as a subversive* activity, Penguin, Great Britain.

Powell, JV and Reiff, JC 1993, 'Preservice teachers preference of the Nova-Net instructional delivery system among ten strategies', *Journal of Educational Technology Systems*, vol. 22, no. 1, pp. 69-76.

Prensky, M 2001, *Digital Game-based Learning*, McGraw-Hill, New York.

Prensky, M 2001a, 'Digital Natives, Digital Immigrants', *On the Horizon* (NCB University Press, Vol 9 No.5, October 2001), viewed 17/9/2002, <http://www.twitchspeed.com/site/Prensky/DitialImmigrants/Part1.htm>.

Prensky, M 2001b, 'Do They Really Think Differently?' *On the Horizon,* NCB University Press, Vol 9 No 6 October, 2001, viewed 17/9/2002, <http://www.twitchspeed.com/site/Prensky/DitialImmigrants/Part1.htm>.

Prensky, M 2002, 'Not Only the Lonely' *On The Horizon*, vol. 10, no 4.

Prensky, M 2002, *Open Collaboration – Finding and Polishing "Hidden Gems"*, viewed 20/2/2003, <http://www.marcprensky.com/writing/Prensky%20-%20Open%20Collaboration%20-%20OTH%2010.3.pdf>.

Prensky, M 2003, 'Has 'Growing Up Digital' and Extensive Video Game Playing Affected Younger Military Personnel's Skill Sets?' *I/TSEC* Conference.

Prensky, M 2003, 'Overcoming Educator's Digital Immigrant Accents – A Rebuttal' *Commentary-the technology source*, viewed 11/6/2003, <http://ts.mivu.org/default.asp?show=articleandid=2003>.

Prensky, M 2005, 'Adopt and Adapt', *Edutopia,* December, 2005, viewed 1/12/2006, <http://edutopia.org/bigideas>.

Prensky, M 2005, "If we Share, We're Halfway There", viewed 22/12/2006, <http://72.14.253.104/search?q=cache:gGluniMPV0AJ:www.marcprensky.com/writing/PrenskyIf_We_Share.pdf+prensky+%2B+if+we+share,+were+halfway+thereandhl=enandgl=auandct=clnkandcd=1>.

Prensky, M 2006, 'Listen to the Natives', *Educational Leadership,* vol. 63, no. 4, pp. 8-13.

Prichard, KW and McLaran Sawyer, R 1994, *Handbookof College Teaching – Theory and Applications*, Greenwood Press, USA.

Privateer, P 2007, 'Digitalizing the Universe: The New Alphabet and the Global Battle for Human Nature', *The Third International Conference on Technology, Knowledge and Society*, Cambridge, UK.

Prosser, M and Tridwell, K 1999, *Understanding Learning and Teaching – The Experienced in Higher Education*, Open University Press, UK.

QSITE *Guidelines for effective ICT related professional development for Queensland teachers,* 2004, viewed 2/11/2005, <http://www.qsite.edu.au/uploads/documents/store/doc_1_51_finaldraftpos.pdf>

QSITE Report – Towards a model of effective professional development in ICT for teachers, 2005, Queensland, viewed 20/1/2005, <http://www.qsite.edu.au>.

Rainey, MA and Kolb, DA 1995, 'Using Experiential Learning Theory and Learning Styles in Diversity Education', in Sims, RR and Sims, SJ *The Importance of Learning Styles-Understanding the Implications for Learning, Course Design, and Education,* Greenwood Press, Westport, Connecticut.

Ramsden, P 1992, *Learning to Teach in Higher Education*, Routledge, London.

Ramsey, G 2000, *Quality Matters: Revitalising Teaching: Critical Times, Critical Choices,* NSW Department of Education and Training, Sydney, viewed 20/3/2006, http;//www.pub-ed-inquiry.org/reports/final_reports/04/>.

Reinharz, S 1984, *On becoming a social scientist - from survey research and participant observation to experiential analysis*, Transaction Publishers, USA.

Renck Jalongo, M 1991, *Creating Learning Communities: The role of the teacher in the 21st century,* National education Service, Bloomington, Indiana.

Resnick, LB 1996, 'Situated Learning', in De Corte, E and Weinert, FE (Eds) *International Encyclopedia of Developmental and Instructional Psychology,* pp. 341-347, Pergamon Press.

Resnick, LB 1987, *Education and learning to think*, National Academy Press, Washington, DC.

