

The integration of learning technologies in
open distance learning at the
North-West University

Integration of Technology Enhanced Learning at the School of Continuing Teacher Education at North West University

1 Background

The Republic of South Africa consists of nine provinces with eleven official languages. The World Bank report on South Africa, the continent's largest economy by far and its only G-20¹ member, confirms that it remains one of the most unequal societies in the world, with the top quintile accounting for 58% of the country's income and the bottom quintile accounting for

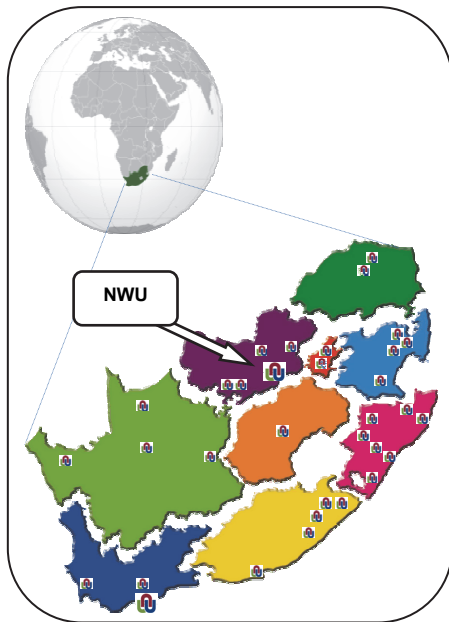


Figure 1: North-West University in South Africa, showing provinces

0.5% (World Bank, 2012). With unemployment levels among the world's highest and the inability to create employment opportunities on a large enough scale, assistance through social grants is not enough and needs to be complemented by a special focus on human capital development through education. The North-West University (NWU) in the North West Province has three campuses: Mafikeng Campus, Potchefstroom Campus, and Vaal Triangle Campus. Approximately half of more or less 50 000 students registered at the Potchefstroom Campus consist of unqualified or underqualified practising teachers improving their qualifications through Open Distance Learning (ODL), living and working in all nine provinces in South Africa and in the neighbouring country, Namibia. Contact sessions at 39 regional

support centres across Southern Africa, including four in Namibia, augment ODL provided through a second generation correspondence distance education model (Taylor, 2001) at the School of Continuing Teacher Education (SCTE), NWU. Access, computer illiteracy, technological disadvantage and technophobia hamper employment of electronic learning technologies. The SCTE, NWU is committed to promoting learning technology adoption and this research study aimed to address the main research question:

Which aspects will be prominent in a framework for the integration of technology enhanced learning at the North-West University, and how should they be addressed?

¹ "The Group of Twenty, or G20, is the premier forum for international cooperation on the most important aspects of the international economic and financial agenda. It brings together the world's major advanced and emerging economies. The G20 includes 19 country members and the European Union" (G20, 2012).

2 Context of the Study

The SCTE as a school at the Faculty of Education Sciences, Potchefstroom Campus, North-West University, South Africa, delivers in-service programmes for under and un-qualified teachers² currently in the teaching profession: the National Professional Diploma in Education (NPDE), the Advanced Certificate in Education (ACE), Baccalaureus Degree in Education (BEd), and the Honours Baccalaureus Degree in Education (BEd Hons) (Blignaut & Els, 2009). The school is responsible for the delivery of more than 180 individual modules (courses) and supports services to the approximately 24000 students, using a single mode of course delivery. These students live across South Africa and Namibia and are linked to 39 learning centres. About seventy per cent are black; most live in remote and rural communities; 67% are female; and the average age of the students is 41 (Blignaut, 2009). Web connectedness of SCTE students is in the region of 10% (Kok & Blignaut, 2009).

Each student receives a pack consisting of an information booklet, year plan, study guides, textbooks, and Digital Versatile Disks (DVD) via surface mail. Short message service (SMS) text messaging on mobile phones is used for administrative arrangements. In the last two years computer mediated conferencing using electronic Interactive White Boards (IWBs) was introduced between lecturers on campus and the 39 regional learning centres (Esterhuizen, 2012).

Thirty seven lecturers at SCTE, NWU, create study material, provide support and perform most of the assessment for these approximately 24000 teacher-students. Many of these lecturers were previously employed at a teachers' training college where research and program development did not feature prominently in their responsibilities. This research indicated that as a result of a commitment to teacher training (Esterhuizen *et al.*, 2012a), they are dedicated to the needs of teacher-students and show sincere concern and passion in this regard. In preparation for this study, the researcher conducted preliminary discussions with SCTE lecturers. They indicated a need for the advancement of e-learning as part of the ODL model at SCTE. They, *inter alia*, indicated the significant number of SCTE students at NWU that do not have access to the Internet and computers as a major obstacle. However, using information and communication technology (ICT) in teaching and learning is in line with the requirements of the South African Government White Paper on e-Education (South Africa. Department of Education, 2004). Pena-Bandalaria (2007)

² Unqualified teachers do not have any teaching qualifications whatsoever while underqualified teachers' qualifications are inadequate for appropriate teaching positions and need upgrading.

concluded that with ICT enhanced ODL, the culture of learning in the Philippines has shifted from students passively listening in a classroom where attendance matters, to the culture of proactive reading, encoding and decoding anytime, anywhere, indicating ICT ODL efficacy. Studies from other developing countries such as Israel (Kurtz *et al.*, 2009) and the Arab Open University in Jordan (Dirani & Yoon, 2009) concur with these findings. According to Daniel:

Teacher education institutions may either assume a leadership role in the transformation of education or be left behind in the swirl of rapid technological change. For education to reap the full benefits of ICTs in learning, it is essential that pre- and in-service teachers are able to effectively use these new tools for learning. Teacher education institutions and programmes must provide the leadership for pre- and in-service teachers and model the new pedagogies and tools for learning (UNESCO, 2002, p. 13).

Empowering, instilling techno-confidence and improving the qualifications of thousands of practising teachers in Southern Africa is vital to the future of the people in one of the most unequal societies in the world, desperately in need of a special focus on human capital development through progressive education methods (World Bank, 2012).

3 The Problem and Motivation for the Research

“Educational systems around the world are under increasing pressure to use the new information and communication technologies (ICTs) to teach students the knowledge and skills they need in the 21st century” (UNESCO, 2002, p. 10). Participation in the knowledge economy requires techno-literacy and information literacy (Oliver & Towers, 2000). SCTE needs to improve proficiency in the use of ICT in teaching and learning. ICTs that permeate people’s everyday lives also affect teachers’ professional lives (Aguti *et al.*, 2010). It is imperative that SCTE expands e-learning use as a result of the importance of technology enhanced learning (TEL) in ODL (Spamer, 2011).

ODL students unable to use computers do not benefit from the online opportunities available through the university. These include student support services, access to electronic information sources off-campus through the institution’s library web site hosting a large collection of electronic databases, e-books and free research publications, the learner management system and collaboration with lecturers and other students (Esterhuizen *et al.*, 2012b).

The problem is the under-utilisation of learning technologies for ODL at SCTE and the motivation for the research is to identify aspects to be included in a framework for addressing integration of TEL at NWU and how to address these aspects.

4 Review of Literature

A focussed literature review places this study in context regarding learning technology integration. Each of the five sub-questions is addressed individually by one of the papers included in this study, which each also includes applicable literature reviews.

This study about technology enhanced learning integration focusses on computer literacy of teacher students and to a lesser degree also of lecturers. Historically, Rist and Hewer (1996) define learning technology as: “The application of technology for the enhancement of teaching, learning and assessment. Learning Technology includes computer-based learning and multimedia materials and the use of networks and communications systems to support learning.” Linking learning technologies to a wide range of applications in 1996, they name six acronyms which all include the concept *computer*. CAI (Computer Aided Instruction), CAL (Computer Aided Learning), CBL (Computer Based Learning), CBT (Computer Based Training), CAA (Computer Aided Assessment), CMC (Computer Mediated Communication). They consider an essential component in a learning technology package the ease with which the learner can interact with the contents—the human-computer interface (HCI). They name the following categories as main application areas for learning technology, presumably using computers: drill and practice, tutorials, information retrieval systems, simulations, micro-worlds, cognitive tools for learning, productivity tools, and communication tools (Rist & Hewer, 1996).

Looking at the use of technology in United States of America (USA) education in 1995, limited use of computers in K-12³ classrooms was attributed to: (i) Insufficient modelling of appropriate use of computers for instructional purposes in courses or field experiences by lecturers (teacher educators) for pre-service teachers, (ii) teacher training programs not incorporating technology across the curriculum and (iii) instruction provided to pre-service teachers focusing more on older and simpler instructional applications of computer technology such as word processing instead of newer, more sophisticated tools which support development of students’ higher-order thinking and problem-solving skills (Abdal-Haqq, 1995). This *Educational Resources Information Center (ERIC) Digest* recommended expansion of technology use among teacher educators and addressing obstacles to infusing technology into teacher education programs. The obstacles include: (1) limited availability of equipment; (2) insufficient faculty training; (3) unclear expectation that faculty will incorporate

³ K-12 Kindergarten to twelfth grade: used for talking about the 13 years of school before university education
<http://www.macmillandictionary.com> accessed 1st October 2012.

technology in academic activities; (4) insufficiency of funds; (5) insufficient time to develop facility in using equipment and software; (6) doubt about the pedagogical validity of using some of the newer technologies since the appearance of literature about these tools considered relatively recent; (7) insufficient technical support; (8) insufficiency of appropriate materials, particularly integrated media materials suitable for teacher education instruction; and (9) unclear programmatic goals for the teacher education program as a whole. Contention existed whether computer literacy courses teaching pre-service teachers how to use basic computer tools should be phased out and, instead of discrete computer literacy courses, computer instruction should be integrated into existing methods and foundation courses (Abdal-Haqq, 1995).

Later The South African Government White Paper on e-Education defines ICT thus: “Information and communication technologies (ICTs) represent the convergence of information technology and communication technology. ICTs are the combination of networks, hardware and software as well as the means of communication, collaboration and engagement that enable the processing, management and exchange of data, information and knowledge” (South Africa. Department of Education, 2004, p. 15). The White Paper contains the following about the term e-Learning:

e-Learning is flexible learning using ICT resources, tools and applications, focusing on; accessing information, interaction among teachers, learners, and the online environment, collaborative learning, and production of materials, resources and learning experiences. e-Learning may involve the use of Internet, CD-ROM, software, other media and telecommunications (South Africa. Department of Education, 2004, p. 16).

ICT can be a powerful tool for advancing education efforts. Turning the potential of ICT for Education (ICTE) into reality with results is a tremendous challenge. If not used appropriately and properly, ICT can increase existing social and economic inequalities if access and use of ICTE is not equally available to everyone (Gutterman *et al.*, 2009, p. 1). Daniel declared that new ICT tools “have the potential to transform the nature of education—where and how learning takes place and the roles of students and teachers in the learning process” (UNESCO, 2002, p. 3). Innovations regarding the application of technology in education originate at the macro-level, referring to organisational innovation strategy and policy and the micro-level, the application of relevant and related technologies in educational activities, according to Schneckenberg (2007). Though there is increasing interest in the use of ICTs in education institutions in low-income countries, the development of the infrastructure is disproportionately expensive and sustainable interventions are very difficult to achieve (Bass, 2010).

The South African Government White Paper on e-Education (South Africa. Department of Education, 2004, p. 41) prescribes that: "ICTs will be central to the pre-service training of recruits and the on-going professional development of practising teachers...all pre-service teacher training in higher education institutions must include basic ICT literacy and basic ICT integration into teaching and learning." The White Paper requires that eventually each graduating teacher should be "able to combine knowledge of the learning process and instructional systems theory with various forms of media and learning environments to create the most effective and efficient learning experiences" (South Africa. Department of Education, 2004, p. 38). Furthermore, the planning cycle time frame of the White Paper states that every South African teacher and learner should be ICT capable by 2013. While increased use of learning technologies through ICT is called for, the white paper expresses general concern with slow progress in this regard: "Despite the difficulties that constrain the integration of ICTs into management, teaching and learning, the Ministry is determined to direct the implementation of a progressive programme for change" (South Africa. Department of Education, 2004, p. 11). Change should be managed with more than technology provision:

In practice, changing the way thousands of teachers teach, learners learn, innovation is promoted and sustainable change in traditional institutions is achieved across hundreds of different disciplines is a demanding endeavour that will not be achieved by learning technologies alone. It involves art, craft and science as well as technology (Salmon, 2005, p. 201).

