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CHAPTER 6. ECOSPHERE

It is a very strange wisdom.
To get power you give away a lot of it.
At that point you are poised to do a lot of good.
The point of authority is to empower.
It is wonderful when it work.

Dell (2011)

6.1   INTRODUCTION

The previous chapter considered the current and potential affordances of emerging technologies within the frame of the technosphere. The core category *innovation negotiation in context* that emerged from data analysis was expanded upon and presented in the themes *technology implications, innovation strategy and reflexive pedagogy* (*cf.* Table 3-9, p.112)

In Chapter 1 the research objective for this section was presented as part of the research puzzle (*cf.* Table 1-1, p. 15). It is briefly revisited in Table 6-1 below.

Table 6-1: Research puzzle for the ecosphere

Research Question	Objective	Subsidiary research question
How does tacit knowledge manifest when innovative teachers engage with emerging technologies to achieve pedagogical efficacy?	To consider the response of governance harnessing the innovative teachers within the school environment.	How do governance structures respond to the innovative teacher within the ecosphere?

This chapter contemplates the last research subsidiary question: How do structures of governance respond to the innovative teacher within the ecosphere? To answer this question the researcher collected and analysed data (*cf.* Table 3-4). Literature, related to the emerging categories and themes, was considered and facilitated additional insight into the interpretation and

conceptualisation of emerging theory. The findings are presented in the form of *quotations* and *reflections* to support the interpretation of the researcher.

6.2   ECOSPHERE: PROFESSIONAL AND ORGANISATIONAL LEARNING

The last part of the initial conceptual framework to be considered in this research is the *ecosphere* which surrounds the teaching and learning theory as set out in Section 2.4. The *ecosphere* demarcates the learning environments and the way in which technology influences organisational structures and functions. Continued professional development through in-service training programs and the role of the innovative teacher as change agent within the organisational structures are contexts which are considered in this section.

Learning cycles within the education system are protracted and management structures have been slow to respond and exploit the transformational potential of digital technology. However, in the teaching and learning milieu transformation deals more with *human and organisational issues* than with the *use of technology*. Therefore a gap exists between the *turnaround time* for change within an organisation and the *adoption* of new practices. Innovative teachers, when engaging with emerging technology in their practice, fill this gap with a creative bloom of activities. The current imaginative use of technology in education within this group of innovative teachers is a *bottoms-up change process* in which teachers change their practice without guidance and leadership. If a *top-down change process* was in place, a clear strategy would exist and it would be widely communicated to all stakeholders within the community (Beetham & Sharpe, 2007). Because of the slow response time of education systems, teachers are lobbying for change within their own micro environments. They are concentrating their efforts on that which is within their immediate reach and those areas where they are sure to be successful.

Various data collecting instruments were used (cf. Table 3-4, p. 92) to collect data that was analysed in accordance with the Straussian Grounded Theory method. Instances from literature are used to supplement the research findings. In Table 6-2 below, the specific conceptualised themes (second column) which emerged from sub themes (first column) along with the specific

core category is provided. These themes were derived from the coding process where ATLAS.ti was used to determine the specific themes relating to ecosphere in this study.

Table 6-2: *Responsive Governance* as the emerging core category with expanded theme *skills transfer* highlighted for discussion

AXIAL CODING (Categories clustered in sub themes)	SELECTIVE CODING (Emerging themes derived from sub themes)	CORE CATEGORY
Self empowerment (*cf*. Section 6.3.1)	**Skills transfer (*cf*. Section 6.3)**	Responsive governance
Capacity building (*cf*. Section 6.3.2)		
Self development path (*cf*. Section 6.3.3)		
Hierarchal movement	Organisational change	
Incentives for change		
Lobby for change		
	Leave teaching	

This section will present the emerging theme *skills transfer* (*cf*. Section 6.3) which originated from the core category *responsive governance*. Sub themes *self empowerment, capacity building* and the *self development path* (*cf*. Sections 6.3.1 – 6.3.3) of innovative teachers are expanded upon and discussed in detail in the form of quotes from participants, competition entry documents, reflections from the researcher and representations from literature.

6.3 SKILLS TRANSFER

For the purpose of this section, a skill is seen as a learned capacity to deal with a specific set of domain related problems (Cordingley & Bell, 2007). In this research the transfer of skills pertains to *experts,* identified as innovative teachers, who share their practice with their peers and in so doing stimulate their development and growth. A teacher's new capabilities manifest themselves in *observable changed practice*. They conquer their fear of new technologies as they

start to engage with their learners in a more relaxed and accessible manner. Sharing expert knowledge can be structured in formal training sessions or it can be totally unstructured and serendipitous in nature.

If teachers wish to be more comfortable in developing 21st century skills in their learners, they themselves need to be exposed to models and examples relevant to their subject areas. Teachers need coaching and mentoring to improve not only their *digital skills* but the following skills areas as well:

- Generic skills related to teacher duties as articulated in Section 4.3.

- Time management, planning, organisational and decision making skills.

- Designing learning events to exploit emerging technologies to their full.

- Flexibility to deal with constant change and unexpected outcomes.

- Designing appropriate assessment instruments and

- Contextualising the curriculum through strategies which aim to harvest indigenous knowledge from community experts.

Innovative teachers transfer their newly acquired competencies to their colleagues in an effort to affect change within their own school and to elevate their profession as teachers outside the boundaries of their particular school become more capable of dealing with the added pressures of integrating technologies into their curriculum. Nussbaum (2000) views the transfer of expert knowledge as enabling people to access and develop human, economic, natural and social assets.

Innovative teachers split the practice of transferring their knowledge into two distinctly different actions. On the one hand they *introduce new knowledge* to their peers and on the other hand they *take measures to sustain and reinforce its use*. To increase their fellow teachers' confidence they also actively mentor their peers and collaborate with them on projects. Another strategy, suggested by Hargreaves (2003), which aims to ensure a higher rate of knowledge and skill transfer is to make use of ICT to access and share available contextualised examples of good

practice. A teacher can also use his/her own personal learning network or pre-existing networks to share practice between schools.

The next section will consider the value of the skills which innovative teachers have developed in their practice and how they disperse them amongst those that share their ecosystem. Each of these emerging sub themes as displayed in Figure 6-1 will be discussed in greater detail below (*cf*. Sections 6.3.1 – 6.3.3).
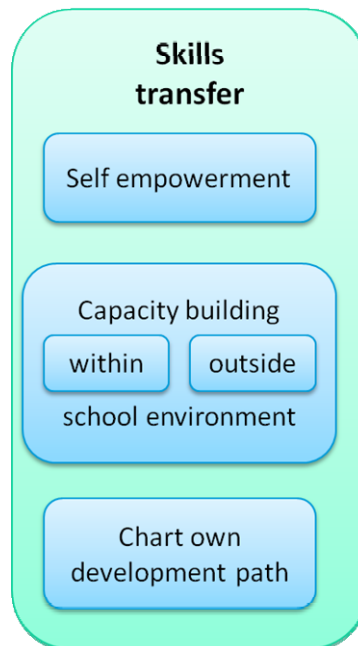
Figure 6-1: Expanded emerging theme: Skill transfer

6.3.1 Self empowerment

This section will describe and discuss *self empowerment* as one of the sub themes that stems from the main theme of *skills transfer*. Through the action of experimenting with emerging technologies in their teaching and learning environments, innovative teachers develop new skills that are highly sought after. This newly developed knowledge is held in mental models that are not generally accessible to the innovative teacher him/ herself or to others that share their environment (Brown, 2009). Unless the tacit nature of the new knowledge is explicitly shared, it remains a hindrance to organisational growth. As a result, innovative teacher exert control over organisational growth and simultaneously they grow their professional profile as they are held in higher esteem. Bordum (1999) warns that unless this new tacit knowledge is disseminated to

other teachers it can lead to an abuse of power and that it can even be used to manipulate others. However, once open and accessible to all, knowledge can result in the growth of other individuals within an organisation.

In making their knowledge explicit, innovative teachers provide pedagogical leadership in guiding their colleagues from the more traditional teaching methods to being more engaged and focused on community and learner needs. Pauline Skosana teaches in a rural community at a school which is still trapped in the conventional way of teaching. She explains below why she views herself as being innovative:

Why am I innovative? I am the first teacher in my school to integrate ICT in my lessons. Most of my colleagues are not computer literate and this is the best way of motivating them. Our area is disadvantaged and the only place for learners to be exposed to ICT is at school. The parents are excited because the school is their only hope for the future of their kids (Pauline Skosana, VCT 2008).

Through her efforts and leadership she has managed to keep herself motivated by experimenting with various emerging technologies in learning events which are greatly influenced by the school's rural context. In the process she has inspired her colleagues to change their practice and formalise their computer skills. Her personal and professional profile in the community has increased and parents are satisfied with the increased accessibility to technology and the additional opportunities which are being created for their children. *Innovation* is *heavily context dependent* and what might not have been deemed as innovative in a *technology rich environment*, is deemed innovative in the *rural technology poor environment*. Table 6-3 was extracted from Pualine Skosana's VCT and demonstrates her role as *change agent* within her school and community.

Table 6-3: Pauline Skosana reflects on the benefits that her innovative teaching has brought to her school and community noting changes in teacher and learner perceptions

TEACHER
Most of my colleagues have started learning computer skills so that they too can integrate ICT in their teaching.
Teaching is becoming a new exciting career amongst my colleague.
Even during my absence the lesson can be presented.
No learner misses my lessons.
Parents who can't afford to take their kids to schools in town are excited for ICT at no extra cost.
LEARNER

Learners are excited to use their cellphones, digital cameras and other own equipment for learning.
Even lazy learners are now doing their activities and tasks effectively.
No learner misses my period.
Learners are requesting their educators to use computer in their teaching.
The rate of absenteeism is minimised because learning is exciting.
Our learners are ICT competitive.