Ribble, MS Bailey, GD and Ross, TW 2004, 'Digital Citizenship – Addressing appropriate Technology Behavior', *Learning and Leading with Technology*, Vol. 32, viewed 12/12/2006, <http://coe.ksu.edu/digitalcitizenship/TeachingDCdigitalcitizenship/1stLandL.pdf>.

Ribble, MS and Bailey, GD 2004, *Teaching Digital Citizenship, when will it become a priority for 21st century schools?* viewed 25/11/2006, <http://coe.ksu.edu/digitalcitizenship/TeachingDC.pdf>.

Ribble, MS and Bailey, GD 2004, *Teaching Digital Citizenship Reflection: A four-Stage Technology Learning Framework* viewed 12/12/2006, <http://www.educ.ksu.edu/go/bailey>.

Richardson, L 1994, 'Writing A Method of Inquiry' in Denzin, NK and Lincoln, YS (eds), 1994, *Handbook of Qualitative Research,* Sage, Thousand Oaks.

Riddle, EM 1999, *Lev Vygotsky's Social Development Theory*, viewed 12/6/2005, <http://chd.gse.gmu.edu/immersion/knowledgebase/theorists/constructivism/vygotsky.htm>.

Riding, P 2001, 'Online Teacher Communities and Continuing Professional Development' *Teacher Development,* vol 5, no. 3, United Kingdom.

Rizzo, A 2003, 'Activity Centred Professional Development and Teachers' Take-Up of ICT'. Australian Computer Society, Inc. This paper was presented at the IFIP Working Groups 3.1 and 3.3 Working conference: *ICT and the Teacher of the Future*, held at St. Hilda's College, The University of Melbourne, Australia.

Roberts, DF, Foehr, MA and Rideout, V 2005, *Generation M – Media in the Lives of 8-18 Year-Olds,* Kaiser Family foundation, viewed 10/12/2008, <http://www.kff.org/entmedia/entmedia030905pkg.cfm>.

Robinson, D and Reeve, K 2006, *Experiences of new immigration at the neighbourhood level*, Joseph Rowntree Foundation, viewed 20/5/2008, <http://www.jrf.org.uk/knowledge/findings/socialpolicy/0086.asp>.

Roblyer, MD Edwards, J and Havriluk, MA 1997, *Integrating Educational Technology into Teaching*, Prentice-Hall, New Jersey.

Rogers, A 1996, *Teaching Adults,* Open University Press, Buckingham.

Rogers, C and Freiber, HJ 1983, F*reedom to Learn* (3rd ed) Merrill, New York.

Romano, M 2003, *Empowering Teachers with Technology – Making it happen,* The Scarecrow Press, USA.

Rorty, R 1991, *Objectivity, relativism, and truth: Philosophical Papers,* vol 1, Cambridge University Press, Cambridge, MA.

Rosa, A and Montero, I 1992, 'Historical context of Vygotsky's work' in Moll, LC (ed) *Vygotsky and Education,* Cambridge Press, Cambridge.

Rosenberg, M 2001, *E-Learning Strategies for delivering knowledge in the Digital Age,* McGraw-Hill, New York.

Rossman, GB and Rallis, SF 1998, *Learning in the field - An introduction to qualitative research,* Sage Publications, London.

Rowland, S 2000, *The Enquiry University Teacher,* St Edmundsbury Press, Great Britain.

Rozycki, EG and Goldfarb, MF 2000, *The educational Theory of Lev Semenovich Vygotsky (1896-1934)* viewed 21/9/2005, <http://www.newfoundations.com/GALLERY/Vygotsky.htm>.

Rudd, K and Smith, S 2007, *The Australian economy needs an education revolution,* Australian Labor Party, Canberra, viewed 12/4/2008, < http://www.alp.org.au/download/now/education_revolution.pdf>.

Rué, J 2006, 'Reconstructing teaching professionalism in the new modernity: an agenda for new action narratives' *Educational Action research,* vol. 14, no. 1.

Russell, G and Bradley, G 1997, 'Teachers' computer anxiety: Implications for professional development', *Education and Information Technologies*, Issue 2, pp 1-14.

Ryan, Y 2004, 'Teaching and Learning in the Global Era', in King, R 2004, *The University in the Global Age,* Palgrave-Macmillan, Great Britain.

Sachs, J 2003, 'Teacher Professional Standards: controlling or developing teaching?' in *Teachers and Teaching: Theory and Practice,* vol. 9, no. 2.

Salmon, G 2001, *E-moderating - The key to Teaching and Learning Online,* Kogan Page Ltd, London.