The aims of learning technology integration, intended outcomes and requirements for success appear to be vague:

Typically there is banal and obvious usage of a learning technology. For example, it is a common belief among managers, policy-makers and strategists that, by encouraging academics to post some notices or PowerPoint slides on a VLE, an e-learning process emerges that will benefit learning, and that in some magical way such academics will 'cross the divide' and understand motivating online learning systems or even remote knowledge construction (Salmon, 2005, p. 203).

Nominal compliance with the requirements to advance learning technology integration may result in sub-standard adoption, reinforcing established educational practices and absence of meaningful transformation. Zentel classifies such endeavours jestingly as "Alma Mater Multimedialis" and elaborates:

Increasingly, the traditional universities will integrate some online components into their on-campus courses, using different possible forms. Such online components may be add-ons to traditional lectures and seminars, offering some kind of reinforcement, or part of a 'mixed mode' course model with on-campus and Internet components. The established universities will be less likely to offer distance education in its pure form (Zentel *et al.*, 2004, p. 238).

There is a need for a complete re-think of activities to support the learner, because online learning and strategies should augment qualities in face-to-face learning and teaching (Ascough, 2002; Bennett *et al.*, 2004). Different approaches are needed for online offerings than what might be the norm in established lecturing methods:

Online courses are different than traditional classroom experiences. In many instances online instruction is undertaken with a view that it involves nothing more than uploading an instructor's course notes onto the Web. It is the student's task to read and process those notes, usually evidenced by the submission of written assignments. This knowledge transfer mode of education is not only outdated in the educational world generally (online or face-to-face); it simply will not work online (Ascough, 2002, p. 18).

Ascough elaborates as follows: Serving student needs should be a prime concern. For both the students and the faculty, online course delivery allows for creative pedagogy. Students learn to construct their own learning and instructors learn how to teach differently. Despite the hopes of deans and presidents to the contrary, online course delivery will not solve an institution's financial problems. Often only poorly designed and poorly delivered courses can be generated at minimal cost. While they may generate some initial surplus income, they will not sustain themselves over the long term. Quality online course delivery is expensive, especially if an institution has to invest in the technological infrastructure (Ascough, 2002).

Bates (1997) considered the impact of technological change on open and distance learning and identified four reasons he overheard most frequently for using technology:

- to improve access to education and training
- to improve the quality of learning
- to reduce the costs of education
- to improve the cost-effectiveness of education.

He considers these four reasons contradictory and incompatible in certain cases. Regarding the first he states:

Technology can in fact both widen and reduce access to education. Technology can be used to deliver training right into the workplace, by embedding training in computer applications, by enabling just-in-time or on-demand training, and by bringing specialists from anywhere in the world into conferences and meetings. This certainly widens access to employers and employees. However, a university requiring all students to have access to the Internet can, at an administrator's stroke, deny access to all those students who cannot afford a computer, who are not skilled or confident in using a computer, or who cannot get Internet access where they live (Bates, 1997, p. 94).

He discusses pros and cons of the other three and then says: "The wise use of technology can allow us simultaneously to widen access, improve the quality of teaching, and improve

the cost-effectiveness of education. That is not a bad goal to strive for. There are also many things that are valuable in education, as in life, that technology cannot do, and we need to recognise that” (Bates, 1997, p. 95).

Taylor (2001) classifies distance education into four distinctive generations and added a fifth in his conceptual framework in 2001. Computer literacy on the part of students was not essential for the first generation where learning is offered through the correspondence model. Most of the delivery technologies prevalent in the second generation (the multimedia model) also did not require computer literacy, except computer-based learning. In the third generation (the telelearning model), none of the delivery technologies required computer literacy. All of the delivery technologies from the fourth generation (the flexible learning model) require computer literacy: interactive multimedia online, internet-based access to the World Wide Web resources as well as computer-mediated communication. Taylor’s fifth generation: the intelligent flexible learning model, includes all the delivery technologies of the fourth generation, but adds automated response systems to computer-mediated communication. An additional delivery technology is added in the form of campus portal access to institutional processes and resources. Taylor emphasised the possibility of reducing distance education costs using the fifth generation when large student numbers are involved (Taylor, 2001). Computer literacy is essential for participating in fourth and fifth generation distance education delivery technologies. The focus in Taylor’s distance education conceptual framework is on flexibility (learning any time, any place and any pace); the ability to present learning through highly refined materials, advanced interactive delivery and reducing institutional variable costs.

More recently, the OECD Centre for Educational Research and Innovation (CERI) Report (2010) considers the initial main policy expectations regarding technology in education:

The first was that schools would equip students with the technical skills required by an increasingly technology-pervaded economy. The second was that schools would bridge the digital divide by providing students with universal access to computers and the Internet during compulsory education. The third was that technology would improve educational productivity by making teaching and learning more effective—improving learning outcomes by changing teaching and learning strategies. In some respects, it would seem that the initial policy expectations have not been fulfilled, but a closer analysis shows the need to reframe them in light of changing societal needs. In particular; the issue of the effects of technology use on educational performance should be reviewed (OECD, 2010, p. 23).

The report refers to the productivity paradox, which is the deficiency of relation between adoption of new technology and productivity gains in business or industry context (Solow, 1987) which relates to *the educational productivity paradox* (Peslak, 2005), or the *student*

productivity paradox (Hikmet *et al.*, 2008). In the last two cases, the paradox is the perceived lack of gains in student performance as measured by standardized test scores that have resulted from increased information technology expenditures.

On the other hand, technology plays a crucial role in the environments learners are living in and will be required to work in. There is no reason why schools should be excluded from this world; on the contrary, schools should strive to be leaders in this technology-rich world or at least to provide learners the opportunity of increased understanding and benefitting from the opportunities a networked society and economy offer (OECD, 2010).

In the context, problem and motivation as stated, the study should inform the interactions between learners, lecturers and learning technology. Technologies should be chosen based on pedagogical requirements (Ascough, 2002). There will then be a relationship between technologies used and the design of learning materials. Scanlon (2010) quotes Issroff and Scanlon (2002), saying that they “distinguish between two groups of theories in use in work with learning technologies. The first are related to 'principled decisions about the design of learning materials' and the second are used to 'influence the way we frame our research on learning'. They argue that both types of work are necessary to research learning in relation to technology. What we require as educational technologists are theories which provide a framework in which we can understand the complex interactions between learners, teachers and the resources they use” (Scanlon, 2010).

In a planning guide for integration of ICTs in teacher education (UNESCO, 2002), an illustration depicting student-centred learning shows concentric circles with the learner in the centre circle. The learner interacts with other students, the teacher, information resources, and technology:

The learner engages in authentic tasks in authentic contexts using authentic tools and is assessed through authentic performance. The environment provides the learner with coaching and scaffolding in developing knowledge and skills. It provides a rich collaborative environment enabling the learner to consider diverse and multiple perspectives to address issues and solve problems. It also provides opportunities for the student to reflect on his or her learning. Although the new learning environment can be created without the use of technology, it is clear that ICTs can provide powerful tools to help learners access vast knowledge resources, collaborate with others, consult with experts, share knowledge, and solve complex problems using cognitive tools. ICTs also provide learners with powerful new tools to represent their knowledge with text, images, graphics, and video (UNESCO, 2002, p. 24).

Volk (2010) argues that teaching staff need two types of competencies when dealing with the integration of e-learning in teachings at the university, namely teaching skills (duties and responsibilities in terms of the subject, as well as knowledge on instructional models,

teaching methods and didactical planning), as well as media literacy (understand the role of media in teachings, requirements in different situations and implications for lecturers). This highlights the responsibility for staff to obtain a reflective and critical view on media and their pedagogical consequences on students (Volk, 2010). The challenge for lecturers who have to integrate learning technologies at SCTE is not so much to transmit information and culture, but to act as leaders, experts and motivators for learning (García-Valcárcel & Tejedor, 2006).

In the context of this study about learning technology integration, the role-players are the thousands of unqualified and under-qualified practising teachers studying at SCTE through ODL in the process of upgrading their professional qualifications; the lecturers at SCTE who are responsible for facilitating learning, design and delivery of the curriculum and the university as institution with its particular vision for teaching and learning. On a secondary level the beneficiaries include the learners at the schools where these teachers teach, benefitting from their teachers' improved techno-competence and empowered state. Ultimately, society could benefit through participation in the knowledge economy.

The impression that ICT is equated with the modern world, economic success and futuristic value may support the argument for embracing technology unreservedly in education; even equating ICT use with the raising of standards in teaching and learning (Watson, 2001). Three valid approaches to the relationship between technology and education were prevalent at different stages according to Watson: ICT was seen as a tool to deliver the curriculum, as a subject with skills to be mastered and as a means to search for and download information from the Web needed for subject lessons. Indiscriminate emphasis on any of these or any other focus on ICT use such as the premise that technology will be the catalyst to create change in education, without clear focus on what learning entails, Watson considers putting the cart before the horse. “[U]sing the computer to assist learning can be located within a pedagogic cultural agenda where knowledge and reflection are still important” (Watson, 2001, p. 261), explaining a proper perspective thus:

With the rapid changes to the capabilities and directions of the technology, too much attention is focused on the actuality of the new rather than their function and implications, on the development of lower-order skills rather than higher-order learning, and on Information. This has obscured its educational potential...[T]he fact of ICT enabling access to large amounts of data is relatively uninteresting compared with furthering opportunities to learn to select, evaluate and analyse information with discrimination, learnt from critical use and leading to an understanding of issues of validity, currency and veracity...[T]his perspective re-positions technology not as the catalyst for change, but rather its tool. Developing a philosophy, a rationale that is fundamentally societal and pedagogic, means that the vocational will naturally fall into place (Watson, 2001, p. 264).

Some assumptions about the application of technology in education are overoptimistic. Oettinger and Marks (1968) predicted the revolutionising of education through the application of technology and the individualising of instruction as the ultimate dream of effective education. Their suppositions include:

Youngsters of all ability levels would learn more. And they would enjoy school far more, thus reducing discipline problems. There would be no need for compensatory education for deprived children, on which the Federal government now is spending \$1 billion of its \$4 billion annual education budget. The dropout problem would largely be licked. Teachers would cease being mere dispensers of information and would be free to tutor students individually and encourage youngsters to think and to express themselves. Parents could take children out of school for vacations any time during the year without disrupting their learning process (Oettinger & Marks, 1968, pp. 699-700)

Bennett *et al.* (2004) see statements that online learning is the *future direction* for learning and teaching and that technology will *replace the teacher* as examples of misconceptions. Such misconceptions resulted in mistakes within planning, creation and implementation of technology and its integration into educational processes. A poor opinion towards this so-called *future direction* has developed claiming that it resulted in students being left to their own devices without guidance and having to teach themselves. Some claim that digital media could substitute previous communication technologies such as language, script, print and broadcasting (Pfeiffer, 2012). In reality, technologies should be seen as enablers, instead of replacements. When technology itself was seen as a fix for shortcomings, initiatives failed through misunderstanding how new generations relate to technology (Bennett *et al.*, 2004). It is a misguided assumption to think that technology would save time and money for students and staff members alike. It does not recognise that new technologies and software actually takes up more time, e.g. responding to e-mails, editing documents or dealing with work calls outside traditional working hours because of mobile access (Bennett *et al.*, 2004). Misconceptions include that furnishing schools with computers would directly improve learning and the more computers, the greater the improvements. Supposedly, equity could be achieved by ensuring that the same student-to-computer ratio is maintained at schools in wealthier and poorer communities and once teachers have learned the basics of using a computer they will be able to put the technology to effective use (Kleiman, 2000).

Some of the details to be investigated in this study may be the limited use of technology by SCTE students, consisting of practising teachers in the process of improving their qualifications. Determining these may explain why some practising teachers studying as SCTE students who also complete a module on computer literacy as part of their studies seem unable to use computers in their studies. According to the South African Democratic

Teachers Union's (SADTU) chairperson, Thokile Nthola, the Department of Education (DoE) has failed to provide the union's members with the necessary resources, despite expecting it to produce human resources for the country:

Our members' job is to produce skilled resources for the country, but after fourteen years of independence, ninety per cent of teachers are still computer illiterate. That's a difficult task confronting us. If you are going to revolutionise education, you should make ICT an important part of everyday activities (South African Democratic Teachers Union (SADTU), 2008).