Innovative teachers report that there is a slight change in how they are perceived by their colleagues. As an insider in the organisation they are viewed as being approachable and find themselves being daily consulted for guidance and assistance in the use of technology during teaching. An innovative teacher comments on their altered status below:

I find myself now as the go-to-person that is able to help other teachers with their technology questions and the practical bits of how to use it in the classroom. As a result of using these technologies in the classroom I find that I now have more authority and have gained the respect of my peers as well as my principal (UI,1).

This section looked at the concept of *self empowerment* as innovative teachers find that their status within communities is elevated. They also provide pedagogical leadership to their colleagues and engage with organisations outside their schools to engender educational change.

The next section presents the concept of *capacity building* as it emerged from the data. Innovative teachers are involved, both in their own schools and in the wider community, in training efforts to uplift teachers and introduce them to pedagogies concerned with incorporating 21st century skills.

6.3.2 Capacity building

This section reflects on the tendency of innovative teachers to become involved in initiating training events of both an informal and formal nature. Because innovative teachers are located *within* a particular community and well versed in the contextual challenges teachers in their region face, they use techniques that resonate with the participants in their workshops. The notion of tailoring training material concurs with Dottin's (2010) earlier findings. His study found that experts structured their knowledge in a way as to reflect the contexts in which it is to

be used. These teachers also hold mental models that allow them to transfer their knowledge across contexts, making them highly valued in their profession.

Increased access to technology is sometimes used as a *reward*, however, it can also be employed as an *incentive for change* as reported by one of the school principals participating in the project: *Teaching and learning from a distance.* In this project participating schools team teach sharing lessons in real time through connected whiteboards, video, audio and shared desktops. Even though this particular school principal does not currently have the required skills to adequately manage the new technology that was allocated to his school through private donors, he expresses his determination to improve his competencies through training. The school principal states:

I feel privileged to be managing in a school with this equipment. I feel challenged to upgrade my management skills to equate to the development. The equipment has scored a first in the history of this school where black and white learners can directly share resources. The project has changed the attitude of learners towards Maths and Science to change for the better. The level of discipline has gone up. The teachers' preparation has improved as the internet helps them to research beyond the textbook. The profile of the school has improved. We are expecting more learners to enrol into the school (Frans Kalp, VCT 2009).

- *The broadcasting of lessons from the different venues will contribute a lot in helping our learners to uplift the quality of our schoolwork. It also helps all our teachers to learn from others and it is of great help to share information and learning aids through the server.*

- *The project has proved most successful in bridging the urban-rural digital divide and a positive attitude has been created, especially in rural schools . . . being able to share quality teaching among the geographically dispersed classrooms has had a marked improvement in the quality of lesson content and teaching methodology.*

- *To our amazement, the majority of the educators grasped the use of the technology very quickly, simply because they were not using a mouse, but their finger, which feels more natural (Frans Kalp, VCT 2009).*
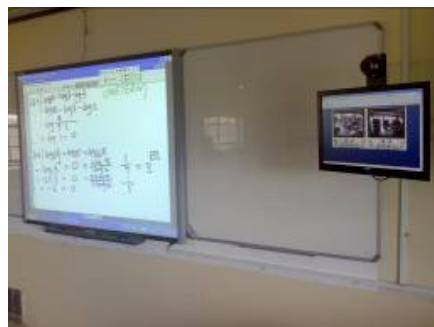

Figure 6-2: Classroom 27 km from Ligbron

The transfer of skills and capabilities are not only informally shared amongst staff members, but knowledge transfer from learners to teacher also occurs. Learners move from a subject area where they are engaged in learning with emerging technologies to a different subject area where teachers are not interested in changing their practice and cling to traditional methods of imparting knowledge. In such a case, learners slowly break down the barriers of these reluctant teachers as they share some of their ideas and practices in a non-threatening way. Learners tend to coach and inform their teachers of new developments in emerging technologies allowing for collaboration between learners and teachers in an informal way. In his project, *Local is lekker,* Thamsanqa Makhathini observed the growth in his learners and report their sharing of knowledge with other teachers. He writes:

I believe that the way they integrated ICT use and learning in general was one of the significant achievements that we can be proud of. My learners are now exploring the same strategies in other subjects which make me feel great that I opened another page in their learning environment (Thamsanqa Makhathini, VCT 2008).

During team teaching events, teachers transfer their skills through collaboration and thus get practical experience in methods to integrate ICT into their everyday practice. In the project *My community my pride*, Mfeka Hlengiwe shares the willingness of teachers from other schools to become involved in pooling their resources to the benefit of everyone. She relates her colleagues' growth through the project:

Several educators were involved and they claimed that they have learnt a lot from the project. Some of the educators have also suggested that this integration be extended even into their subjects. Teachers from other schools have shown interest and offered to help with other materials that will enhance our ability to use ICT in many other everyday activities.The members of the community that were involved also showed interest and were happy that indeed the school was part of the community and is affected as they are affected (Mfeka Hlengiwe, VCT 2009).

Disconfirming the concept of knowledge and skills transfer, some innovative teacher slow in recognising their own value to the organisation and could benefit from stronger leadership. Caren Roberson shares her insecurity as regards the intrinsic value of her own knowledge. Her insecurity should serve as a warning to schools that do not fully exploit the expertise of the innovative teachers in their midst. Caren Robinson explains:

"I am not sure that my knowledge of computers will be able to help you help others! But… I'm very willing to share – Caren Robertson.

Innovative teachers do not consciously create space for the involvement of other teachers in their projects. The hesitancy to get other teachers involved as co-learners early on in the conceptualisation phase of a project is evident form John Lanser's comments. He delays bringing other teachers on board until such time that he is confident in the design of his learning event and thereby denies his colleagues a learning opportunity.

The idea is to involve my colleagues in the creation of GIS projects, once I've ironed out most of the problems (John Lanser, VCT 2007).

Teachers progress faster through training or coaching that is tailored to their specific needs. Training can focus on reinforcing existing skills whilst building and increasing knowledge in small incremental steps so as not to overwhelm the participating teacher. The comment below made by an innovative teacher reflects:

Teachers come from such diversified subject areas & abilities and therefore within a school environment it is easier to tailor their training to their skill level. Mentoring is therefore much more personal and therefore more successful because you can cover practical examples of integrated ICT lessons related to their subject making it far more relevant to them (UI,2).

 Innovative teachers engage in training opportunities outside their immediate school environment. Their motivation is increasing the proficiency of other teachers and in this way affect education at large. In their classroom they feel that their reach of affecting change is limited to the learners in their care, however, if they train other teachers they may indirectly affect and change the life of every learner in the care of the teacher they have just trained. Innovative teacher Sadique Boateng from Ghana shares his passion for training teachers from other schools:

As a leader and a regional ICT coordinator, I have worked with many other teachers from other schools in developing their own skills and to teach with ICT in their various subject areas. As a believer in sharing of ideas and resources, by empowering students and teachers to use a range of tools and learning methodologies has in many ways changed how teaching and learning occurs. More especially teachers and students are able to access online communities and use learning pathways and are able to go in many directions with their teaching and learning. Showing other teachers what their colleagues had achieved inspired and motivated many more teachers to experiment and use similar technologies in their

classrooms. Consequently, I still have a backlog of teachers I have to run workshops for (Sadique Boateng, VCT 2009).

During one training session a particular teacher questioned the way in which all previous training was conducted and he expressed a wish for more change in the teacher development programs. Subsequent to attending his training session one of his colleagues John Adjei, a physics teacher, had this to say:

Sometimes I'm sitting at the computer and I just open up my learning package project and say to myself, "I did that!" In our other courses, we are expected to listen to lectures, write what the lecturer says, and remember it for the exam. One time I was interested in a topic. I did some extra research in the library and even went to an Internet cafe. But when I included that information on the exam, it was marked wrong. We should be encouraged to learn on our own, to go beyond the lecture, but instead the educational system discourages initiative (John Adjei in Sadique Boateng, VCT 2009) .

Innovative teachers also increasingly arrange training events for educators that are outside their own school environment. These teachers can be from the surrounding districts or from areas further afield. There are three distinctly different approaches to training which crystallised from this research. They are presented Table 6-4 below:

Table 6-4: Approaches to in-service training

Role of facilitator	Quotes from data as evidence to support claims
Learners develop training material and facilitate workshops during teacher training events.	*On Saturday morning, we had to train. I was extremely nervous because I did not know what to expect, but once the teachers arrived I felt much better knowing that I could really help an adult concerning computers. . . What a great experience! This was an amazingly enriching experience, getting to know how teachers feel about the use of computers in their everyday life. I am in great debt to the teacher I trained (Sarietjie Musgrave).*
Teachers, on their own volition, organise training events and act as facilitators. They actively source sponsorships to cover the cost of training events, resources, venue hire, transport and catering.	*Although what we do relies on sponsorships, there is a clamour for more of these and a kind of desperation in their lack of resources & training. It is for this reason that I wanted to share the work I have done (& continue to do) in training teachers (Gaye Pieterse).*
Innovative teachers are approached by training organisations to facilitate workshops that target teachers wanting to increase their ICT skills and the integration of technology into their subject areas.	*He's got a passion for computers, the trainings and workshops from Schoolnet keep him in touch with the latest trends in computer use in education (Murphy Mugabi).*

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| | |

Table 6-4 above reveals different approaches to conceptualising and delivering training to teachers in service. Contextual training materials are developed by volunteer teachers or learners facilitating in-service training sessions. Teachers are also approached to deliver in-service training on behalf of training organisations in which case the training materials already exist. The opportunity afforded innovative teachers to act as trainers and facilitators for organisations outside their schools, increases their awareness and exposure to further employment prospects.