Schensul, SL Schensul JJ and LeCompte, MD 1999, *Essential Ethnographic Methods - Observations, Interviews and Questionnaires,* AltaMira Press, USA.

Schön, D 1983, *The Reflective Practitioner*, Basic Books, England.

Schuman, LS 2004, *The Wisdom of Practice - Essays on Teaching, Learning, and Learning to Teach*, Jossey-Bass, San Francisco.

Schutz, R 2007, *Stephen's Theory of Second Language Acquisition*, viewed 20/6/2008, http://www.sk.com.br/sk-krash.html.

Schwille, J Dembélé, M and Schubert, J 2007, *Global perspectives on teacher learning: improving policy and practice*, UNESCO: International Institute for Educational Planning, Paris.

Senjov-Makohon, N 2003, 'Teacher Immigrants', II International Conference on Multimedia and Information and Communication Technologies (m-ICTE), *Advances in Technology-Based Education: Toward a Knowledge-Based Society*", Badajoz, Spain.

Senjov-Makohon, N 2004, 'How do Digital Immigrant Teachers (DITs) learn ICT for the Information Age?', AARE (Australian Association of Research in Education) Conference, *Doing the Public Good: Positioning Education Research,* Melbourne. Australia.

Senjov-Makohon, N 2005, 'Understanding the Balance of Experienced Teachers', AARE (Australian Association of Research in Education) Conference, *Creative Dissent: Constructive Solutions,* Sydney, Australia.

Senjov-Makohon, N 2006, 'The Experienced Teacher in the Elearning Environment', AARE (Australian Association of Research in Education) Conference, *Engaging Pedagogies,* Adelaide, Australia.

Senjov-Makohon, N 2006, 'Experienced teachers and Multiple Intelligences', ASCILITE (Australasian Society for Computers in Learning in Tertiary Education) Conference, *Who's Learning? Whose Technology?,* Sydney, Australia.

Senjov-Makohon, N 2007, 'Digital Citizenship*', Third International Conference on technology, Knowledge and Society*, Cambridge, England.

Senjov-Makohon, N 2008, 'Uchit and the Teacher Educator', *Edmedia*, Association for the Advancement of Computering in Education, Vienna, Austria, viewed 28/7/2008, <http://www.aace.org/CONF/EDMEDIA/>.

Shank, G and Villella O 2004, 'Building on new Foundations: Core Principles and New Directions for Qualitative Research' *The Journal of Educational Research,* vol. 98, no. 1.

Sharpe, R and Benfield, G 2005, 'The Student Experience of E-learning in higher Education', *Brookes eJournal of Learning and Teaching,* vol 1, issue 3, 30/9/2005, viewed 22/8/2007, <http://www.brookes.ac.uk/publications/bejlt/volume1issue3/academic.html>.

Shulman, LS 1987, 'Knowledge and teaching: Foundations of the new reform', *Harvard Educational Review*, vol. 57, no. 1, pp. 1-22.

Silver, H Strong, R and Perini, M 2000, *So Each May Learn,* Association for Supervision and Curriculum Development, Virginia, USA.

Silverman, D 2001, *Interpreting Qualitative Data Methods for Analysing Talk, Text and Interaction*, Sage Publications, London.

Singley, J and Anderson, T 1989, *Teaching and Learning Styles that Facilitate Online Learning*, viewed 27/2/2002, <http://tafe.sa.edu.au/Isrsc/natproj/tal/conmodel>.

Skeff, K 2008, 'Successful Models of Faculty Development Train the Tranier Model', *Academic Pediatric Association*, viewed 28/07/2008, <http://www.ambpeds.org/Site/education/nutsandbolts/pdfs/skeff.pdf>.

Slyke, van C and Bélanger, F 2003, *E-busisness technologies Supporting the Net-enhanced Organisation*, John Wiley and Sons, USA.

Smith, H 1999, *Opportunities for ICT in the primary school*, The Cromwell Press Ltd, Wiltshire, Great Britain.

Smith, MK 2002, 'Howard Gardner and multiple intelligences', *the encyclopedia of informal education*, viewed 23/9/2003, <http://infed.org/thinkers/gardner.htm>.

Smith, MK 2001 'Kurt Lewin, groups, experiential learning and action research', *the encyclopedia of informal education*, viewed 18/10/2007, <http://www.infed.org/thinkers/et-lewin.htm, last update 21 September, 2007>.