Examples abound of the un-preparedness of living and learning with technology, especially with students from Africa (Blignaut & Lillejord, 2005; Schrum *et al.*, 2005). The researcher proposes that the needs and fears of the SCTE students, especially regarding technology use, should be paramount in any proposed learning technology integration for in-service programmes aimed at under and unqualified teachers currently in the teaching profession. Barriers to using ICT range from basic computer literacy, through access to or acquisition and establishment of a working computer connected to the internet with useable bandwidth (Blignaut & Lillejord, 2005) and higher levels of competency, such as the ability to participate in online learning through interacting with facilitators and online communities (Schrum *et al.*, 2005). The literature and research pertinent to student retention in online learning suggests that the drop-out rate is high even among societies expected to have acceptable levels of computer literacy (King, 2002).

Basic computer literacy in this study refers to the use of desktop computer boxes or portable versions of the same; "digital literacy" (Junge & Hadjivassiliou, 2007, p. 3). The researcher considers getting to know and use the vast array of emerging mobile and other emerging learning technologies, the aptitude and familiarity required to use social networking as well as other web-features for educational purposes may hold additional unimagined obstacles for students and staff of the SCTE. Motiwalla (2007) refutes beliefs that students will not be able to work in an m-learning (mobile learning) mode when in busy environments such as airports and train stations. He concurs with Ally (2009) that this mode could fulfil the real *anywhere, anytime, anyhow* notion, since the technology is portable and usable without interdependency on computers.

Fluck (2001) reviewed some national and regional frameworks for integrating information and communication technology into school education and from the evidence accumulated during the data-gathering exercise, there appears to be three phases through which countries progress as computers become more prevalent in education:

Phase 1: Where students in school first use computers and information technology becomes a curriculum choice.

Phase 2: Where information and communication technologies are used transparently to enhance learning opportunities in all conventional curriculum subject areas.

Phase 3: Where the universal curriculum clearly includes topics of study that would not exist without information and communication technologies and schooling for most students no longer fits the traditional face-to-face instructional model.

Students should not only have an ever increasing understanding of how to interact, work and collaborate online, but also an expectation that this should form part of their learning experience. The modes of communication should be aligned with workday experiences and become less visible. Alignment is, of course, a key feature to teaching and learning and the question increasingly being asked by students is not why are our courses online?, but more often why are our courses not online? (Bennett et al., 2004).

Moersch (1995) created a conceptual framework that measures levels of technology implementation in classrooms with seven discrete levels teachers can demonstrate, ranging from Non-use (Level 0) to Refinement (Level 6).

As a teacher progresses from one level to the next, a series of changes to the instructional curriculum is observed. The instructional focus shifts from being teacher-centered to being learner centered. Computer technology is employed as a tool that supports and extends students' understanding of the pertinent concepts, processes, and themes involved when using databases, telecommunications, multimedia, spreadsheets, and graphing applications. Traditional verbal activities are gradually replaced by authentic hands-on inquiry related to a problem, issue, or theme. Heavy reliance on textbook and sequential instructional materials is replaced by use of extensive and diversified resources determined by the problem areas under study. Traditional evaluation practices are supplanted by multiple assessment strategies that utilize portfolios, open-ended questions, self-analysis, and peer review (Moersch, 1995, p. 41).

Though the framework of Moersch is intended for classroom use, frameworks such as these may inspire grading methods for integration of TEL for the purpose of this study.

Intensive benchmarking exercises regarding the use of learning technology have been performed in institutions with visible progress towards adoption. Examples are the Higher Education Academy e-Learning Benchmarking Project (Chatterton, 2006, pp. 1-13) which included the University of Wales Institute, Cardiff, University of Strathclyde, University of Bristol and University of Hertfordshire. Three of these institutions adopted the Embedding Learning Technologies Institutionally (ELTI) tool (University of Wales Institute at Cardiff, University of Bristol & University of Hertfordshire) whilst University of Strathclyde adopted the

MIT90s framework (Chatterton, 2006, p. 3). They concluded there should not be a single benchmarking toolkit used, but rather a selection of benchmarking methodologies informs and map to a benchmarking framework: The framework should include: key stages, processes, and activities inputs or outputs. Chatterton (2006, p. 13) concludes that the scope of benchmarking should include institutional, school, faculty or departmental information; students' teaching, learning and assessment experiences; curriculum design; evidence of consolidated effective practice; quality assessment; dialogues and information exchange; benchmarking, as well as auditing; guides to tools or toolkits; minimum criteria for approving such tools/toolkits; facilitating updating; continuous improvement for tools/toolkits; and resources and links. A framework could also focus on the issues of the evaluation of cost-effectiveness; cost of ownership; and drivers and benefits of using technology in teaching and learning. Other issues that relate to developing a learning technology framework include the selection of learning technologies, tools for learning and managing change (Chatterton, 2006, p. 13).

eCompetence, according to Schneckenberg, is at its core dealing with the development of personal competences in the creative use of ICT:

Thus our conception of eCompetence is that it is the ability to use ICT in teaching and learning in a meaningful way. Whilst there is a distinction between eCompetence at the individual and institutional levels, both describe the ability to successfully use eLearning technologies in routine educational practice. For example, the personal eCompetence of an individual academic teacher describes his or her ability in using ICT in their teaching and course delivery. Institutional eCompetence describes the structures, processes and policies in place, by which a university aims to embed the ICT use into its core tasks of research and education (Schneckenberg & Wildt, 2006, p. 32)

Schneckenberg (2010) illustrates the core components of the action competence concept,

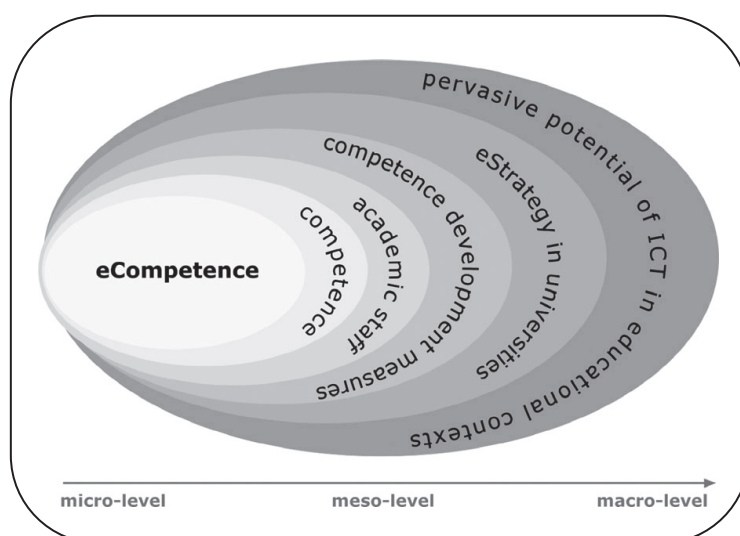


Figure 2: Model of eCompetence layers
(Schneckenbera. 2010. p. 4)

namely Knowledge, Skills and Attitudes (Figure 2). Many of these competencies can be measured only by observation of performed action.

eCompetence as the ability to use ICT meaningfully could be applied to the student, staff members and the University itself. Formal e-Learning training is only the beginning and not enough to

sustain use of ICT within faculty (Schneckenberg, 2010). ICT qualification schemes not directly linked to the real teaching and learning contexts of faculty produce insufficient learning results. “Direct trainings present in the absence of real and meaningful action contexts rather inefficient vehicles for the transfer of taught knowledge into future practices of learners” (Schneckenberg, 2010, p. 5).

Competence is also about sharing knowledge. A substantial element of the competence definition is the relation of competence to performance, which links competence to action in social situations (Schneckenberg, 2010). By making the book *Theory and Practice of Online Learning* freely available through a Creative Commons license as an open and free gift to others the authors endeavoured to contribute knowledge about using technology in distance education. Anderson and Elloumi declare that:

[W]e believe that education as one of the few sustainable means to equip humans around the globe with the skills and resources to confront the challenges of ignorance, poverty, war, and environmental degradation. Distance education is perhaps the most powerful means of extending this resource and making it accessible to all. Thus, we contribute to the elimination of human suffering making as freely available as we can the knowledge that we have gained from developing distance education alternatives (Anderson & Elloumi, 2004, p. 4)

The researcher sees in this example the objective of successfully integrating learning technology in a particular context to enable sharing knowledge gained in the process, to the benefit of education everywhere. The context for the present study is Southern Africa, especially in relation to technologically disadvantaged practising teachers improving their qualifications.

5 Research aim, Objectives and Purpose of the Study

The researcher is of the opinion that urgent integration of learning technology utilisation into distance education experiences through an informed process requires investigations into the environment, perceptions and needs of key participants in the process.

5.1 The Main Research Question

The Main Research Question as stated in Background above comprises two parts:

- (i) Which aspects are prominent in a framework for the integration of TEL at NWU?
- (ii) How could they be addressed?

Through an emergent research design, according to an approach of adapted design-based research (Plomp, 2007; Van den Akker *et al.*, 2006) the researcher formulated a set of sub questions to collectively address the main question.

5.2 Sub-Questions

- (a) Which aspects should be considered during the process of developing a framework for the integration of TEL at the SCTE?
- (b) What is the significance and implications of technophobia, technological disadvantage, ease of use and usefulness of computers on SCTE's students new to TEL?
- (c) How could SCTE's ODL students' affective learning be addressed during TEL?
- (d) What are SCTE lecturers' perceptions of the realities of adopting a TEL environment?
- (e) How can the prominent aspects of TEL be integrated in a framework at the NWU?

Each of these sub-questions is addressed individually by one of the papers included in this study. To some extent, the papers also address sub-questions globally.

6 The Need for a Framework for Learning Technology Integration

In the researcher's view, reporting on learning technology integration could be presented at numerous levels. Were it considered a routine study, results of such inquiry might be delivered as a PowerPoint™ presentation to management accompanied by a written report. At different other levels, possibilities include delivering the findings as a research report, technical recommendation, treatise, motivated strategy, and training course, publishing the findings as a blog or web site, a tool or simply as guidelines.

Though an emergent design may change the emphasis and direction as a result of data gathered and analysis performed during the course of the inquiry, addressing the research question needs to start with people assumed to be central to the inquiry. From the background, context of the study, the problem and motivation of the research mentioned above, the researcher saw a number of participants and several critical success factors crucial to the success of the endeavour (Ma *et al.*, 2000). Spotts (1999) identifies five significant e-learning variables in an effort to obtain information beneficial for faculty

development of TEL: the learner, faculty, technology, environment, and perceived value. Through an initial inquiry into the problem and motivation for the research the researcher identified the need for a comprehensive technology integration framework as a result of the following: There were (i) significant identifiable existing uncertainties, (ii) clear short term requirements for action, (iii) possibilities to address uncertainties through distinct interventions, (iv) a need for continuation of effort and persistence during intermediate phases of transition where (v) proceeding actions are dependent on evolving perceptions, maturing attitudes and commitments. Framework indicators and milestones could enable (vi) assessment of initiatives and evaluations of performance target attainment and (vii) reflection and research to perform cyclic review of long term goals. Since the researcher thought it unlikely that involved procedures and intricate interventions would stay the course if left to individual people's aims and personal views, a comprehensive framework which transcends personal whims and integrates efforts and investments seemed an appropriate choice. Well documented strategies systematically evaluated could enable research and reporting to share results with the education community and outlive individual personalities to contribute to an enduring institutional consciousness.

7 Research Design and Methodology

The researcher designed the study to consist of design-based research cycles towards the development of a framework for the integration of learning technologies in open distance learning at SCTE NWU. He intended an emergent design in which close cooperation between researcher and participants would enable the development of a people-centred technology integration framework which could have long term usefulness. The researcher developed the survey instrument used for *Student Computer Literacy Analysis* during 2009. The researcher presented the preliminary findings of this survey instrument at the NADEOSA 2010 Annual Conference in September 2010 (Blignaut *et al.*, 2010). Since January 2011, the researcher holds the position of e-Learning Manager at SCTE, NWU. The development of a learning technology integration framework for SCTE was one of the required key performance areas for the e-Learning Manager. His duties also included performing e-learning strategic planning, establishing e-learning facilities, and design and implementation of SCTE lecturer professional development. Through his dual role of researcher and e-Learning Manager, he had the opportunity to design, implement and evaluate learning technology utilisation initiatives while working in close cooperation with participants in the research process.