Looking back on this section, the development of human capabilities to their fullest extent is of primary importance to innovative teachers. They seize every opportunity, whether formally structured events in their own school or structured workshops involving teachers from the neighbouring districts to provincial level. They develop training strategies in which they contextualise their examples thus ensuring a higher uptake of new practices. Innovative teachers also express a desire to shrink the current gap between teachers of formerly disadvantaged schools and their counterparts in better trained and resourced schools. One of their objectives is also to increase the stature of their own profession.

The next section reveals how teachers, because of their increased exposure and demonstrated skills, are increasingly valued in the organisations they serve and how they manage to chart their own development though selecting desired training opportunities.

6.3.3 Teachers chart their own development path

Innovative teachers enjoy the freedom to choose their own development path within their schools as they are highly valued by management and their school governing bodies. Because they are role models to colleagues, provide guidance and assistance on a regular basis to leadership in making decisions on ICT acquisition, they are afforded the opportunity to select training in their area of interest. Below is an extract from a Microsoft document profiling Sarietjie Musgrave as one of the previous national innovative winners.

Soon, Sarietjie was more than just the computer teacher and the school was integrating technology into the other courses on offer. She did her first Microsoft Partners in Learning ICT integration training course in 2003 through SchoolNet. This course is designed to help teachers organise, schedule and set exciting and stimulating lessons, while meeting the needs of the curriculum. "Microsoft, SchoolNet and Intel's training programmes have helped me widen my horizons, and their Peer Coaching training has taught me how to empower the teachers around me," she says. "The Partners in Learning training has helped in developing the teachers around me – and the initiative is just growing because of its impact of networking with other colleagues from all over the country." Sarietjie encourages other teachers to reach out and grab the opportunities presented by these courses, to take it further and to get their fellow schools and teachers involved (MicrosoftSA, 2009, online).

This section looked at how the innovative teachers provide pedagogical leadership to their colleagues and engage with training organisations outside of the school environment. Their interest in developing human capabilities through formal and informal occasions to bring about personal growth, leads to an increased sense of self empowerment.

Moving on to the next section, also the last theme to emerge from the analysed and interpreted data, the core category *responsive governance* is presented with the expanded sub themes.

Table 6-5: *Responsive governance* **as emerging core category with expanded theme** *organisational change* **highlighted for discussion**

AXIAL CODING (categories clustered in sub themes)	SELECTIVE CODING (Emerging themes derived from sub themes)	CORE CATEGORY
Self empowerment	Skills transfer	Responsive governance
Self development path		
Capacity building		
Hierarchal movement (*cf*. Section 6.4.1)	**Organisational change (*cf*. Section 6.4)**	
Incentives for change (*cf*. Section 6.4.2)		
Lobby for change (*cf*. Section 6.4.3)		
	Leave teaching	

The next section will present the last theme to emerge from the core category *responsive governance*. The remaining theme *organisational change* consists of the sub themes *hierarchal movement*, *incentives for growth* and how innovative teachers *lobby for change* in their schools. Each of these as displayed in Table 6-5 above will be discussed in greater detail (*cf*. Sections 6.4.1 - 6.4.3).

6.4   ORGANISATIONAL CHANGE

Organisations such as schools cluster people together to accomplish a shared vision. Within a dynamic structure such as a school, people need to be managed effectively to reach their full potential and at the same time improve the performance of the organisation. The premise of organisational learning and change is rooted in Peter Senge's (1990) systems thinking model and comprises five core disciplines as presented in Figure 6-3 below.
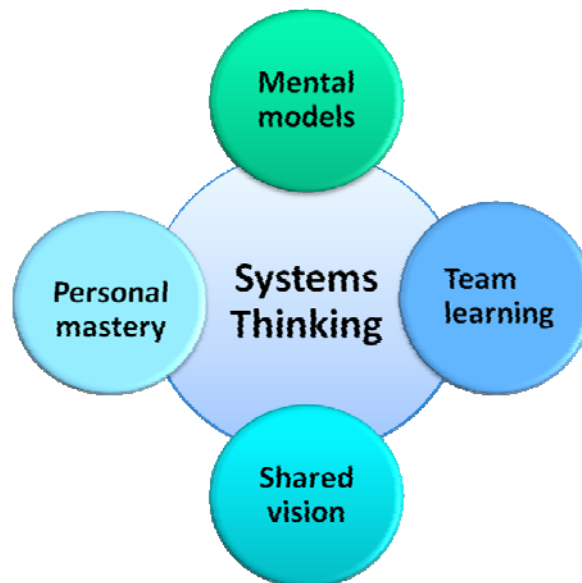

Figure 6-3: Senge's disciplines of systems thinking

Systems thinking lies at the heart of organisational learning, whilst personal mastery, mental models, team learning and shared vision all contribute to keep a system healthy. Systems theory considers the way in which the different parts of the system relate to each other. How these parts are organised and interact determines the properties of the system (Senge, 1990). Innovative

teachers function within an open system where they are able to respond to pressures from within their own school environment but where they can also be influenced by factors outside the school. Each element of the systems thinking model is described and then related to innovative teachers and their actions within a school as organisation in Table 6-6 below.

Table 6-6: The core disciplines of systems thinking applied to innovative teachers and their schools

Core discipline	Short description	How it applies to innovative teachers
Personal mastery	Personal mastery is the process of continually refreshing your own skills and pursuing areas of interest with an increasingly deeper understanding. Concurrently self esteem develops and the confidence and willingness to take risks and explore life experiences.	Innovative teachers constantly renew their skills and challenge their boundaries as they explore emerging technologies in their practice. The tacit knowledge which they develop is tested through trial and error.
Mental models	Each individual holds deep beliefs and attitudes that are ingrained in their world view. Individuals' actions are guided by these mental models and shape the decisions and responses to events.	Innovative teachers' mental models are dynamic and constantly change as they continue with exploration and generative learning. Their tacit knowledge needs to be articulated and disseminated so that it can be more accessible to other team members.
Shared visions	When everyone in an organisation is aware of and understands the current vision and future strategy and the responsibility of aligning their personal goals, it contributes to the overall success of the organisation.	By sharing their own goals with other teachers and governance it allows for growth changed by others' insight.
Team learning	Teams are safe environments in which to share experiences, question, reflect and address problem areas and vehicles through which to receive feedback. With team learning, the learning ability of the group becomes greater than the learning ability of any individual in the group. Being a contributing member of a learning team is fundamental to a professional learning organisation.	Innovative teachers initially function in their individual capacity where they action change within their immediate teaching and learning environment. However, they are very quick to engage with their colleagues and form teams to coach, mentor and collaborate with.
Systems thinking	*Systems thinking* ties all the other disciplines together and is described as the key component. The strength of an organisation is in how well these individual components are managed as	Strong leadership is required from governing structures to fully utilise the potential of innovative teachers as a valuable team member.

Core discipline	Short description	How it applies to innovative teachers
	the strength lies in the interrelationships rather than in the isolated parts.	

Organisational learning, which aims to bring about change, relies on tangible events and actions that are implemented step by step. These changes can be in the form of new infrastructure or technologies, new management methods and ideas around new pedagogies. Maintaining the change momentum, teachers develop an enduring capacity and appetite to refresh themselves and their practice and with continued support the school and governing structures are rewarded through commitment and innovation from their staff.
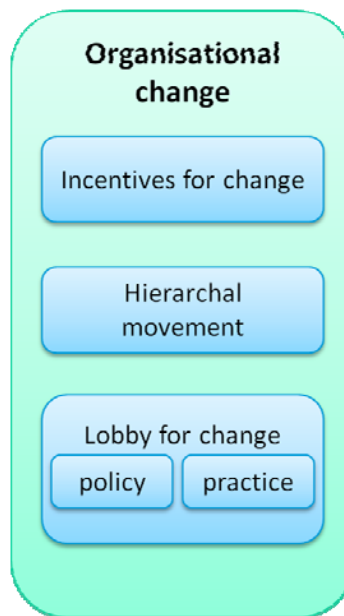

Figure 6-4: Expanded emerging theme: Organisational change

The next section describes the movement of innovative teachers within the organisational structures once they have been identified and recognised in the annual Innovative Teachers Forum Award competition *(cf.* Sections 6.4.1 – 6.4.3).

6.4.1 Hierarchal movement

This section will look at the tendency of innovative teachers to move up in the organisational school structure into positions of more authority. Professional learning communities, such as schools, are rigidly structured along hierarchical patterns. Subject areas are clustered together and are comprised of junior members of staff, who are usually responsible for overseeing the younger learners in lower grades, and senior teachers, who are allocated higher grades and are held accountable for maintaining exit levels though motivating their learners and maintaining the school's academic standard. Heads of subject areas oversee and coordinate the various members of staff within their team. Principals act in a more administrative capacity and can elect to teach a subject of their choice if they wish to do so. Deputy Principals assist in matters such as learner behaviour and are expected to teach a few lessons. One teacher that falls outside the normal hierarchical structure is the computer science teacher. Apart from teaching the specialist subject area of computer science, this teacher is often tasked with the additional duty of maintaining the technology framework within the school without any technical staff to assist. Andrew Moore, a former teacher facilitating innovative teacher workshops, shares his prior teaching history:

I had a growth spurt by doing my masters. It is kind of a fuzzy attitude - I did my masters and did little tasks and then thought "this is really useful" – it changed my teaching. I went from a very good history teacher to a very poor ICT teacher. It was very strange; I was struggling to master the basics in the subject. It was not satisfying. I knew there was something better and I moved on. I don't always get that anymore - that spark (Andrew Moore, WS 2008).