Smith, MK 1999, 1996, 'Andragogy', *the encyclopaedia of informal education*, viewed 7/9/2007, <http://www.infed.org/lifelonglearning/b-andra.htm>, Last update: August 23, 2007.

Somekh, B and Davis, N 1996, *Using IT Effectively in Teaching and Learning: Studies in Pre-Service amd In-Service Teacher Education*, Routledge, London.

Snyder, I 1997, *Page to Screen, Taking Literacy into the Electronic Age*, Allen and Unwin, Australia.

Snyder, I 2002, *Silicon literacies, communication, innovation and education in the electronic age*, Routledge, London.

Snyder, I 2005 'Identifying the changes to literacy practices associated with ICT', *The Changing Landscape of Communication – Emerging Trends and their Impact on Learning*, Educationau Ltd Meeting, Melbourne, Australia.

Sparks, D and Loucks-Horsley, S 1990, 'Models of Staff Development', in W. R. Houston (ed) *Handbook of Research on Teacher Education*, Macmillan, New York.

Spradley, J 1980, *Participant Observation*, Holt, Rinehart and Winston, New York.

Squires, D 2000 'The impact of ICT use on the role of the learner', *Lifelong Learning in Europe*, vol. V, issue 1, pp. 55 – 61.

Stark, S 2006, 'Using action learning for professional development' in *Educational Action Research*, vol. 14, no. 1, pp. 23-43.

Stenhouse, L 1985 'Research as a Basis for Teaching' in Rudduck, J and Hopkins, D 1985, *Research as a Basis for Teaching readings from the work of Lawrence Stenhouse*, Heinemann Educational Books Ltd, London.

Sternberg, RJ 1985, *Beyond IQ: A triarchic theory of human intelligence*, Cambridge University Press, NY.

Stevens, V 2007, 'The Multiliterate Autonomous Learner: Teacher Attitudes and the Inculcation of Strategies for Lifelong Learning', *Independence 42*, Winter 2007, viewed 28/7/2008, <http://www.learnerautonomy.org/VanceStevens.pdf>.

Stringer, ET 1996, *Action Research – A Handbook for Practitioners*, Sage Publications, London.

Summers, L 2000, *Multiple Learning styles in Web-based courses*, viewed 27/2/2002, http://www.Webct.com/communities.

Tang, C 1998, 'Effects of Collaborative Learning on the Quality of Assignments' in Dart, B and Boulton-Lewis, G (ed) *Teaching and learning in Higher Education*, Acer Press, Australia.

Tapscott, D 1998, *Growing up digital: the rise of the net generation*, McGraw-Hill, New York.

Taylor, L 2003, 'ICT skills learning strategies and histories of trainee teachers', *Journal of Computer Assisted Learning*, vol. 19, issue 1, pp. 129-140.

Tennant, M 1988, *Psychology and Adult Learning*, Routledge, London.

Thorpe, M, *New Technology and Lifelong Learning*, viewed 8/9/2004, <http://www.open.ac.uk/lifelong-learning/papers/393CCE (*Concrete Experience*)3-0008-67C6-00000157/MaryThorpepaper.docv5.0.doc>.

Trochim, WMK 2002, *Qualitative Methods* viewed 10/06/2002, <http://trochim.human.cornell.edu/kb/qualmeth.htm>.

Tsai, JH 2006, 'Xenophobia, ethnic community, and immigrant youths' friendship network formation', *BNet Australia*, summer, viewed 10/07/2008, <http://findarticles.com/p/articles/mi_m2248/is_162_41/ai_n26976657/pg_1?tag=artBody;col1>.

Turner, GW 1989, *The Australian Concise Oxford Dictionary*, Oxford Press, Melbourne.

Tyner, K 1998, *Literacy in a digital world: teaching and learning in the age of information*, L. Erlbaum Associates Mahwah, N.J.

UCLA, 2008, 'Health Data Train the Trainer Project', *UCLA Centre for Health Policy Research*, viewed 28/07/2008, <http://www.healthpolicy.ucla.edu/healthdata/ttt_prog1.pdf>.

UNESCO (United Nations Educational, Scientific and Cultural Organisation), *Learning Without Frontiers*, viewed 5/12/1999, < http://www.unesco.org/education/lwf/ >.

UNESCO (United Nations Educational, Scientific and Cultural Organisation), viewed 27/7/06, <http://portal.unesco.org/education/en/ev.php-URL_ID=18645andURL_DO=DO_TOPICandURL_SECTION=201.html>.