In order to perform research and development simultaneously, the researcher followed “a series of approaches, with the intent of producing new theories, artefacts, and practices that account for and potentially impact learning and teaching in naturalistic settings” (Barab & Squire, 2004, p. 2), including typical design research characteristics (Van den Akker *et al.*, 2006). The actions performed during the inquiry had to inform subsequent interventions which in turn built on what happened previously. Design-based research (DBR) may appear unsuited for doctoral students to attempt in the limited time frame of study:

At first glance, the requirement that design-based research should address complex problems in real contexts in close collaboration with practitioners may appear to be such a long-term and intensive approach to educational inquiry that doctoral students, most of whom expect to complete their PhD degree in 4-5 years, should not attempt to adopt this approach for their doctoral dissertations. But we argue that design-based research is not only feasible for doctoral students, but that stronger students should be encouraged to engage in it by their academic advisors (Herrington *et al.*, 2007, p. 3).

However, the researcher considered the urgency of learning technology integration to demand immediate action. He intended these actions to represent design-based approaches forming small design cycles within an overall cycle which collectively comprised one of a series of large design-based research cycles. The outcomes of this study would be conclusions, recommendations and an intended framework for the integration of TEL at NWU. The researcher intends that these outcomes will represent the required inputs for a next macro cycle of DBR, not part of this study. Future macro DBR cycles could involve benchmarking initiatives or similar on-going evaluations and interventions, typical of continuing DBR. While this particular adaptation of DBR has its limitations (§ 5.6), consideration for the urgency of the inquiry justified the approach:

We have to appreciate that design-based research is inherently exploratory and speculative. At the same time, it is a socially responsible enterprise because it puts the concerns and problems of practitioners in the forefront of the research and development process (Herrington *et al.*, 2007).

7.1 Paradigms

Burrell and Morgan (1979) classify assumptions about the nature of science in terms of the subjective-objective dimension and assumptions about the nature of society in terms of a regulation-radical change dimension in a two-dimension four-paradigm scheme for the analysis of social theory. They represent these quadrants as four mutually exclusive, but closely interrelated views of social reality. They think it possible to address the same research theme across all paradigms over time. Their position is however that it is difficult to address research effectively in more than one paradigm at any given point in time, since in accepting the assumptions of one, we defy the assumptions of all the others (Burrell &

Morgan, 1979). This position of paradigm incommensurability is opposed by views that the paradigm boundaries are permeable with transition zones between them or that possibilities of multiparadigm perspectives and paradigm interplay exist (Goles & Hirschheim, 2000).

Goles and Hirschheim (2000) discuss the concerns that most of the research in the field of information systems (IS) at the time appears to be guided by one set of philosophical assumptions—those of positivism. They hold that a particular set of assumptions—those surrounding functionalism—has dominated IS research at that time. While “reliance on a solitary research paradigm inhibits a full understanding of and appreciation for the multifaceted reality of information systems” they suggest “an alternative paradigmatic position—pragmatism—as a vehicle for moving towards a more balanced stream of research” (Goles & Hirschheim, 2000, p. 250). They see this viewpoint as that of the pacifists—one of the groups calling for an end to the paradigm wars. They consider this paradigmatic coexistence or *détente* as introducing a fresh perspective on research. According to this viewpoint, grounded in the philosophical school known as pragmatism, researchers should use whatever philosophical and/or methodological approach that works best for the particular research program under study (Goles & Hirschheim, 2000; Tashakkori & Teddlie, 1998)

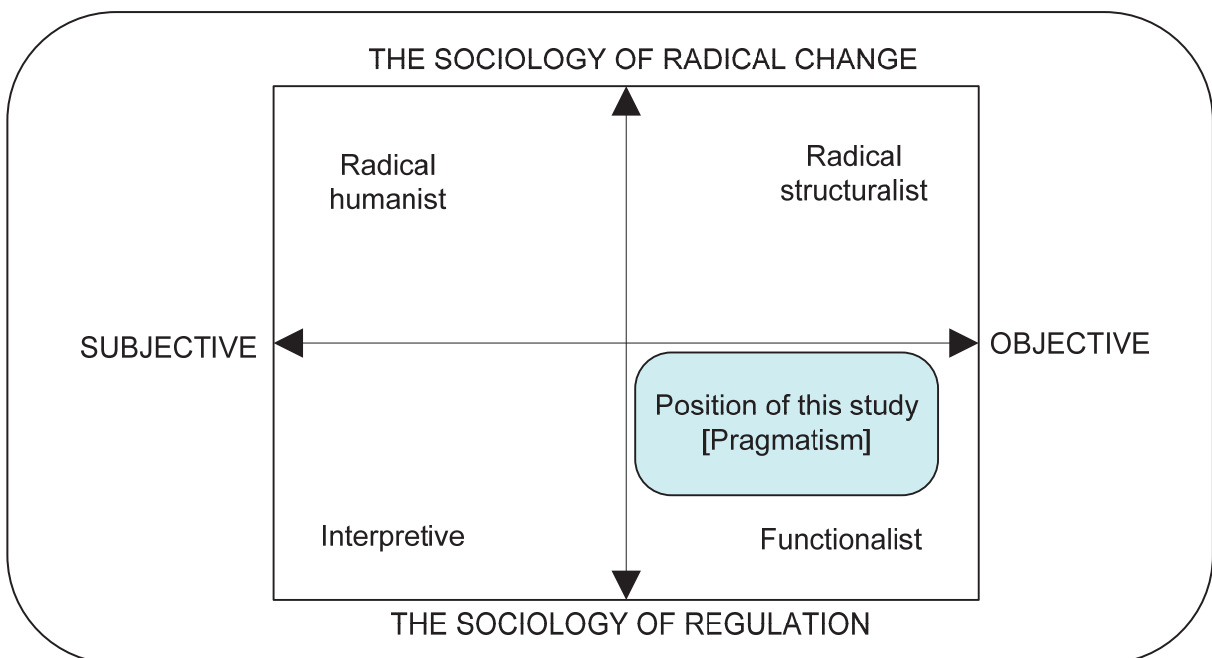


Figure 3: Four Paradigms for the Analysis of Social Theory
(Burrell & Morgan, 1979, p. 22)

A summary of each of the four paradigms for the analysis of social theory by Burrell and Morgan (1979) shows the background to the position of this study.

The *Radical Structuralist* paradigm represents a position of sociology of radical change from an objectivist standpoint. Radical structuralism is committed to radical change, emancipation and potentiality, in an analysis which emphasises structural conflict, modes of domination, contradiction and deprivation, approaching these general concerns from a realist, positivist, determinist and nomothetic standpoint. A common view in this paradigm is that contemporary society is characterised by fundamental conflicts which generate radical change through political and economic crisis. Human emancipation from the social structures in which they live is brought about through conflict and change (Burrell & Morgan, 1979).

The *Radical Humanist* paradigm is defined by its concern to develop a sociology of radical change from a subjectivist standpoint. Similar to the *interpretive* paradigm regarding its approach to social science, but its frame of reference is a view of society which emphasises the importance of overthrowing the limitations of existing social arrangements. The social consideration is intent on a critique of the *status quo*, emphasising radical change, emancipation and deprivation (Burrell & Morgan, 1979).

The *Interpretive* paradigm is informed by a concern to understand the world as it is, characterised by a sociology of regulation. It tends to be *nominalist, anti-positivist, voluntarist* and *ideographic* in its approach to social science. The interpretive paradigm endeavours to understand the world as it is. The frame of reference is that of the participant as opposed to the observer of action (Burrell & Morgan, 1979).

The *Functionalist* paradigm “is characterised by a concern for providing explanations of the *status quo, social order, consensus, social integration, solidarity, needs satisfaction* and *actuality*. It approaches these general sociological concerns from a standpoint which tends to be *realist, positivist, determinist* and *nomothetic*... It is a perspective which is highly pragmatic in orientation, concerned to understand society in a way which generates knowledge which can be put to use. It is often problem-orientated in approach, concerned to provide practical solutions to practical problems” (Burrell & Morgan, 1979, p. 26). With the intention to generate knowledge which can be put to use through a pragmatic approach, the *Functionalist* paradigm is appropriate for this study.

From the problem and motivation for the research, the researcher may have approached this study from an ontological global position using any of the paradigms for the analysis of social theory. If the researcher had performed the study from the perspective of the *Radical Structuralist* paradigm, the focus would have been on radical change through social transformation by advocating drastic action to change historical technological disadvantage. The focus would have been on inequalities, digital illiteracy, denied access to technology, emancipation from inadequate educational opportunities in deep rural areas and drastic actions through radical objective interventions.

Had the research study been performed from the perspective of the *Radical Humanist* paradigm, the voluntaristic abilities of disadvantaged SCTE students, facilitators and staff members to lift themselves above their circumstances would determine a framework for integration of learning technologies. Elements of the transformative-emancipatory paradigm may manifest relating to this dimension in the study, focussing on radical change through human effort of the stakeholders themselves. An analogy may be drawn with this in terms of technology as active participation of the poor in seizing opportunities ICTs offer to lift themselves up and become “active producers and innovators” in terms of Information and Communication Technologies for International Development (Heeks, 2008, p. 33).

If using the *Interpretive* paradigm, the researcher would have attempted examining the lived experience in the natural setting of distance education students, facilitators of the SCTE and the involved stakeholders at the university. From the perspective of the participants, their technological disadvantage, digital illiteracy, historical disadvantage, technophobia and other themes emerging from the investigation would contribute to a picture of the world as they perceive it. The focus would not be on radically changing their world, but understanding the essence of the everyday world they perceive, requiring interpretation and an appreciation that the facts may not speak for themselves.

While the researcher could have approached this study from any of the four paradigms as summarised above, the ontological global position for this research is *pragmatic*, situated in the *Functionalist* paradigm. The aim is to examine the *status quo*, generate knowledge which can be put to use and recommend appropriate actions. Burrell and Morgan see the commitment to a philosophy of social engineering as a basis for social change from the perspective of the functionalist paradigm:

The functionalist paradigm generates regulative sociology in its most fully developed form... It is often problem-orientated in approach, concerned to provide practical solutions

to practical problems. It is usually firmly committed to a philosophy of social engineering as a basis of social change and emphasises the importance of understanding order, equilibrium and stability in society and the way in which these can be maintained. It is concerned with the effective 'regulation' and control of social affairs (1979, p. 26).

As mentioned above, Goles and Hirschheim (2000) discuss the possibility that paradigm boundaries could be seen as permeable with transition zones between them. Burrell and Morgan, not seeing paradigm boundaries as permeable, describe how a *region* of the functionalist paradigm was *influenced* by intellectual influences from other traditions of social thought:

Since the early decades of the twentieth century, however, the functionalist paradigm has been increasingly influenced by elements from the German idealist tradition of social thought...[E]lements of this idealist approach have been utilised within the context of social theories which have attempted to bridge the gulf between the two traditions. In so doing they have forged theoretical perspectives characteristic of the least objectivist region of the paradigm, at its junction with the interpretive paradigm. Such theories have rejected the use of mechanical and biological analogies for studying the social world and have introduced ideas which place emphasis upon the importance of understanding society from the point of view of the actors who are actually engaged in the performance of social activities (1979, p. 27).

In this study, the researcher associates with a focus on the responsibility of the university to objectively empower and support Southern African society to promote increased understanding and benefitting from the opportunities a networked society and economy offer. An emphasis in this study upon the importance of understanding society from the point of view of the actors who are actually engaged in the performance of social activities may be seen as residing in the least objectivist *region* of the paradigm. In this respect, it borrows from the influence of the interpretivist paradigm. If on the other hand paradigm boundaries are seen as permeable with transition zones between them, using the lived experience in the natural setting of distance education students, lecturers and involved stakeholders in initial data collection could be considered in the transition zone between *Interpretive* and *Functionalist* paradigms. Either way, the use of a mixed methodology with methodological pragmatism as a method of inquiry resulted in a *Functionalist* position for the development of a socially transformative integration framework. In a pragmatic stance, the researcher intends the following on his own initiative in guiding the research process:

- 1) He intends to recommend a socially transformative TEL framework focussed on the subjective needs, vision, fears and challenges as articulated by the SCTE students, faculty and support staff.

- 2) The framework should objectively address urgent short term needs through interventions and solutions developed as a result of analysis of practical problems in close collaboration between the researcher and practitioners.
- 3) The testing and refinement of solutions in practice should produce design principles for medium-term actions.
- 4) The framework should contain long term goals and benchmarks for progress evaluation.
- 5) The framework may be the first cycle in a continuing process of evolving strategies informed by evaluation, reflection, enhancement, refinement and action towards dynamic competence and transformation.