Teachers who are knowledgeable about technology and specifically how to integrate it into their subject areas, are highly valued staff members. These teachers often find themselves moved from their original position as subject teacher to areas with higher authority and more responsibility as documented by the innovative teacher Frans Kalp. He explains how his role within his school changed over the past few years:

My role as Technology coordinator was a natural progression from teacher in Electronics to a full time project coordinator and server administrator. My role as Technology coordinator is to sustain the high level of technology in our school and to upgrade every classroom to a classroom of the future (Frans Kalp, VCT 2009).

Task differentiation results in an increased workload for teachers who remain in their classes but who gain additional duties including initiating programs to support their colleagues with

integrating technology into their practice. Moving innovative teachers out of the classroom and the subject areas they originally taught can result in a loss of future innovative initiatives from these teachers. The dynamic partnership that exists between learners and teachers in their engagement through explorative learning, fuels the innovation process. To remove the teacher from the classroom environment results in the death of the partnership. Innovative teachers that have moved out of their classrooms to assist in managing technology or its integration, report a loss of enthusiasm for teaching as they miss learner interaction and the dynamic generative learning environment.

As teachers we recast ourselves. Our new skill set brings along new responsibility towards colleagues in the schools setup but at the same time it allows for less time in exploring new ways of learning. Even though I am finding that I am helping loads of other teachers get more comfortable and confident in their new skills, I find myself stagnating and not developing any new skills because I am too busy helping others. For the moment the reward for helping other teachers is still enough but there will come a time when I will need another challenge to keep me going (UI,2).

Apart from dealing with an increased workload, the added responsibility of developing and facilitating in-service training, innovative teachers also act within an advisory capacity to school leadership. An interview participant reveals:

I was invited to serve on the school IT committee planning in-service training events and advising on the acquisition of IT equipment and software purchases (UI,1).

Teachers that are innovative in their own learning area become responsible for other areas of the school organisation. Their access to structures of governance and recognised increased capabilities allow them to lobby for greater change in policies and practice.

6.4.2 Incentives for change

Various mechanisms are employed to coerce teachers into training opportunities to keep abreast of developments in their fields. Innovative teachers, however, lead the change on organisational level affecting policy and practice within their particular schools. They cite mainly intrinsic factors that keep motivating them to innovate; however, they do recognise additional incentives as playing a role as well. Tangible rewards, such as professional recognition and favourable professional assessment, contribute significantly to their continued efforts.

As a result of participating in this competition, our project has featured in the local papers and I have been approached by other schools to come and do presentations. My principal has also asked me to help with their technology strategy and I have been rated very high this year on my own assessment resulting in a salary raise. I am thrilled with all the attention my project has received and will definitely enter again next year (UI,7).

Rewarding innovation through tangible or intangible incentives to aid organisational change is consistent with findings in research conducted by Roberts. She states: "Possible incentives can include release time, stipends, mini-grants, teaching with technology awards, upgrades to current hardware or software, travel to conferences to present work, or support for publications that showcase technology adoption" (Roberts, 2008, p. 8).

6.4.3 Lobby for change

Innovative teachers engage with their leadership in an effort to influence policy. The area in which they are the most successful thus far is in making special arrangements to allow for the use of mobile phones in the classroom for teaching and learning. Most school in South Africa banned these devices citing reasons such as learner safety and misuse during lessons. Teachers, being well aware of the reticence of school principals, nevertheless approached them with the requests for more lenience. Thamsanqa Makhatini relates how he went about gaining permission from his principal and how his tenacity paid off with the management team more willing to allow other initiative in the future. He stated:

In my school, cell phones are not allowed at all. But for this project, it was supposed to be an exceptional case. I had to get permission for my class to bring and use cell phones during my class. The school management team (of which I am part of) was not very pleased at all. However, I explained the importance of the lesson using available technology to teach in an exciting way. They gave me a green light. I was happy that even the school management team alluded to the fact that technology is here to stay (Thamsanqa Makhathini, VCT 2008).

Annie Behari relates how she had to gain permission from her school principal as well as the learners' parents before being allowed to use mobile phones for teaching. The approach to lobby for change in policy manifests and is consistent across the dataset. She explains below:

At my school cell phones are not allowed because of the negative publicity. (Please note I asked permission from my principal as well as the parent to teach this lesson.) I taught my pupils to use cell phones in an educational way. I am glad to report that I had no discipline problems (Annie Behari, VCT 2009).

Requests to leadership is not limited to allowing mobile devices to be permissible for use in the classroom, teachers also request more resources to be allocated to their areas as Murphy Mugabi explains:

I will make a requisition to the school principal so that we can buy some software for our learners to use during project based learning. Because all the software we used in this project were trial versions and had so many limitations (Murphy Mugabi, VCT 2007).

Areas of additional influence stretch all the way to the top as this participant found herself being consulted by her principal:

I am also consulted by leadership. My principal has lots of questions and in that way I can influence their decision making (UI,5).

Linda Bradfield shares her vision for the future and identifies areas needing improvement. She also makes recommendations regarding the acquisition of additional resources in the form of technology hardware. She relates the gist of her conversation with the IT director:

Since coming back from The Pan African Event, I have had many meetings with our school IT Director. He has been very interested and supportive of my ideas. Within the next 2 years I would like to introduce Microsoft Multi-Point server, or the equivalent, in each of the Grade 1 and 2 classrooms thus allowing group projects to take place on a more regular basis (Linda Bradfield winner of the Pan African collaboration award, 2010).

This section considered innovative teachers and their interactions within their schools to affect organisational change. They tend to move higher up in the organisational structures of the school with additional duties and tasked with staff development programs relating to the use of ICT in the classroom. They actively lobby management structures to amend policy and their changed practice is used as a model for new initiatives.

The next section will look at teachers that leave their teaching posts when they redefine their personal goals.

6.5   TEACHERS LEAVE

The reasons that teachers leave the profession are well documented in literature. However, not much is known as to the reasons why innovative teachers leave their current positions other than Novotný's (2003) earlier research. He documented case studies of identified innovative teachers

within the Czech Republic. He articulates the frustration many teachers experience with the slow pace of change in school culture and mention five different outcomes are as teachers tend to:

- Resign and escape from teaching.

- Stay at school and actively engage to modify the system.

- Some withdraw into their classrooms.

- Some are promoted to head-teachers and

- Some become strongholds of in-service training.

Within two years after being selected as a finalist in the Microsoft Innovative Teachers Award competition, innovative teachers tend to leave their particular school. Their elevated status and increased confidence levels motivates them to seek out better opportunities for themselves. They either move to a different school as a promotion or leave teaching altogether. The teachers electing to leave teaching choose a career path that allows them to remain within the educational profession. They are approached by organisations that are involved with pre-service and in-service teacher training programs. Innovative teachers pursue positions where they affect greater change in education. The findings pertaining to teachers leaving is consistent with the comments below:

Another instance involves a highly qualified teacher that was moved from a regular academic subject to teaching the subject of ICT because of knowledge of ICT integration into his subject area. Subsequently, even though he was very competent and innovative in his use of technology in the previous subject he felt stifled in the new curriculum as he lacked the content knowledge to safeguard his exploration of the curriculum boundaries. If I use ICT in the class, I will get promoted. If I use it well, I will get head-hunted out of education. That is my ultimate aim (UI,4).

It is thus evident that teachers leave to elevate or improve themselves or their conditions. The following section makes known how the emerging themes for this chapter combine and shape the final core category *responsive governance*.

6.6 RESPONSIVE GOVERNANCE

This section reflect on the previously mentioned themes of *skills transfer* and *organisational change* and how the innovative teachers need to be managed by governing structures within a school to capitalise on the change agent in their midst. As an overview to this section Figure 6-5: Building theory: *Responsive Governance* as emerging core category with expanded themes is presented below.
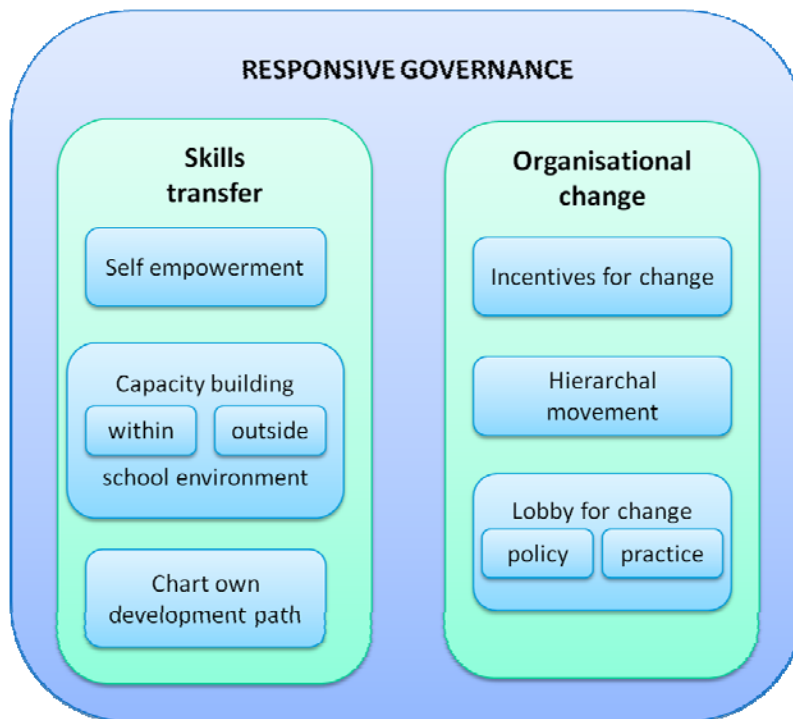

Figure 6-5: Building theory: *Responsive Governance* as emerging core category with expanded themes

The value of innovative teachers to their schools lies in their ability to be innovative and engage with emerging technologies in amending their pedagogical practices despite the numerous limitations they might face. The confines of contexts cannot be underestimated and the relevance of their solutions carry more value as they are able to contextualise training and tailor it to the needs of each individual teacher rather than an outsider coming in to engage in in-service training. These teachers are intimately familiar with the teaching conditions, the abilities of their learners and their own school culture.