UNESCO, 2004, *Higher Education in a Globalised Society- UNESC Education Position Paper*, viewed 11/5/2007, <http://unesdoc.unesco.org/images/0013/001362/136247e.pdf>.

UNHCR (United Nations High Commissioner for Refugees) 2001-2005, viewed 2/5/2005, <http://www.unhcr.ch/cgi-bin/texis/vtx/basics/+OwwBmerNQw_xwwwhFqoUfIfRZ2ItFqtxw5oq5zFqtFEIfgIAFqoUfIfRZ2IDzmxwww1FqtFEIfgI/opendoc.htm>.

Van Der Vier, R and Valsiner, J 1994, *The Vygotsky Reader*, Blackwell, Oxford, UK.

Van Hear, N 1998, *New Diasporas – The mass exodus, dispersal and regrouping of migrant communities*, University of Washington Press, Seattle.

Veenema, S and Gardner, H 1996, "Technology and Multiple intelligences," *The American Prospect*, vol. 7, issue 29.

Vermette, P Harper, L and DiMillo, S 'Cooperative and Collaborative Learning with 4- Year Olds, How Does Research Support Teachers' Practice?', *Journal of Instructional Psychology,* vol. 31, no 2.

Vialle, W Lysaght, P and Verenikina, I 2005, *Psychology for educators*, Thomson, Victoria.

Victorian Curriculum and Assessment Authority, 2004, *Introducing the Curriculum and Standards Framework 11:Information kit*, viewed 2/5/2004, http://www.vcaa.vic.edu.au/prepio/csf/publications/infokit.htm.

Victorian Department of Education, 1998, *Learning Technologies Capabilities Matrix,* viewed 4/8/2001, <http://www.eduvic.vic.gov.au>.

Victorian Department of Employment, Education and Training, 2003, *Blueprint for Government Schools*, viewed 13/12/2004, <http://www.sofweb.vic.edu.au/blueprint>.

Victorian Department of Employment, Education and Training, 2006, *Blueprint for Government Schools, updated 2006, Principles of Learning and Teaching P-12 (PoLT),* viewed 15/12/2006, <http://www.sofweb.vic.edu.au/blueprint/fs1/polt/default.htm>.

Victorian Institute of Teaching http://www.vit.vic.edu.au/techec/reqteach.html viewed 4/8/2005.

Victoria University, Course Handbook, viewed 25/5/2003, <http://vu.edu.au/Courses/Handbooks/HUMAN/>.

Vygodskaya, G 1995, 'His Life', *School Psychology International*, vol. 5, pp. 105-116.

Vygotsky learning notes 3/4/99, viewed 21/9/2005, <http://www-personal.une.edu.au/~lgrunwa2/une/psychology_theory>.

Vygotsky - Выготский, ЛС 1999, *Мышление и речь*, Лабиринт, Москва.

Vygotsky, LS 1997, *Educational psychology* (R. Silverman, Trans.), Boca Raton, FL: CRC Press, (Original work published 1926).

Vygotsky, L 1994, 'The problem of the environment', in Van Der Veer, R and Valsiner, J *The Vygotsky Reader*, Blackwell, USA.

Vygotsky, LS 1987, *The collected works of L. S. Vygotsky, Volume 1, Problems of General Psychology*, (translated by Rieber and Carton), Plenum, New York.

Vygotsky, L 1978, 1981 *Mind in Society*, Harvard University Press, USA.

Vygotsky, L 1975, 1962 *Thought and Language*, MIT Press (Translation of the Russian original, published 1934), Cambridge MA.

Wadsworth, Y 1998, *What is Participatory Action Research?*, viewed 15/6/2002, <http://www.scu.edu.au/schools/gcm/ar/ari/p~ywadsworth98.html>.

Waldinger, R and Lichter, Multiple Intelligences 2003, *How the Other Half Work: Immigration and the Social Organisation of Labor*, University of California Press, Los Angeles, USA.

Walters, J and Gardner, H 1998, 'Domain Projects as Assessment Vehicles in a Computer-Rich Environment', in Torff, B (ed), *Multiple intelligences and Assessment – A collection of articles*, Hawker Brownlow Education, Melbourne.

Warschauer, M 1997 'Computer-mediated collaborative learning: Theory and practice', *The Modern Language Journal*, vol. 81, no. 4, pp. 470-481.

Waterhouse, L 2006 'Multiple Intelligences, the Mozart Effect, and Emotional Intelligence: A Critical Review' in *Educationalist Psychologist,* Vol 41, Issue 4 February 2006, pp 207-225.