The researcher commits to a pragmatic strategy aiming to be functional:

Thus, pragmatists decide what they want to research, guided by their personal value systems; that is, they study what they think is important to study. They then study the topic in a way that is congruent with their value system, including variables and units of analysis that they feel are most appropriate for finding an answer to their research question (Tashakkori & Teddlie, 1998, p. 26).

This study resorts essentially under the *Functionalist* paradigm since for the pragmatist, all discourse is transformational, “as experience immediately had is made into objects of knowing and meaning for the purposes of future action” (Maxcy, 2003, p. 60). In addressing the research question, action is the key:

As a group, pragmatists are convinced that human thought is intrinsically linked to action. Theory was joined with practice. Ideas operate as instruments rather than ideals. Reality is in process, undergoing change at every turn of events. The universe is seen as evolving rather than static. External forces do not determine humans; rather, through intelligence, humans are capable of shaping experience (Maxcy, 2003, p. 63).

According to Maxcy, pragmatism is Peirce's (1966) contribution to research methodology and his position has three ingredients: (a) the acceptance of reality; (b) the role of the future as the space within which things may be known; and (c) a purport, or a commitment to purposive action, following a plan with an end or highest good (Maxcy, 2003, p. 67).

Methodological pragmatism, “proposes that pragmatism itself be conceived either as (a) a method for selecting inquiry methods or (b) a method of inquiry itself, broadly conceived. As such, methodological pragmatism has a weaker and stronger version” (Maxcy, 2003, p. 81). The researcher's position in this study is *methodological pragmatism*, as a method of inquiry.

The multifaceted and complex nature of the topics to be investigated necessitates diverse assumptions and approaches. Answering the first part of the main research question: *Which*

aspects will be prominent in a framework for the integration of technology enhanced learning at the North-West University, presumes an inventory of aspects resulting from the research. While determining prominent aspects, the investigation may look at barriers and challenges. These have dual characteristics in the sense that perceived barriers and challenges have to be personally experienced, but counting the barriers and challenges provide an opportunity to quantify and measure results, which are real. The reasons for not implementing learning technology use as a result of the existence of these perceived barriers and challenges again need subjective interpretation based on aggregated perceptions of stakeholders. Analysis of perceived barriers and challenges may contribute to a list of aspects that will be prominent in a framework. It could be, however that the barriers and challenges as perceived by stakeholders do not represent the prominent aspects to be included in a learning technology integration framework. Other aspects may need consideration, which may only be acquired by looking at research literature and conclusions based on innovative and experiential expertise of prominent researchers. Prominent aspects found in literature may also not agree totally with the aspects to be included in the framework produced by this study, as a result of different sociological conditions in the local context. Assuming agreement on a list of aspects, how the aspects should be addressed opens another multidimensional conundrum which may include financial, technological, procedural, policy, attitude, preference, competence and human capital considerations. This is to be expected when the study involves real life issues concerning interaction of people and technology.

7.2 Using Adapted Design-Based Research

Using design research methods enabled research and development to be performed simultaneously (Barab & Squire, 2004). The actions performed during the inquiry informed subsequent interventions which in turn built on what happened previously (Van den Akker *et al.*, 2006). If DBR methods are derived from the definition of the research problem in close collaboration with practitioners and fine-tuned through literature, it serves to clarify what is already known about the problem and guide the development of potential solutions. The inquiry that forms the basis of DBR helps the researcher to understand the underpinning processes and variables (Van den Akker *et al.*, 2006).

The cyclic nature of this approach meant that individual cycles had specific research approaches. The researcher followed an overarching approach of adapted Design-Based Research (DBR) (Reeves, 2006; Van den Akker *et al.*, 2006) to address the research question (see paragraph 1). In order to address short term and medium term measures, the

researcher initiated a series of events towards immediate actions, followed by strategies towards medium-term solutions. Initial actions formed part of the inquiry which enabled the development of an initial framework (Esterhuizen & Blignaut, 2011). Intense involvement of the researcher with the research participants included iterative cycles of training, observation, evaluation and adaptation (Van den Akker *et al.*, 2006). In this way, the involvement of participants also counteracted researcher bias, since verification of proposed solutions and practices took place through interaction with participants collectively. Other measures to guard against bias included co-coding during qualitative analysis procedures and using a fully mixed methodology. Triangulation through quantitative verification of qualitative analysis enabled the data to speak for itself.

The employment of an adapted DBR approach comprised a single overall macro cycle which consisted of five iterative cycles. The macro DBR cycle concerned addressed the main research question while the individual iterative cycles contributed towards the design of the study. Since this study could be part of a next macro cycle of DBR, subsequent research should follow the recommendations of this study (Van den Akker *et al.*, 2006).

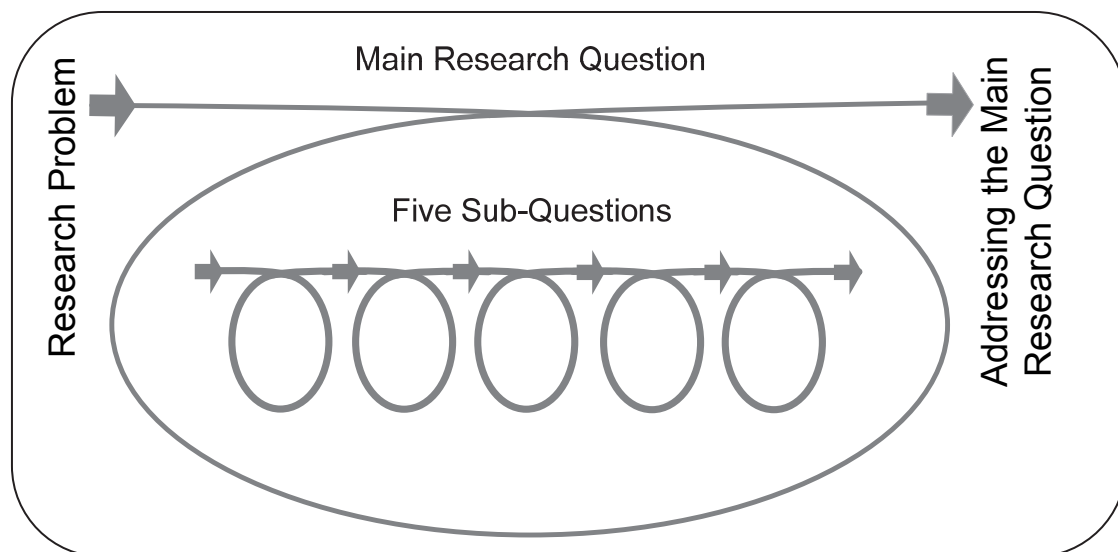


Figure 4: The Adapted Design-based analogy approach to the study

Starting with the research problem, five cycles of design research address the research question. The environment encircling TEL integration includes the *developing context* in which TEL should be integrated, the *policy environment* of the university as well as the government, the *evolving technology environment* and the *technological maturity* of the participants.

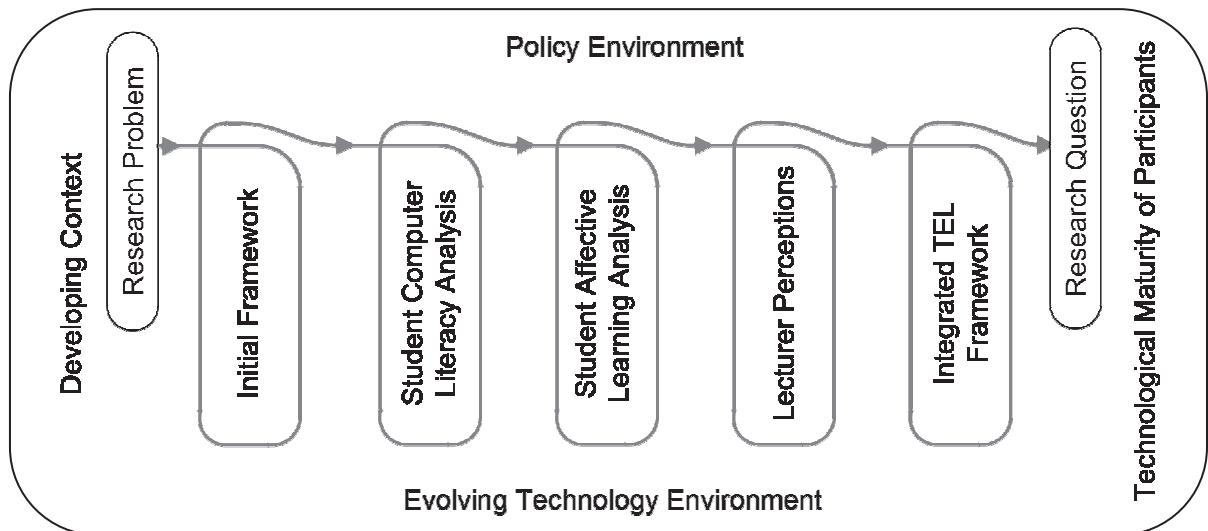


Figure 5: The design research cycles which address the Research Problem to address the Research Question

The adaptation of DBR in this study borrows from *Design-based research approaches in educational technology research* (Reeves, 2006, p. 96). The stages as set out comprise:

- Analysis of practical problems by researchers and practitioners in collaboration
- Development of solutions informed by existing design principles and technological innovations
- Iterative cycles of testing and refinement of solutions in practice
- Reflection to produce *Design Principles* and enhance solution implementation
- The systems control loop returns the enhancements to previous stages through refinement of problems, solutions, methods and design principles.

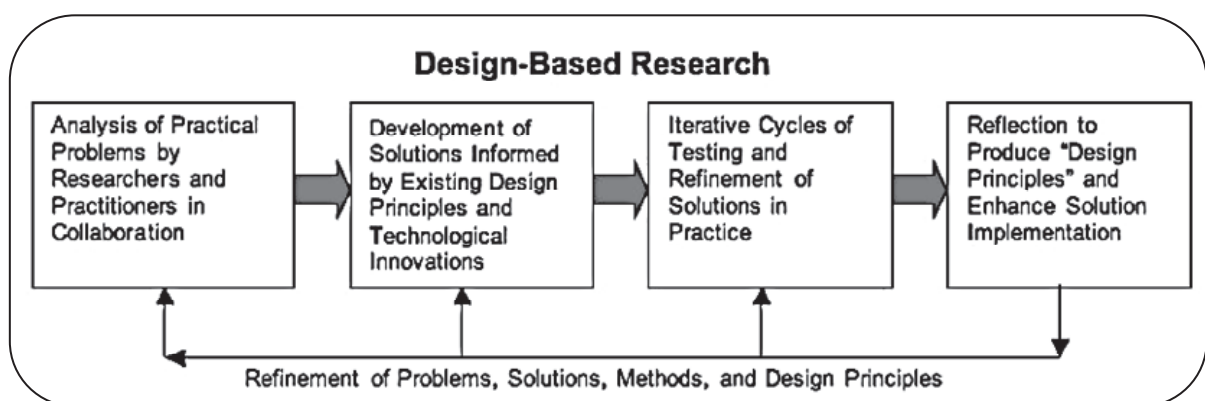


Figure 6: Design-based research approaches in educational technology research (Herrington *et al.*, 2007, p. 3; Reeves, 2006, p. 96).

7.3 Researcher's Role

The researcher holds the position of e-Learning Manager at SCTE since the beginning of 2011. He has subsequently been intensely involved as participant observer in close collaboration with all the participants of this research. Using an adapted version of DBR research methodology enabled short-term solutions based on interventions recommended during the initial DBR cycles to be implemented and evaluated *in situ* in the naturalistic setting. Evaluation and adaptation of interventions relating to medium term and long term solutions could be part of the proceeding macro DBR cycles following this study. As a result of this approach, the urgency of short-term solutions, short-term interventions and the evaluation of these needed not to wait for the conclusion of the study. The responsibilities of the e-Learning Manager included managing learning technology integration and strategies, future planning, design, installation and adaptation of technologies, and learning technology training. This implied interaction with the university as institution regarding infrastructure and technology, academic and curriculum implications of technology use. The responsibilities included being lecturer and examiner for e-Learning as subject for BEd(Hons) students, adaptation of the study guide for off-campus students and introducing SCTE students to the university learning management system.

This study presents two versions of the emerging framework: An initial framework and the emerged framework, representing early and late cycles of the main group of five inherent iterative design cycles in this study. The prominent aspects identified in the approaches and interventions proposed resulted in the evolvment of the learning technology integration framework in progressively increased detail as the study progressed. The actions performed during the inquiry informed an initial socially transformative learning technology implementation framework which the researcher delivered under "ODL and human capacity building" as part of the conference proceedings at the 24th ICDE (Esterhuizen & Blignaut, 2011).