Innovative teachers function not only as innovators within their own teaching and learning spaces, but are part of a larger learning system. Their personal visions and mental models are accommodated into the organisation, resulting in organisational change.

School governance structures should take note of the following guidelines put forward by Tidd, Bessant and Pavitt (1997) in Table 6-7 below. Even though the list was originally drawn up more than a decade ago and focused on large organisations, the relevance to organisational leadership is persistent. Components such as vision, the will to innovate, structuring effective teams with the focus on individual development and the cultivation of a creative climate put forward and later supported by Nijhof, Krappendam and Looise (2002) as areas requiring strong leadership.

Table 6-7: Components of the innovative organisation (Tidd, et al., 1997)

Component	Key Features
Vision, leadership and the will to innovate	Clearly articulating a shared sense of purpose with strategic intent and management commitment.
Appropriate structure	Finding the balance between organic and mechanistic options in designing for contingencies.
Key individuals	Champions, gatekeepers and other roles which can energize or facilitate innovation.
Effective team work	Appropriate use of teams requires investment in team selection and building.
Continuing individual development	Long term commitment to training to ensure high levels of competence and the skills to learn effectively.
Extensive communication	Internally in three directions: upwards, downwards and laterally. Within and between external organisations and external parties.
High involvement in innovation	Participation in organisation-wide continuous improvement activity.
Focus on the learning	Internal and external customer focus – a total quality culture.
Creative climate	Positive approach to creative ideas, supported by relevant reward systems.
Learning organisation	Processes, structures and cultures which help institutionalise individual learning.

Schools are very similar in their hierarchical structures and tend to be very stagnant. For the innovative teacher to be accommodated within the structures of the organisation, a unique position tends to be created. The teacher is moved out of the classroom and tasked to formalise

tacit knowledge and mental models on technology integration and generative learning into learning objects, artefacts and training sessions in order to support staff development and growth. The key is to first recognise and then reassign innovative teachers to bring about organisational change. However, innovative teachers can become overburdened in the process and Novotný, sounds a note of warning to school leadership highlighting the vulnerability of innovative teachers:

"Those who implement innovations are often under heavy pressure from their environment. This is especially alarming with those who simultaneously undergo a transition on their own, of their behaviour and their working conduct. They often have to combat their own doubts and with the resistance of the system. The demands they impose upon themselves may become too extensive" (Novotný, 2003, p. 4).

Governing Body and Leadership of the school encourages creativity and innovation that will benefit the learners (Fiona Beal, VCT 2010).

Hanrahan, Ryan and Duncan (2001) caution against the formalisation of spontaneous in-service learning into institutional agendas as they found the outcomes to be unspecified and hard to measure. This results in a lack of enthusiasm from staff involved in the process and further influences the success of future training events. It therefore comes as no surprise that Sullivan and Glanz (2006) found some evidence that school leadership is, in some cases, reluctant to change in response to innovative teachers being in their midst and that they also lack the vision to strategise their deployment outside their own subject areas. The following statement was made by a workshop participant:

Integration of innovative teachers into the schools is sometimes problematic. Because they are taken out of the classroom to assist other staff in integrating ICT in to their lessons, their direct colleagues experience an amount of pressure due to additional classes that have to be picked up(IC,89)

Responsive governance is all about carefully managing the expectations of innovative teachers and how to best employ their highly valued skills to bring about organisational change. At the same time a shared vision for the school must be clearly communicated and each staff member needs reassurance as to their own inherent value to the organisation:

Hernández-Ramos states that "…when the reform involves technology, we now know that the true possibilities for transformation come not from the technologies themselves but from the

deep changes in school organisation and in teacher's beliefs and pedagogical practices that the introduction of technology may catalyse" (Hernández-Ramos, 2005, p. 51).

6.7 SUMMARY

This chapter on the ecosphere revealed *responsive governance* as the core category to emerge from analysed data considering innovative teachers' use of emerging technologies in their practice. Data were analysed using various instruments as illustrated in Table 3-4 on page 92. The themes *skills transfer* and *organisational change* were presented with their expanded sub themes in quotes from participants and in the researcher's reflective comments.

The final chapter concludes with the researcher's reflections and recommendations for future research.
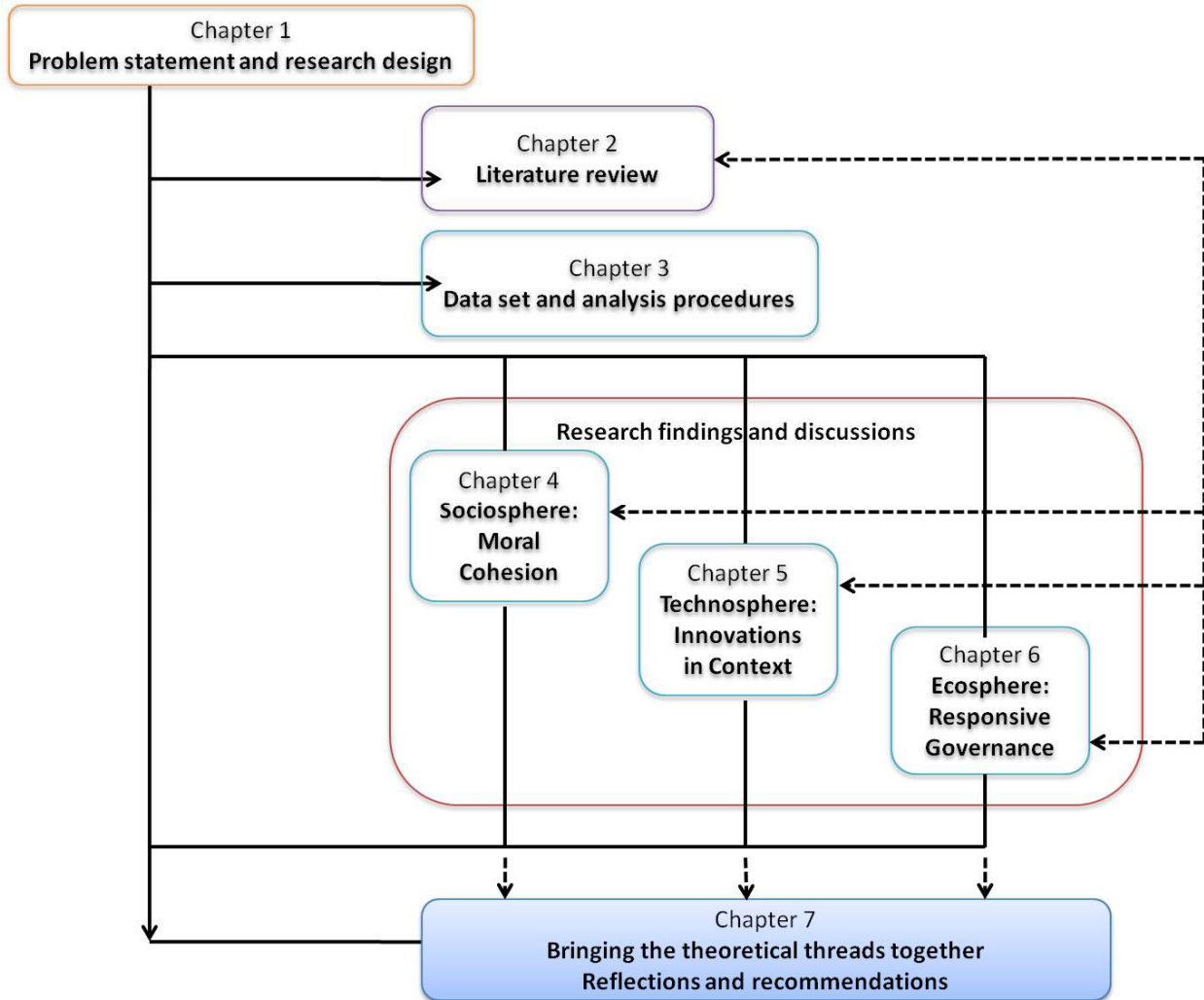
CHAPTER 7. CONCLUSIONS AND REFLECTIONS

If educational theory goes beyond its proper limits,
if it pretends to supplant experience,
to promulgate ready-made formulae that are then applied mechanically,
it degenerates into dead matter.
If, on the other hand, experience disregards pedagogical thinking,
it in turn degenerates into blind routine
or else is at the mercy of ill-informed or unsystematic thinking.

Emile Durkheim (2002)

7.1   INTRODUCTION

The aim of this chapter is to provide a synopsis of the research by revisiting the research questions and subsequently presenting the developed substantive theory.   This investigation pursued a Grounded Theory Method of exploring innovative teachers' pedagogical efficacy in their use of emerging technologies. Contained in this chapter are methodological and personal reflections that influenced this study as well as a critical account of the quality of the research. The chapter concludes with recommendations for further research.

The next section provides an overview of the research study by outlining the main events in each chapter.

7.2   RESEARCH PRESENTATION

The essence of each chapter is presented below:

Chapter 1 provided the background and research purpose which culminated in phrasing the main and subsidiary research questions. This interpretive study followed a qualitative research design with an inductive approach. The Grounded Theory Method was used to collect and analyse data. The study development phases were illustrated in Figure 1-9 and ethical considerations were explained.