Webb, R B and Glesne, C 1992, 'Teaching qualitative research', in LeCompte, MD Millroy, WL and Preissle, J (eds.), *The handbook of qualitative research in education*, Academic Press, San Diego.

WebCt (Web Course Tools), 1995, viewed 28/7/2004, <http://webct.usg.edu/webct/public>.

Webster, B and Pournelle, J 2007, 'E-books vs Dead-Tree Books: An Alternate Dialogue', *The Bulletin of the Science Fiction Writers of America*, Summer, viewed 19/07/2008, http://www.sfwa.org/bulletin/articles/ebooks_Fall_2007.pdf.

Weiss, R P 2000, 'Howard Gardner talks about Technology' *Training and Development*, vol. 54 issue 9, p. 52, EBSCO Host, viewed 12/6/2003, <http://0-web15.epnet.com.library.vu.edu.au>.

Wells, A 2004, *Conservative cultures of teaching practice and the impact of new learning theories on the design development of learning environments*, viewed 8/6/2004, <http://www.edspace.school.nz/pages/ciassign.html>.

Wells, G and Claxton, G 2002, *Learning for life in the 21st century: sociocultural perspectives on the future of education*, Blackwell Publishers, Oxford, UK; Malden, Mass.

Wertsch, JV 1992, 'The voice of rationality' in Moll, LC (ed) 1992, *Vygotsky and Education*, Cambridge Press, Cambridge.

Wertsch, JV Del Rio, P and Alvarez, A 1995, *Sociocultural Studies of Mind*, Cambridge University Press, UK.

Wertsch, JV 1985, *Vygotsky and the Social Formation of Mind.* Cambridge University Press, Cambridge.

West, LHT and Hore, T 1989, 'The Impact of higher Education on Adult Students in Australia: Part 2. The Person', *Higher Education*, vol. 18, no. 4, pp. 476-483.

Wheeler, S 2001, 'Information and Communication Technologies and the changing role of the Teacher', *Journal of Educational Medi*a, vol. 26, no. 1, pp. 7-17.

White, J 2000, *Do Howard Gardner's multiple intelligences add up?*, Formara Ltd, London.

Whitehead, J 1998, 'How do I improve my practice? Creating and legitimating an epistemology of practice', *Reflective Practice*, vol. 1, No. 1, pp. 91 – 104.

Wilhelm, J Friedemann, P and Erickson, J 1998 *Hyperlearning Where projects, inquiry, and technology meet*, Stenhouse Publishers, Portland, Maine.

Williams, B 1993, *Barriers to New Technologies, Part One: Staff Balkanization*, viewed 4/4/2002, <http://staffdevelop.org/sd7.html>.

Williams, DL Boone, R and Kingsley, KV 2004, 'Teachers beliefs about educational software: a Delphi study', *Journal of Research on Technology in Education*, viewed, 6/8/2004, <http://infotrac.galegroup.com.library.vu.edu.au/itw/infomark>.

Williams, JB and Jacobs, J 2004, 'Exploring the use of blogs as learning spaces in the higher education sector' *Australasian Journal of Educational Technology* 2004, 20(2), 232-247.

Williamson, A. and Nodder, C. *Using Online learning to enable Reflection Upon Authentic Tasks*, viewed 8/9/2004, <http://ascilite.org.au/conference/auckland02/proceedings/papers/15.html>.

Wood, B and Jorgensen, G 2001, *Spotlight on Multiple intelligences for teachers and children too*, Heads Together, Qld, viewed 5/6/2003, <www.eohan.sdsu.edu/faculty/feenberg/wbsi3.htm>.
Zimmerman and Schunk 2001, *Self-regulated learning and academic achievement: theoretical perspectives*, Lawrence Erlbaum Associates Publishers, Mahwah, N.J.

Zuber-Skerritt, O 1992, *Action Research in Higher Education-Examples and Reflection*, Kogan Page, London.

Zuber-Skerritt, O 1992b, *Professional Development in Higher Education-A Theoretical Framework for Action Research*, Routledge, London.

Zuber-Skerritt, O 1988, 'Eliciting personal constructs of research, teaching and/or professional development', in J. Steele and J. G. Hedberg (Eds), *Designing for Learning in Industry and Education*, pp 126-135, Proceedings of EdTech'88. AJET Publications, Canberra, viewed 15/2/2005, http://www.aset.org.au/confs/edtech88/zuber-skerritt.html>.

Zubrzycki, J 1964, *Settlers of the La Trobe Valley*, Australian National University Press, Canberra.