7.4 Participant Selection

The researcher used purposeful sampling (De Vos *et al.*, 2005) during participant selection. The purpose of sampling was using *people that really know, who were directly involved* (Merriam, 2002). The thesis addresses the main research question through five research papers; each addressing one of the sub-questions. The five research papers: one peer reviewed conference paper and four peer reviewed articles, focus on different aspects identified during the process of developing a framework for the integration of learning

technologies in open distance learning at NWU and in consideration of how each of these aspects should be addressed (Sub-Questions paragraph §5.2). Each of the relevant research papers forming part of this study describes in detail the specific participants of that cycle of the study.

In terms of **Figure 6**: Design-based research approaches in educational technology research (Herrington *et al.*, 2007; Reeves, 2006), the *Analysis of Practical Problems by Researchers and Practitioners in Collaboration* refers in this study to the participants in each of the relevant DBR cycles. During *Student Computer Literacy Analysis* in Figure 5 as one of the DBR cycles, the *Practitioners* are the SCTE students, being practising teachers studying to improve their qualification through SCTE. Their *Practical Problems* include the attainment of *Computer Literacy* for each one individually. The researcher develops *Solutions Informed by Existing Design Principles and Technological Innovations* in the second phase of the DBR approach according to **Figure 6**. In this cycle as example, the first *Cycle of Testing and Refinement Solutions in Practice* (**Figure 6**, phase three) involved hands-on computer literacy training as intervention. Analysis of the responses of the participants represent *Reflection to Produce “Design Principles” and Enhance Solution Implementation* (**Figure 6**, phase four), contributing to *Refinement of Problems, Solutions, Methods, and Design Principles* (Figure 6). This is one of the iterative cycles of DBR. The same participants were involved in the *Student Affective Learning Analysis* DBR cycle in Figure 5, though in this cycle the emphasis was on the students’ emotional learning experiences.

The participants in the *Lecturer Perceptions* DBR cycle (Figure 5) are the researcher and the SCTE lecturers, working in close collaboration to analyse practical problems confronting them (**Figure 6**, phase one). The interventions contributed by the researcher include multiple hands-on training opportunities, assistance during the use of technology, discussions and suggestions. Interviews, questionnaires, discussions and observations contributed to *Iterative Cycles of Testing and Refinement of Solutions in Practice* (**Figure 6**, phase three). The evaluation and reflection in order to produce *Design Principles* and *Enhance Solution Implementation* represent the last phase of **Figure 6** in this DBR cycle. The *Refinement of Problems, Solutions, Methods, and Design Principles* (**Figure 6**, bottom feedback loop) result from analysis of findings regarding *Solutions in Practice* (**Figure 6**, phase three).

In both the *Initial Framework* (Figure 5, the first DBR cycle) as well as the *Integrated TEL Framework* (Figure 5, the last DBR cycle), participant selection included SCTE students and lecturers as well as other *Practitioners*: University management, involved university staff as

members of task teams, support and technical staff, trainers from within and outside the university that were consulted, interviewed, recorded and observed. Participants also included professors and peers during attendance of conferences and visits at other universities.

The researcher used participant selection through purposeful sampling of participants most appropriate to address the research questions under investigation in each of the relevant research cycles.

7.5 Mixed Methodology

The researcher employed mixed methods strategies using qualitative data from observations and interviews combined with qualitative as well as quantitative data from surveys comprising structured and open-ended questions (Cresswell, 2009). In line with the Glaserian “all is data” approach introduced by Glaser (1978), themes from interviews and discussions, observational data, questionnaires and literature review were included in the comparative process. Integration took place during the processes of data collection, data analysis and data interpretation, which enabled an iterative process of concurrent implementation in a mixed methodology research design. Some of the individual cycles of design research focussed on alternative research methodologies, in reference to the five research papers comprising this study. The second research paper (Esterhuizen et al., 2012b) concentrated on a quantitative analysis of computer literacy. The research cycle reported on in the third paper in this study (Esterhuizen et al., 2012c) used a Fully Mixed Sequential Equal Status research design (Leech & Onwuegbuzie, 2009) with a two-phase qualitative analysis, followed by quantizing of the qualitative data (Saldña, 2009) in order to quantitatively validate the emotion codes identified from the qualitative data. A pragmatic approach guided the bounded case study reported in the fourth paper. The study followed a fully mixed sequential equal status design of mixing sequential qualitative and quantitative findings. Data collection strategies concerned a custom-made questionnaire, interviews with faculty members and longitudinal observations by the e-Learning Manager. The research plan encompassed a fully mixed sequential equal status design of mixing of sequential qualitative and quantitative findings during the analysis of the data (Leech & Onwuegbuzie, 2009).

7.5.1 Data Analysis

NWU statistical services analysed and supervised interpretation of the data using descriptive as well as inferential statistical analyses. The applicable statistical procedures are reported in detail in each of the research papers included in this study.

7.5.2 Data Collection

According to Johnson and Turner (2003), the fundamental principle of mixed methods research, that methods should be mixed in a way that has complementary strengths and non-overlapping weaknesses, should be followed for at least three reasons: (a) to obtain convergence or corroboration of findings, (b) to eliminate or minimize key plausible alternative explanations for conclusions drawn from the research data, and (c) to elucidate the divergent aspects of a phenomenon. The fundamental principle can be applied to all stages or components of the research process. Johnson and Turner (2003) discuss six major methods of data collection that are used in empirical research including questionnaires, interviews, focus groups, tests, observation, and secondary data: Each of these methods can be viewed as falling along a continuum with "pure qualitative" and "pure quantitative" as the poles. The centre of the continuum is anchored with the term "mixed." This continuum was used to demonstrate how each method of data collection can vary from a pure form to a mixed form. Intra-method mixing involves mixing within a single method of data collection. The respective research papers included in this study report on the respective data collection strategies followed according to the guidelines presented in Johnson and Turner and other literature pertaining to mixed-method research.

8 Ethical Aspects

The researcher noted and complied with elements, examples and recommendations pertaining to ethical aspects as set out by Cohen, Manion and Morrison (2000) including acceptance by institutions, negotiating access and earning acceptance, privacy and anonymity, confidentiality, betrayal and deception. These authors highlight the "costs or benefits ratio", informed consent, voluntary involvement, and informed refusal. The latter implies the elements of competence, voluntarism, full information and comprehension.

The NWU Ethics Committee approved the research study, assigning full authorisation to the study under ethics approval number NWU-00032-10-A2 (Addendum A). The researcher obtained consent for the study from the Director SCTE (Addendum B), individual staff members involved in the research (Addendum B), teachers in training affected by the

research (Addendum B), the director of SCTE (Addendum B), as determined by the ethics committee. Anonymity and fairness formed the basis of the contact with the population group. The researcher ensured that participation is on a voluntary basis and participants had the option to withdraw at any stage from the activities.

9 Presentation of this Research

The functionalist research paradigm informed the study through pragmatism (Burrell & Morgan, 1979). The researcher used an adapted version of DBR methodology where the main research question was approached through “analysis of practical problems by researchers and practitioners in collaboration” (Reeves, 2006, p. 96), a large number of variables were involved and the researcher developed “solutions informed by existing design principles and technological innovations” (Reeves, 2006, p. 96).

9.1 Practitioners in Collaboration with the Researcher

All the selected participants without exception acted as *Practitioners* in collaboration with the researcher at some point in the process of identifying and *Analysis of Practical Problems* (**Figure 6**). Collaboration with some participants as *Practitioners* had been more active than with others. The specific group of SCTE students participating in the survey used in two of the research papers included as part of this study only responded to one questionnaire. However, their responses contributed to intriguing insights which informed the framework, as will be noted in the relevant research papers (Esterhuizen *et al.*, 2012b; Esterhuizen *et al.*, 2012c). The researcher observed interaction with other SCTE students participating in IWB computer conferencing sessions and also interacted with SCTE students enrolled for the Bed (Hons) subject *e-Learning* for which the researcher is responsible. Through discussion with lecturers and other SCTE stakeholders testing and refinement became possible regarding student-oriented solutions in practice. Insights obtained from the student questionnaire informed by observations and personal interaction of the researcher with his own students contributed to development of solutions and reflection to produce design principles. Through the researcher’s collaboration with the SCTE lecturers, their perceptions and vast experience of SCTE students’ needs were noted. Triangulation became possible by comparing these against reactions and insights obtained directly from SCTE students. Continuous *Analysis of Practical Problems* involving SCTE lecturers as well as some of the involved stakeholders at the university enabled typical DBR actions to address complex problems in real contexts in close collaboration with practitioners. As e-Learning Manager, the researcher had the

opportunity to collaborate actively with all the participants apart from the specific group of students mentioned.

The structured approach to the development of these solutions included a series of approaches and actions performed during the inquiry such as informal discussions, formal semi-structured interviews, surveys, providing and receiving training, technology implementation, observation, involvement and participation, evaluation, cyclic review and adaptation, participation in research conferences, peer review discussion and continuing literature review.

9.1.1.1 The Researcher

Activities of the researcher between 2008 and the end of 2012 were keenly focused on gaining insight in all aspects pertaining to learning technology integration both internationally and in the local context. Activity details of the researcher as participant observer comprise:

- (a) Discussions with and observations of SCTE staff and students (Esterhuizen, 2011-2012)
- (b) Presentations at research conferences and discussions with delegates
 - (i) NADEOSA 2010: September 2010 (Blignaut et al., 2010)
 - (ii) 24th ICDE 2011: October 2011 (Esterhuizen & Blignaut, 2011)
- (c) An extended international study tour where peer review informed innovations
 - (i) Open University UK, Milton Keynes, UK: September 2011 (Esterhuizen, 2011a)
 - (ii) Indira Gandhi Open University, Delhi, India: October 2011 (Esterhuizen, 2011b)
- (d) Attending ICT in Education conferences and workshops in South Africa
 - (i) The classroom of the future workshop at the Meraka Institute, CSIR, Pretoria: 10th February 2011 (CSIR, 2011)
 - (ii) ICT in Higher Education Conference at The Grace Hotel in Rosebank, Johannesburg: 30th-31st March 2011 (Melrose Training, 2011)
 - (iii) ICT in Higher Education at the Premier Hotel, Kempton Park: 13th March 2012 (ICT in Higher Education, 2012)

- (e) Technology forums, exhibitions and training in the use of technology
- (f) In-house training at North-West University and participation in university technology forums (North-West University. Taskgroup for Educational Learning Technologies, 2012a; 2012b; 2012c)
- (g) Facilitating staff training and providing assistance in technology use for staff at SCTE
 - (i) Recording and analysis of events
 - (ii) Survey compilation, administering and analysis
 - (iii) Installation, adaptation and evaluation of technology adoption and use
 - (iv) Training interventions and analysis
 - (v) Observation and analysis of learning technology use
 - (vi) Recording of all staff meetings and university technology-related activities as participant observer.
- (h) Resultant progression in thought informed collaboration between the researcher and practitioners at SCTE and with stakeholders in technology adoption from the rest of the university including management (North-West University, 2012)
- (i) Continuous literature study informed the process.

During the latter part of the study, a process was underway to establish the SCTE as a Unit for Open Distance Learning (UODL), which may eventually also provide ODL to students of other faculties at NWU, in addition to the large numbers of students currently at the SCTE. In preparation for increased learning technology integration in teaching and learning and in anticipation of imminent expansion, the researcher as e-Learning Manager was responsible for strategic planning of e-Learning activities at the SCTE, apart from involvement in the present study. The e-Learning Manager considered university policies and views of stakeholders throughout the University into the future planning process. In this way, the researcher as e-Learning Manager was in an ideal position as participant observer for the purpose of this present study.