Chapter 2 considered the body of literature to sensitize the researcher and the reader towards the main contributors in this field and their perspectives so that they could be revisited later in the study in a process of constant comparative analysis.   Due to the complexity of learning environments a framework was constructed to situate the research within boundaries. Gardiner's model, which consists of three overlapping spheres namely the *ecosphere*, the *sociosphere* and the *technosphere,* was found to be the most appropriate choice when contemplating how innovative teachers conceptualize innovation and pedagogical efficacy.

Chapter 3 presented details of the research process by providing the rationale for selecting the Straussian Grounded Theory Method for gathering data and analysing data. Data gathering considerations as pertaining to the sampling process were discussed and actual data gathering instruments were employed in the research. The key analytical strategies which were used in the

systematic coding process along with the subsequent concept development were covered. Practical guidelines for data handling, as proposed by Coyne (2009), were followed.   Finally, the emerging core categories with their expanded themes and a map of the research findings were presented.

Chapter 4 offered the findings from the *sociosphere* which primarily considered the complex character of innovative teachers' use of emerging technology in social settings, such as schools. The core category *moral cohesion* emerged from the engagement with data and contributions from literature were taken into consideration. The supporting themes *professional burden* and *teacher as bricoleur* were expanded upon. The key drivers in this sphere were found to be *African renaissance* and *teacher disposition*.

Chapter 5 focused on the second sub-research question which attended to the pedagogical shift within the *technosphere*. The core category *innovation negotiations in context* which encapsulates the themes *innovation strategy*, *technology implications* and *reflexive pedagogy* was expanded upon and discussed.

Chapter 6 presented the findings of the last sub-research question concerned with the ecosphere. S*kills transfer* and *organisational change* emerged as themes and tie in together with *responsive governance* as the core category in this chapter.

Chapter 7 concludes the research endeavour with the presentation of the substantive theory constructed from findings as reported in chapters 4, 5 and 6 and is presented as a series of illustrations. The researcher reflects upon aspects of methodology and identifies possible areas for future research.

This study was divided into phases (*cf.* Figure 7.1) in order to manage and keep track of progress and to maintain a steady pace towards developing a substantive theory on innovative teachers' pedagogical efficacy in their use of emerging technologies.
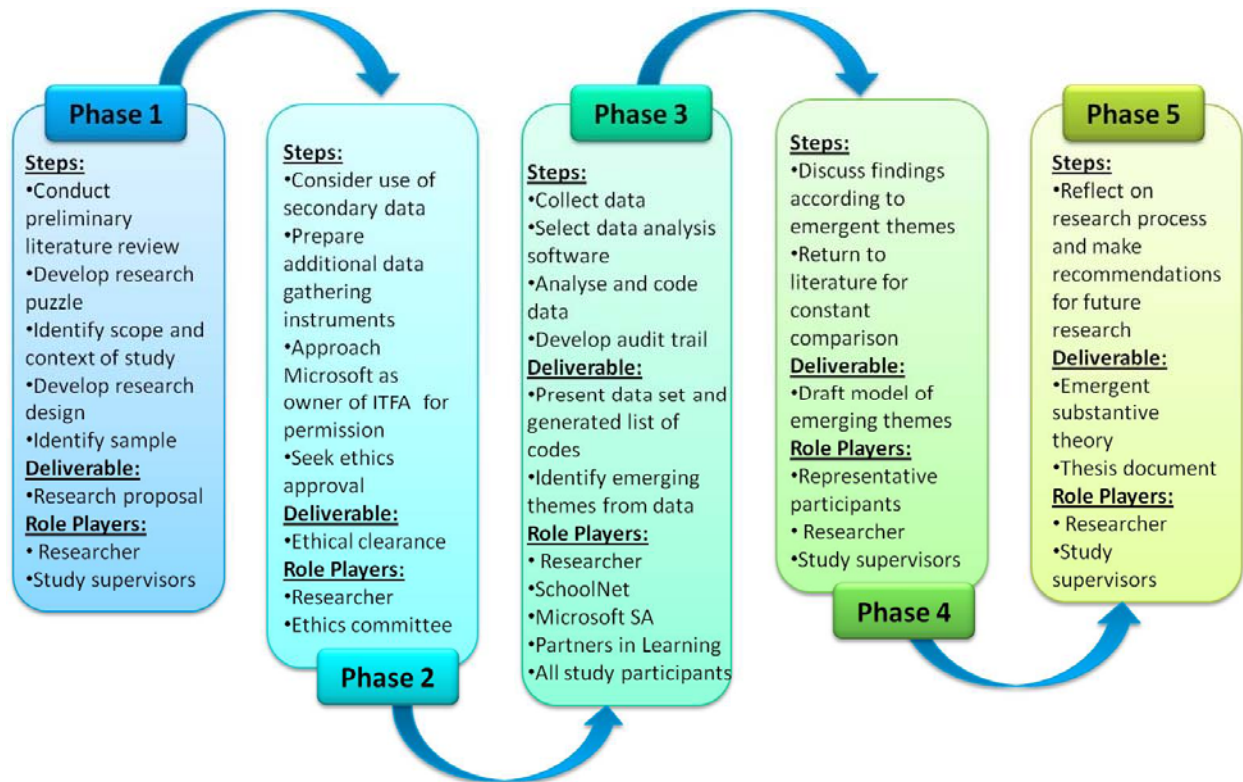
Phase 1

Steps:
•Conduct preliminary literature review
•Develop research puzzle
•Identify scope and context of study
•Develop research design
•Identify sample
Deliverable:
•Research proposal
Role Players:
• Researcher
•Study supervisors

Steps:
•Consider use of secondary data
•Prepare additional data gathering instruments
•Approach Microsoft as owner of ITFA for permission
•Seek ethics approval
Deliverable:
•Ethical clearance
Role Players:
•Researcher
•Ethics committee

Phase 2

Phase 3

Steps:
•Collect data
•Select data analysis software
•Analyse and code data
•Develop audit trail
Deliverable:
•Present data set and generated list of codes
•Identify emerging themes from data
Role Players:
• Researcher
•SchoolNet
•Microsoft SA
•Partners in Learning
•All study participants

Steps:
•Discuss findings according to emergent themes
•Return to literature for constant comparison
Deliverable:
•Draft model of emerging themes
Role Players:
•Representative participants
• Researcher
•Study supervisors

Phase 4

Phase 5

Steps:
•Reflect on research process and make recommendations for future research
Deliverable:
•Emergent substantive theory
•Thesis document
Role Players:
• Researcher
•Study supervisors

Figure 7-1: Research phases revisited

In retrospect, each phase proceeded as planned; however, phases 3 and 4 should ideally be divided into subsections to better reflect the prolonged period spent in analysing and interpreting data and the conceptualisation of the emergent theory.

The next section revisits the main findings and presents the substantive theory to emerge from the dataset and related literature.

7.3   NEW INSIGHTS: THEORY DEVELOPMENT

This section will first consider the core categories that emerged from each sphere as discussed in chapters 4, 5 and 6 before culminating in the presentation of the substantive theory which encapsulates the innovative teachers' pedagogical efficacy in their use of emerging technologies. This research study applied the Straussian Grounded Theory Method in gathering and analyzing data in accordance with the fundamental principles for conducting interpretive research as set out by Klein and Meyers (1999) and reflected in Table 1-3 on page 38.   A conceptual framework was constructed to contain the research based on Gardiner's model called *the three interfaces of*

Adam (Zandvliet & Buker, 2003) which consists of three overlapping spheres named the *sociosphere, technosphere* and the *ecosphere.* Central to this model is the suggestion that people generally deal with three dimensions in their existence namely: other people in their social world or *sociosphere;* the man-made artificial world or the *technosphere* and the natural world or the *ecosphere.*

Innovative teachers, located at the centre of these spheres, are subjected to all three influences and the research findings are presented according to each of the spheres in the sections below before culminating in the substantive theory.

7.3.1 Summary of findings: Sociosphere

The *sociosphere* encapsulated the innovative teacher within specific educational context and explored influences that guide their decisions and actions as members of a larger community.

The sub research question that guided research in this section was:

> RQ1: What role does moral cohesion play within the sociosphere of the innovative teacher?

The construct *moral cohesion* (*cf.* Figure 4-9) supports the notion of an interconnected society with innovative teachers acting as stewards of their communities. They apply their knowledge of new technology to harvest knowledge from members of their community and contribute their ideas and solutions to better the lives of the learners in their care. In addition to the ideas which emerged from the analysis of the dataset and subsequent to engaging with related literature, the concept of indigenous knowledge systems serve as a strong influence on stewardship. Knowledge gained from community experts guide innovative teachers and learners to make sense of the particular value they are capable of adding, through their more modern approach, to solve community problems. Innovative teachers also align themselves with the ideals of the African renaissance as reflected in policy documents and continue to find unique ways to harness resources such as emerging technologies to uplift and enlighten management, colleagues and learners whilst expanding their horizons.

Some uncertainty and additional considerations as to the use of technologies emerged within the theme *professional burden* as there is a distinct lack of appropriate guidelines to govern and direct the actions of both teachers and learners. Innovative teachers respond by setting their own generic guidelines which they clearly communicate to their learners in order to accommodate their changed practice. In the design of learning events, innovative teachers rely on their own repertoire of skills which emanate from a wide area of interest, not all of which are related to their duties as a teacher. Innovative teachers seize seemingly serendipitous exposure to training events, not all of which are related to the use of ICT in the classroom but also relate to areas of personal interest. The concept of *teacher as bricoleur* is an apt way to describe the dexterity with which teachers manipulate their skills when designing and executing learning events wherein emerging technologies are incorporated. The research also revealed the tendency of innovative teachers to hold strong personal convictions regarding personal fulfilment and the need to continually refresh oneself. These findings are substantiated with instances from literature.