The series of approaches and actions performed during the inquiry address the sub-questions to the main research question. The researcher considered key participants to be SCTE students and SCTE lecturers (Esterhuizen & Blignaut, 2011). Three of the research papers focus on these two groups of key participants (Esterhuizen *et al.*, 2012a; Esterhuizen

et al., 2012b; Esterhuizen *et al.*, 2012c). The researcher explored the lived experience in the natural setting of distance education students, lecturers of the SCTE, as well as the involved stakeholders at NWU during initial data collection. At the same time, he maintained a continuous literature study of emergent technologies in order to keep the study current during the course of the investigation, given the dynamic nature of technological development. The researcher followed a sociologically transformative approach, focussing on the use of technology for social empowerment to cross the digital divide, through a theoretical lens of ICT for development. Qualitative data gathered through a social constructivist enquiry (Cresswell, 2009) was implemented into a framework through pragmatism (Teddlie & Tashakkori, 2003). The cyclic nature of this approach resulted in specific focuses emerging from the prominent aspects identified while drafting an initial learning technology integration framework. The *Initial Framework* (Esterhuizen & Blignaut, 2011) referred to in Figure 5 is the first of the five research papers included in the thesis. In each case it includes a literature review according to the needs of the individual question it addresses. The sub-questions emerged through involvement of the researcher with the research participants as participant observer including iterative cycles of training, observation, discussion, evaluation and adaptation (Van den Akker *et al.*, 2006).

9.1.1.2 Students

In a people-centred attempt to explore, describe and understand the lived experiences of SCTE students and staff, perceptions of technological disadvantage and digital illiteracy of students emerged as important (Esterhuizen & Blignaut, 2011; Esterhuizen *et al.*, 2012b). Assessment of the e-Readiness of the current and future students of the SCTE could assist the prediction of successful use of learning technologies in an ODL environment.

Consequently, the second research paper concerned “ODL Students’ Perceived Computer Literacy Competencies, Expectations of Support, Intention to Use and Perseverance.” (Esterhuizen *et al.*, 2012b) This is indicated as *Student Computer Literacy Analysis*, the second DBR cycle in Figure 5. The researcher developed a survey instrument for administering during training sessions arranged for students who required additional support to pass the computer literacy module. The TAM (Davis *et al.*, 1989) produced cues during the compilation of the survey. The instrument gathered data on teacher-students’ (i) demographics; (ii) perceptions of fear of technology, (iii) technological disadvantage; (iv) frustrations during the use of technology; (v) perceived usefulness of computers; and (vi) perceived ease of use of technology. The TAM predicts actual technology use from *intention to use* through *perceived usefulness* and *perceived ease of use* of technology as

preconditions. The survey was presented to a purposeful sample of 338 teacher-students who required only one module, computer literacy, to complete their various qualifications. They attended special computer-literacy contact sessions at twelve learning centres across South Africa during 2010. Some students had never before enrolled for the computer-literacy module, while others had previously failed the module. They completed the survey instruments during the contact sessions. The survey was validated using a mixed methodology research design (Johnson & Turner, 2003).

The limitation of using a single bounded case that is not generalizable to the population of teachers furthering their studies in South Africa means future research should focus on objective e-competence measurement after support initiatives as recommended in the proposed learning technology integration framework have been implemented. However, this article informs the framework from the perspective of SCTE students especially selected as a result of their apparent difficulty in passing the module on computer literacy.

In the preliminary findings of this DBR cycle, the quantitative analysis indicated that expectations of technophobia with SCTE were overrated, but that qualitative analysis indicated a more complex emotional scenario. This informed the subsequent DBR cycle to focus on the affective responses of SCTE students to technology (Esterhuizen *et al.*, 2012c).

The DBR cycle indicated as *Student Affective Learning Analysis* in Figure 5, comprises the third research paper (Esterhuizen *et al.*, 2012c). In this Fully Mixed Sequential Equal Status research design (Leech & Onwuegbuzie, 2009) with a two-phase qualitative analysis, the students acted as practitioners in collaboration with the researcher in the sense that students' responses provided clues of their perceived reality of interaction with technology. The qualitative analysis of their communication regarding emotions required interpretation and an appreciation that the facts may not speak for themselves. Though the particular group may not be involved in iterative cycles of testing, the contribution they made to the understanding of how computers contribute towards affective experiences of disadvantaged teacher-students will be incorporated in the on-going evaluation of the framework.

9.1.1.3 Lecturers

The fourth research article concerns faculty perceptions during e-learning staff development (Esterhuizen *et al.*, 2012a). As mentioned in §1, thirty seven lecturers at SCTE, NWU create study material, provide support and perform assessment to train about 24,000 in-service under qualified and unqualified teacher-students across South Africa and Namibia through

an ODL model. They are assisted by approximately 350 facilitators at 35 learning centres in South Africa and four in Namibia where students may attend contact classes twice a month. Few learning technologies are used. IWBs are used to facilitate communication between lecturers at SCTE on the one side and facilitators and students at the regional support contact centres on the other. Using IWBs, SCTE lecturers may facilitate interactive sessions at multiple regional support contact centres simultaneously, while previously they could only attend sessions at one centre at a time, travelling great distances to do so. Since the introduction of IWBs used for synchronous computer mediated conferencing, lecturers have needed training in the use of the technology and in the adaptation to facilitating learning experiences at a distance. The e-Learning Manager interacted daily with SCTE lecturers since the beginning of 2011, providing training in the use of IWBs for synchronous computer mediated communication, assistance in general computer use, sourcing of material for remote lecturing and recording of hybrid educational DVDs. In order to gather data for development of the envisaged learning technology integration framework, the e-Learning Manager recorded all academic staff meetings, numerous discussions, academic training and planning sessions. All other meetings in which the e-Learning Manager was involved were recorded, such as technology task team meetings about learning technology integration and the development of e-learning. These meetings included participants from university management, staff members and management of university service departments from the NWU Institutional Office and all three university campuses. e-Learning Manager observations included viewpoints from all these role players in relation to faculty experience and contexts.

During May 2011 the researcher conducted individual interviews with four purposefully selected lecturers according to the criterion that they, at that point in time, had just completed making an interactive DVD as part of their electronic study material for their respective courses (Esterhuizen *et al.*, 2012a). This determined the approach to further faculty training in synchronous use of interactive electronic whiteboards for lecturing to regional tuition centres.

The semi-structured interviews focussed on (i) their perceptions of training received previously, (ii) their views on learning technologies, (iii) barriers in implementing e-learning in their subject areas, (iv) time required before they will be ready to properly apply their subject content knowledge using e-learning, (v) what training in e-Learning should consist of, (vi) whether their students expressed a need for using technology more and if the lecturers believed their students would benefit from using e-Learning, (vii) if more use should be made

of electronic technologies with regard to the students lecturers interact with (viii) how long lecturers think it will take to implement technology in the subject content area they are responsible for to the level they would consider desirable and what that would depend on.

In February 2012, the researcher presented a custom-made questionnaire to lecturers attending a follow-up series of participatory training sessions on the use of IWBs. It collected quantitative data on two questions (one binary and one Likert scale data), measuring faculty commitment, as well as qualitative data from two open-ended questions on elaboration of the commitment and five open-ended questions on the perceptions of faculty on the use of learning technology in ODL. The e-Learning Manager compiled a reflective journal of his own observations during the execution of his daily interaction with and training of faculty. This document became the comparative voice during the qualitative analysis in this research cycle (Esterhuizen, 2012).

9.1.1.4 Other Practitioners as Participants

Apart from regular interaction between the researcher as e-Learning Manager and the Director SCTE as line manager, the researcher conducted a semi-structured interview by appointment with the Director (Spamer, 2011). The researcher initiated collaboration with stakeholders in the university around learning technology integration. As a result, a working group for learning technology coordination was initiated by the Manager: Teaching and Learning Technology, Academic Development and Support Services, Institutional Office NWU. Through this workgroup, collaboration developed on a regular basis with Academic Support Services, Information Technology Services and other stakeholders on all campuses of NWU. Needs of SCTE regarding learning technology are addressed through this forum, which eventually was replaced by a larger forum, called *e-Ndaba*, involving more stakeholders. Observations were included in the reflective journal of the e-Learning Manager. Development of solutions, refinement of solutions in practice, reflection to produce design principles and enhance solution implementation utilised inputs and information obtained through such collaboration.

The researcher as e-Learning Manager presented SCTE needs to university management (North-West University, 2012) and participated in various discussions as a result of these initiatives (North-West University. Taskgroup for Educational Learning Technologies, 2012a; North-West University. Taskgroup for Educational Learning Technologies, 2012b; North-West University. Taskgroup for Educational Learning Technologies, 2012c). All these meetings were recorded.

9.1.2 Structure of Research Papers

This study addresses the research sub-questions through five research papers, each representing one cycle of the adapted DBR methodology (Table 1).

Table 1: Research papers addressing research sub-questions

Research Sub-question	Paper Title	Submitted to	Status	Addendum
Which aspects should be considered during the process of developing a framework for the integration of TEL at the SCTE?	<i>A Localized Socially Transformative Learning Technology Integration Framework for ODL</i> (Esterhuizen & Blignaut, 2011)	24th ICDE (International Conference for Open and Distance Education) in Nusa Dua, Bali on 4th October 2011	Published	C
What are the significance and implications of technophobia, technological disadvantage, ease of use and usefulness of computers on SCTE's students new to TEL?	<i>ODL Students' Perceived Computer Literacy Competencies, Expectations of Support, Intention to Use and Perseverance</i> (Esterhuizen et al., 2012b)	Turkish Online Journal of Distance Education (TOJDE)	Published	D
How could SCTE's ODL students' affective learning be addressed during TEL?	<i>Computer Literacy Learning Emotions of ODL Teacher-Students</i> (Esterhuizen et al., 2012c)	AACE (Association for the Advancement of Computing in Education) EdMedia 2012 World Conference on Educational Media and Technology, Denver, Colorado, USA	Published in Conference Proceedings	E
What are SCTE lecturers' perceptions of the realities of adopting a TEL environment?	<i>Looking out and looking in: Exploring a case of faculty perceptions during e-learning staff development</i> (Esterhuizen et al., 2012a)	IRRODL (International Review of Research in Open Distance Learning) journal	Accepted	F
How can the prominent aspects of TEL be integrated in a framework at the NWU?	<i>Seamless Support: Technology Enhanced Learning in Open Distance Learning at NWU</i> (Esterhuizen & Blignaut, 2012)	The Turkish Online Journal of Educational Technology (TOJET)	Under consideration	G

9.1.3 Background to Papers

In paragraph §9.1 a discussion focussing on the participants as *Practitioners* in a DBR process includes some of the detail also included below. Here, the interactive research process of this thesis is described from the perspective of the research papers which resulted from the DBR approach.

9.1.3.1 Paper 1: A Localized Socially Transformative Learning Technology Integration Framework for ODL (Esterhuizen & Blignaut, 2011)

This paper describes the process of developing an initial learning technology integration framework for ODL at SCTE, NWU.

In preparation for this study, the researcher conducted preliminary discussions with staff at the SCTE NWU. They indicated a need for the advancement of e-learning as part of the ODL model at SCTE. They indicated, inter alia, the significant number of SCTE students at NWU that do not have access to the Internet and computers as a major obstacle. This initiated a process of literature study and data gathering. Cues from the Technology Acceptance Model (Davis *et al.*, 1989; Fishbein & Ajzen, 1975) provided structure for the surveys. The researcher compiled a survey comprising single-input and open-ended questions that collected data from a purposeful sample of 338 teacher-students attending additional contact sessions after their unsuccessful completion of a computer literacy course. The questions probed perceived usefulness and ease of use of technology, technophobia, the availability of and access to computers and the Internet. While SPSS analysed the quantitative data, the authors of the first paper (Esterhuizen & Blignaut, 2011) used Atlas.ti™ for qualitative analysis. Data analysis of this survey contributed to the initial framework and later resulted in the second and third research papers included in this study. The rest of the first paper initial framework evolved from interviews and discussions with SCTE lecturers and university stakeholders, observations and a literature review. University policies and statistics augmented the input from management. The e-readiness of students and the e-maturity of the institution moulded the initial framework. During the development of the initial framework included in Paper 1, the researcher was appointed as e-Learning Manager at SCTE and intense involvement of the researcher with the research participants as practitioners collaborating in DBR included iterative cycles of training, observation, evaluation, and adaptation analysis of practical problems. The evaluation of implementation initiatives governed the cyclic process to match the multimodal implementation strategy. As

a result of quantitative analysis of the SCTE student survey data using SPSS, the influence of suspected technological disadvantage and technophobia seemed overrated. Initial qualitative analysis indicated a more complex picture regarding students' emotions of technophobia, but by the time the initial framework emerged, the analysis was still in progress. The initial framework remained emergent while additional cycles of DBR were in progress.

The 24th ICDE (International Conference for Open and Distance Education) of the 4th October 2011 in Nusa Dua, Bali presented an opportunity at the right time for the researcher to present his initial learning technology integration framework under the strand *ODL and human capacity building* (Esterhuizen & Blignaut, 2011). The conference theme was *Expanding horizons—new approaches to ODL*, and provided the opportune time to present the framework that concentrated on suggested interventions to transform the seven identified proponents at SCTE, NWU from pre-existing status to a transformed status in terms of learning technology integration. During the progress of the DBR cycle, considering the prominent aspects in a people-centred social transformational learning technology implementation framework, the focus was on the seven identified proponents, namely SCTE students consisting of practising teachers, academic and support staff, the university as institution, the curriculum, information retrieval skills, access and connectivity, infrastructure and technology (Esterhuizen & Blignaut, 2011).

En route to the conference, the researcher deliberated with professors and peers at the Open University, Milton Keynes, UK and after the conference, with professors and peers at the Indira Gandhi Open University, Delhi, India. The researcher utilised these diverse forums on which a variety of ODL issues were addressed and particularly the one of sustainable development of technology in education under developed and developing sociological conditions. Possibilities were explored around e-learning and the prominent aspects to be included in a framework for the integration of learning technologies in open distance learning at NWU, and how these could be addressed. This collaboration enabled refinement of problems, solutions, methods and design principles, contributing to the Integrated TEL Framework presented in Paper 5 included in this thesis.

9.1.3.2 Paper 2: ODL Students' Perceived Computer Literacy Competencies, Expectations of Support, Intention to Use and Perseverance (Esterhuizen et al., 2012b)

This paper reports on disadvantaged South African practising teachers' perceptions on computer literacy competencies while studying to improve their teaching qualifications (Esterhuizen *et al.*, 2012b). The survey instrument developed by the researcher and presented to the purposeful sample of 338 teacher-students attending additional contact sessions after their unsuccessful completion of a computer literacy course forms the basis for this paper. The instrument gathered data on teacher-students' (i) demographics; (ii) perceptions of fear of technology, (iii) technological disadvantage; (iv) frustrations during the use of technology; (v) perceived usefulness of computers; and (vi) perceived ease of use of technology.

This research paper was submitted for publication to Turkish Online Journal of Distance Education (TOJDE) specifically because of the editors' interest in practical issues such as how educational technology impacts learning, perseverance of the users and perspectives on educational technologies. The content of TOJDE relates to educational technology and is published as a quarterly online journal. Submitted articles are about all aspects of educational technology and address assessment, attitudes, beliefs, curriculum, equity, research, and translating research into practice, learning theory, alternative conceptions, socio-cultural issues, special populations and integration of subjects. With its wider impact as an open access journal, this article fits in with the objective to represent perspectives of students, teachers, school administrators and communities, and this is the target audience of this research paper. The journal has recently been included in the Social Science Citation Index, which signifies its increase in prestige and impact.

As a result of the preliminary findings of this DBR cycle where the quantitative analysis indicated that expectations of technophobia with SCTE were overrated, but that qualitative analysis indicated a more complex emotional scenario, the next DBR cycle focussed on the affective responses of SCTE students to technology.

9.1.3.3 Paper 3: Computer Literacy Learning Emotions of ODL Teacher-Students (Esterhuizen *et al.*, 2012c)

The third research paper: "Computer Literacy Learning Emotions of ODL Teacher-Students" (Esterhuizen *et al.*, 2012c) addresses the affective human lived experiences in terms of the emotions of SCTE teacher-students while attaining computer competencies for teaching and learning, and for ODL. Affective computing relates to the role of affective experiences and the emotional expressions of people during their learning of skills essential for using computers and other electronic devices. The full mixed method study investigated how

computers contribute towards affective experiences of disadvantaged teacher-students, considering (i) the challenges the participants experienced during computer literacy training; (ii) the influence of their background on their computer acceptance; (iii) their perceptions on the value of computer-literacy training they received; and (iv) the personal advantages of becoming computer literate. The second author, Prof A. Seugnet Blignaut presented this research paper at the annual international EdMedia Conference (organized by AACE - Association for the Advancement of Computing in Education) in Denver, Colorado, (Esterhuizen *et al.*, 2012c). The paper received an Outstanding Paper Award and the authors were invited to submit a full paper based on the paper to the AACE (Addendum E). The strand *Teaching/Learning Strategies* was selected to present this paper as the most relevant to report on the emotional experiences of the targeted student group. This is an outstanding forum for practitioners (as many as 1 500 from 70 countries) to discuss issues such as multimedia, hypermedia, and specifically distance learning.

9.1.3.4 Paper 4: Looking out and Looking in: Exploring a Case of Faculty Perceptions during e-Learning Staff Development (Esterhuizen *et al.*, 2012a)

The initial framework (Esterhuizen & Blignaut, 2011) indicated SCTE NWU lecturers as key stakeholders and consequently, the next DBR cycle focussed on their perceptions. "Looking out and looking in: Exploring a case of faculty perceptions during e-learning staff development" (Esterhuizen *et al.*, 2012a) is an explorative study that captured the perceptions of SCTE lecturers new to TEL and the longitudinal observations of the e-Learning Manager during dedicated professional development of these lecturers. A pragmatic approach guided the bounded case study. The study followed a fully mixed sequential equal status design of mixing sequential qualitative and quantitative findings. Data collection strategies concern a custom-made questionnaire, interviews with faculty members and longitudinal observations by the e-Learning Manager. The paper was submitted to the International Review of Research in Open Distance Learning (IRRODL). The journal specifically publishes internationally refereed original research, theory and best practice on ODL worldwide.

9.1.3.5 Paper 5: Seamless Support: Technology Enhanced Learning in Open Distance Learning at NWU (Esterhuizen & Blignaut, 2012)

The fifth research paper involves a position paper: "Seamless Support: Technology Enhanced Learning in Open Distance Learning at NWU" (Esterhuizen & Blignaut, 2012) based on the framework presented as a culmination of the observations and analysis of data

performed during this research study. This framework proposes a sequence from e-learning research informing the ODL strategy regarding the development of e-Capacity, extending cooperation to other faculties and education markets, e-Learning Support to develop e-Competence (Schneckenberg & Wildt, 2006). *Suggested stages for classifying maturity in TEL at NWU* are included for the purpose of e-Learning integration maturity classification. These were inspired by the five types of relationship (Wenger, 1998) used in defining the acceptance that an institution might have in moving toward adopting the concept of a learning community. Since the need for support featured prominently in the needs of students as well as that of the lecturers, the position paper focusses on support as essential characteristic in the e-Learning Implementation Framework. This research paper was submitted for publication to The Turkish Online Journal of Educational Technology (TOJET) since the journal welcomes original research regardless of the length of the article, as long as it is appropriate in terms of the subject matter. The nature of the fifth paper as expressing an opinion is suited to TOJET and specifically to the readership and character of this online journal.

Figure 7 provides a graphical overview of the project design as it was executed according to an adapted DBR. In the first column in Figure 7, the *Context of the Study* provides the main characteristics of the background to the study and the *Framework Requirements* state that the framework needed short term, medium term and long term solutions. In the second and third columns, the focus of each phase of the study design in relation to the DBR cycle which addressed the particular phase indicates four focuses and five cycles. Two DBR cycles were devoted to analysis of the perceptions of SCTE teacher-students.

A pictorial view clarifies the five DBR cycles comprising the overall macro DBR cycle of the whole study and the focus of each DBR cycle to which the five papers were devoted.

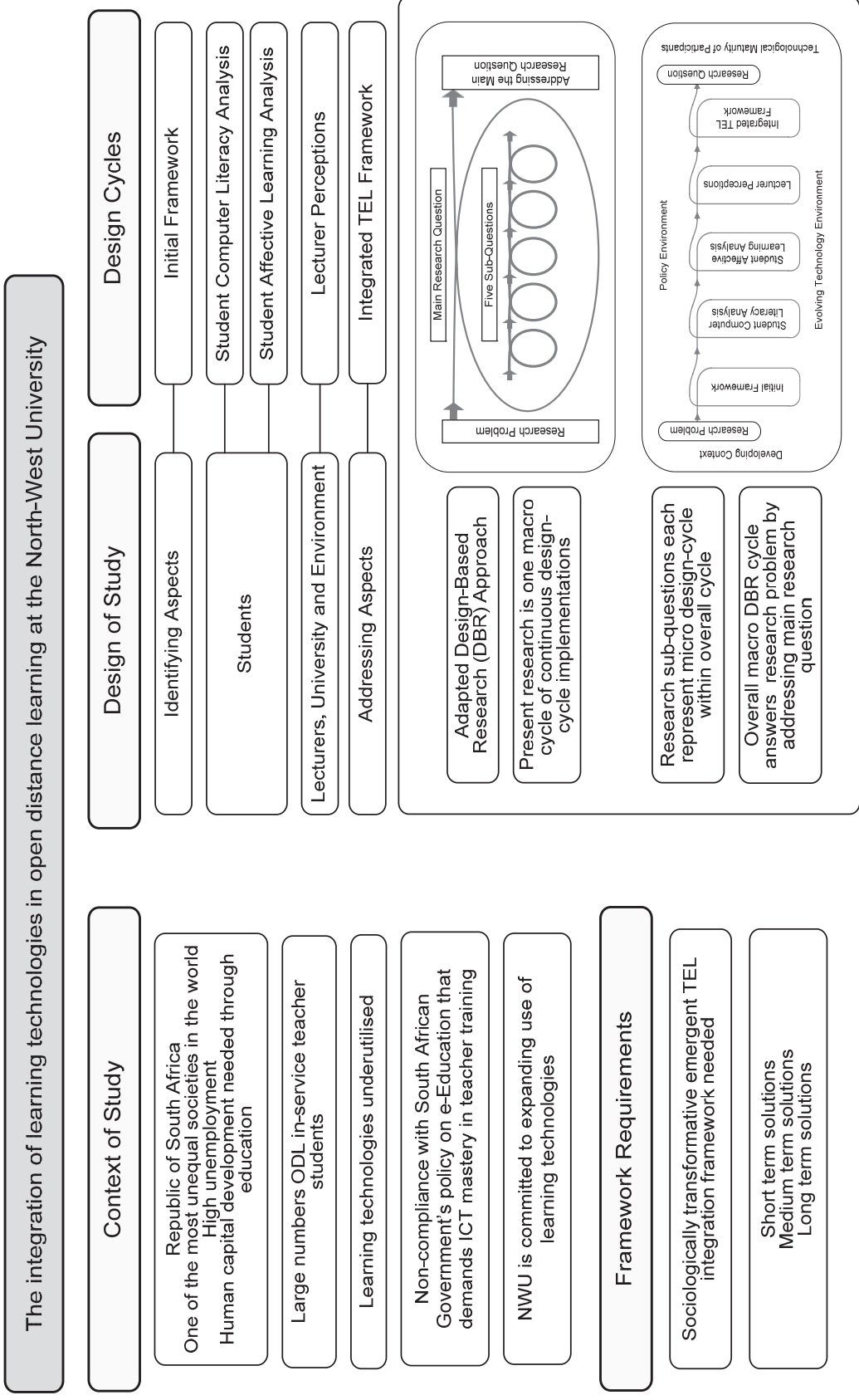


Figure 7: The design of the study as executed according to an adapted DBR process

9.2 Section Summary

The under-utilisation of learning technologies for ODL at SCTE motivated this PhD study. The five research papers included in this thesis discuss the process of identifying aspects to include in a framework for integration of TEL at NWU and how to address these aspects.

Together, the five DBR cycles addressed the Main Research Question. The analysis of the process, conclusions, recommendations and limitations of this research study comprise the last section of this thesis. The future research suggested may be the next macro DBR cycle, where the next research question could be addressed in an on-going TEL research focus.

9.3 Roadmap to this Thesis

This thesis should be read with the following in mind:

The work comprises seven parts in sequence—an introduction, five papers and a conclusion.

The main research question consists of two parts, while each of the five papers individually addresses the sub-questions to the main research question.

The five research papers: one peer reviewed conference paper and four peer reviewed articles, focus on different aspects identified during the process of developing a framework for the integration of learning technologies in open distance learning at NWU and in consideration of how each of these aspects should be addressed (Sub-Questions paragraph §5.2).

Each of the individual papers was written according to the author guidelines prescribed by the individual publishing houses or conference organisers. This influenced not only font type and size, but also layout and bibliographical style. The APA 5th referencing style was used in the introductory and conclusive sections of the research.

While paper references directly follow each of the papers, an integrated bibliography is added at the end to provide a complete overview of references used in all seven sections.

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