This section revealed that innovative teachers' moral cohesion is dependent on their perception of the professional burden they carry as well as their multivariate skills. The concept of the teacher as bricoleur alludes to the educator using *whatever means* and *whatever is at hand* to equip learners with the skills required to make them contributing members of their community and the information society.

7.3.2 Summary of findings: Technosphere

In this study, the *technosphere* considered the pedagogical strategies which innovative teachers employ and how they continue to harness the increased capabilities of new technological tools available to them and their learners within their teaching and learning spaces. The sub research question for this section was:

> RQ2:   How do teachers negotiate innovation within the technosphere context?

The unequal distribution of technology resources in schools across South Africa, and also within different subject areas in the same school, increases the resourcefulness of innovative teachers to harness the full potential of the technology at their disposal. This technology can be the personal

property of the educator or in the hands of the learners. When attempting to manage learner expectations during innovative teaching events and projects, teachers have to pay close attention to the learner's workload to ensure that tasks are distributed fairly amongst group members. They need to step in to prevent project fatigue that can result in the learners losing interest and enthusiasm for future projects. It was noted that learner disposition was heavily influenced by social contexts and learning attitudes. Values, associated with new knowledge, develop in response to finding solutions to a situated problem. Learners became progressively empowered as projects unfolded and they acquired ICT skills which stretched beyond the scope of their specific tasks, awakening their initiative to explore and implement their own preferred outcomes. Said learners expressed the inclination to work on areas that interested them and they engaged in peer coaching and mentoring learners with weaker skills which resulted in a high level of skills transfer within group work. Learners also enjoyed the relative flexibility within the innovative teaching and learning environment and were gratified that their efforts were appreciated and validated by the community. Learners professed themselves to be far more socially conscious as their projects drew to a close.

Aspects of *pedagogical reflexivity* touched on aspects related to the curriculum where the rapid advance in technology and the multitude of devices with differing capabilities require continuous pedagogical renewal to ensure the currency of learning strategies. Examples were presented where teachers engaged with their learners in an effort to address the lack of suitable content by developing their own culturally sensitive learning resources within context. Due to the unprecedented initiatives and the eventualities teachers have to deal with when they engage in innovative activities, research revealed their strategy of dealing with changes. They tackled teaching practice changes in small incremental steps whilst applying their new tacit knowledge. Teachers described existing assessment instruments as inadequate and added that they could not do justice to the new knowledge manifested by learners. They therefore suggest that new instruments be developed in collaboration with learners with more emphasis on formative assessment strategies.

This section considered the way in which innovative teachers negotiate activities in collaboration with learners involved in the innovation process. Strategies for the constant renewal of pedagogical practices and the need for reflexivity included the appropriation of learners'

personal devices for learning where the disposition of learners had to be managed in accordance with their various capabilities. The unprecedented innovation initiatives resulted in the reconceptualising of assessment protocol as existing instruments were deemed to be inadequate to accurately measure learner engagement.

7.3.3 Summary of findings: Ecosphere

The *ecosphere* demarcates the learning surroundings within a school ecosystem. The tendency of innovative teachers to exploit technology in their learning environment affects organisational systems and requires responsive governance to aid organisational change.

> RQ3:   How do structures of governance respond to the innovative teacher within their ecosphere?

Innovative teachers are powerful *change agents* within a school environment and management needs to act in a progressive manner to utilise their skills to the full benefit of the organisation. In this regard a certain amount of freedom should be offered to innovative teachers to further explore their own practice whilst at the same time they should be tasked with additional responsibilities in growing organisational capabilities. Innovative teachers find themselves moving up in the hierarchical management structures of the organisation and various incentives are offered for them to keep abreast of new developments in their field. Besides empowering their colleagues through informal contact and support, they are required to formalise skills transfer in developing in-service training materials and to act as facilitators during training events. Innovative teachers used their increased status and power within the organisation to actively lobby for policy changes through participating in advisory committees and assisting in the drafting of documents that hold strategic, ethical and practical implications for the exploitation of emerging technologies within the organisation.

This section considered innovative teachers and their interactions within their schools to affect organisational change. With increased exposure to and involvement with organisations outside of the school environment and increased levels of self-assurance, innovative teachers tend to leave their academic positions to pursue other more promising employment opportunities. The

following section describes the construction of the substantive theory as a result of engagement in this research endeavour.

7.3.4 Construction of the substantive theory

Each of the chapters concerned with reporting the findings contributed visual illustrations that informed the formation of the final substantive theory. In Chapter 4 (*cf.* Figure 4-10) the interrelationship diagram identified the sub themes *African renaissance* and *teacher disposition* as the key driving forces manifesting in increased *stewardship,* whilst teachers grapple with *ethical concerns.* These sub themes are valid representation of the *moral cohesion* of innovative teachers in their engagement within their sociosphere.

Within the context of the technosphere, as fully discussed in Chapter 5, the figure which pertains to the *innovation negotiations in context* was the model of exploration learning (*cf.* Figure 5-6) as taken from *innovation strategy* (*cf.* Section 5.4). The remaining illustration from the ecosphere, representing *responsive governance,* was taken from *organisational change* (*cf.* Section 6.4) and reflects the 5 core disciples of systems thinking found at the heart of organisational learning. Figure 7-2 below presents a synopsis of illustrations pertinent to the research findings.

The visual map of building substantive theory is depicted in Figure 7-3 as presented individually in chapters 4 (*cf.* Figure 4-9: Building theory: *Moral cohesion* as emerging core category with expanded themes), Chapter 5 (*cf.* Figure 5-10: Building theory: *Innovation in Context* as emerging core category with expanded themes) and Chapter 6 (*cf.* Figure 6-5: Building theory: *Responsive Governance* as emerging core category with expanded themes).
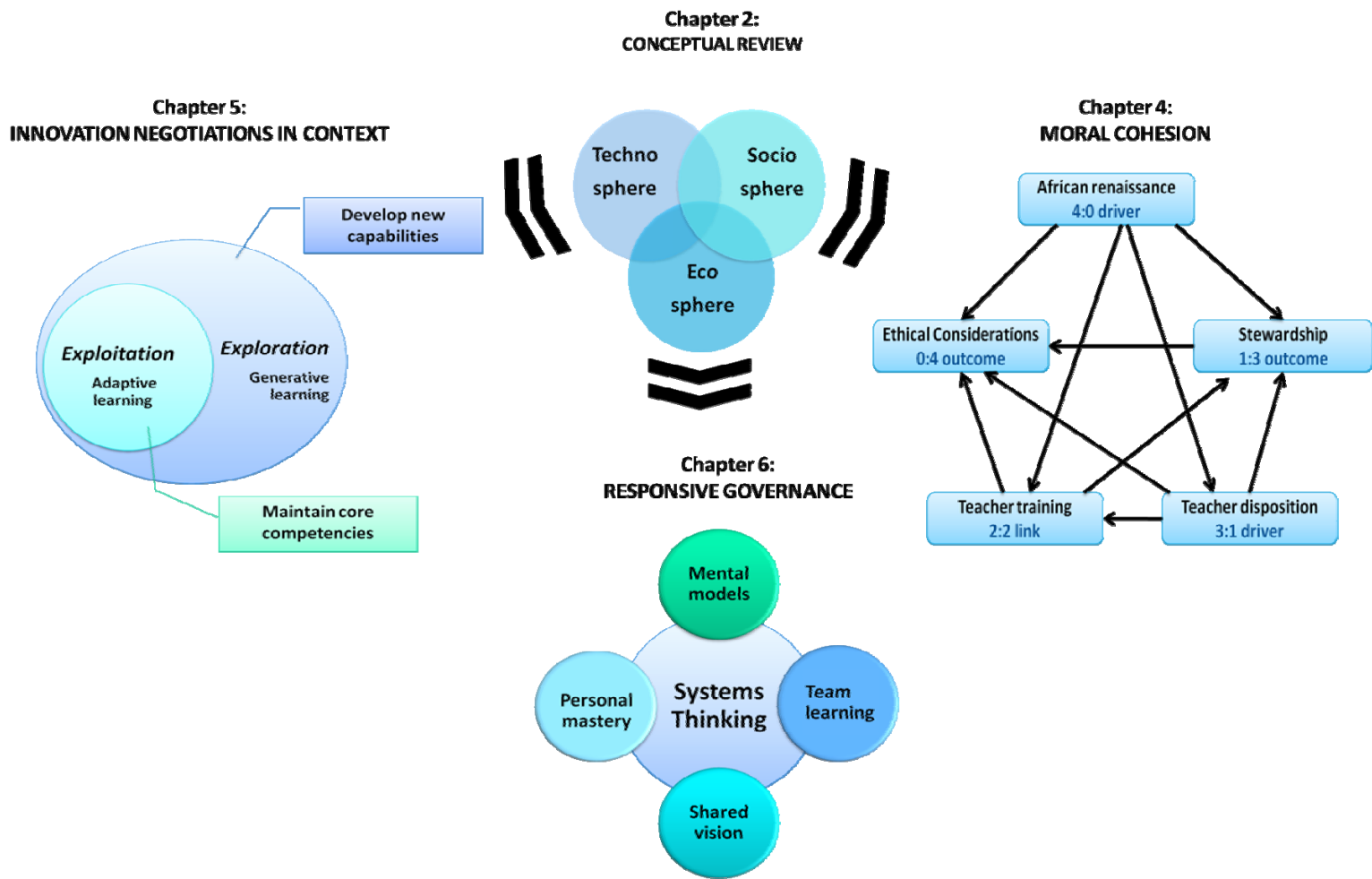
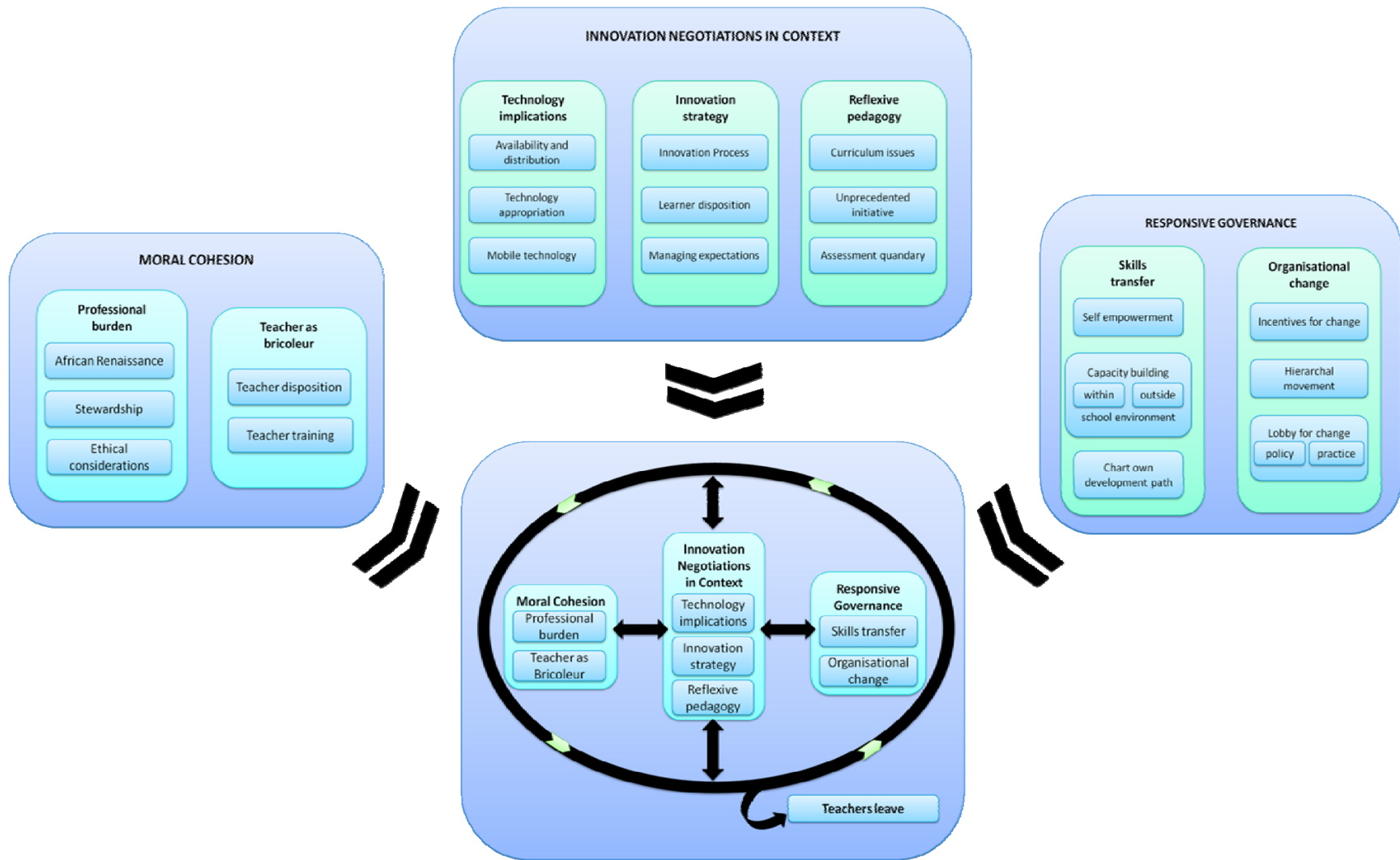**Figure 7-2: Visual synopsis of research findings**

Figure 7-3: The visual map of building theory

The presented substantive theory (*cf.* Figure 7-4) attempts to address the main research question phrased at the beginning of this study:

> How does tacit knowledge manifest when innovative teachers engage with emerging technologies to achieve pedagogical efficacy?

Teachers expressed a strong sense of kinship with the people of Africa and they strived, through their projects, to uplift and enlighten their fellow teachers and the learners in their care by expanding their horizons. Towards this aim they relied on members of their community and activated their own personal network of contacts that stretched well beyond the education sector. They gradually built their skills set through the pursuit of formal and informal training opportunities and struggled with difficulties such as utilizing their personal resources for work or with the level of technology availability to their learners after school hours. *Moral cohesion,* as the defining concept, encapsulated the innovative *teacher as a bricoleur* who carries the burden of their profession as they grapple with indigenous knowledge systems that influence their stewardship of their learners. These teachers must at the same time address the ethical concerns raised as a result of their changed practices.

The emphasis on context when negotiating innovation is framed by the areas of *technology implications, innovation strategy* and *reflexive pedagogies*. Managing learning events and learner expectations as part of the innovation process, whilst contemplating the learning opportunities presented by various technologies for use within the classroom, became part of the teaching and learning environment the innovative teacher was striving to navigate. The unprecedented nature of initiatives resulted in teachers collaborating with learners as equal partners in the learning process.

Maximising the influence of innovative teachers, by dispersing their capabilities across the school community as an organisation, is the responsibility of *responsive governance*. Teachers that reached finalist status in the competition found that their school responded by augmenting their job description with added responsibilities. Their stature within the community and educational bodies outside the school increased significantly. They were required to aid in staff development in both formal and informal instances whilst still increasing their own pedagogical

repertoire. They actively lobbied for change in their school's organisational structures and were invited to serve on committees tasked with the integration of technology into the classroom. It also became evident that teachers tended to leave teaching to elevate or improve themselves or their conditions but continued to remain active within the educational profession.
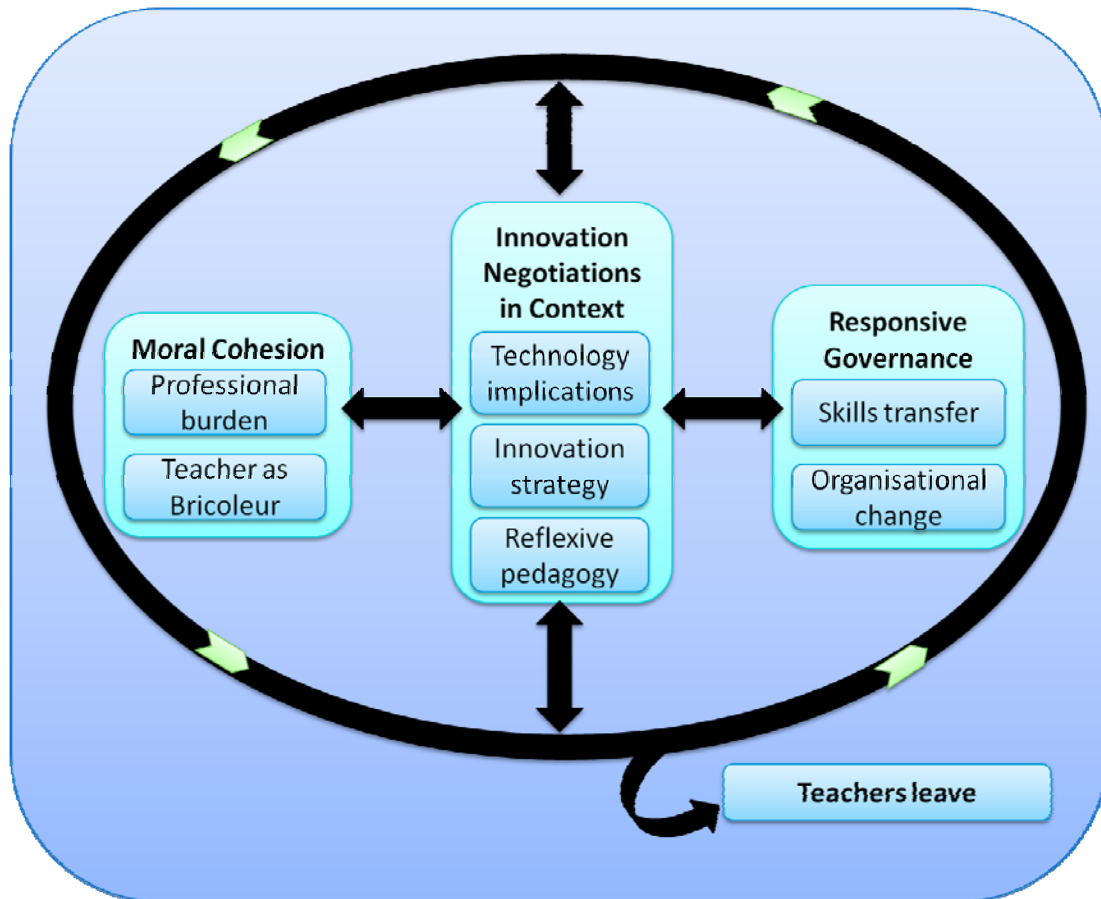

Figure 7-4: Substantive theory of innovative teachers' knowledge manifestations when using emerging technologies to achieve pedagogical efficacy.

In the past two decades the focus of innovation has shifted. It now consists not so much in merely mastering content and perfecting specialised learning but in enabling schools in particular to provide positive learning experiences, to increase willingness and ability to learn, to promote stable personalities and to offer social experiences all with the use of emerging technologies. The function of teaching has become more important than subject-based educational reform.

7.3.5 Substantive theory: Possible practical implementation

Teachers rely on their existing knowledge in the enactment of their duties as professional individuals. They draw from their repertoire of skills developed through trial and error over a long period of time. For teachers to become more innovative in their use of emerging technologies, the expanded substantive theory as depicted in Figure 7-3 could be used to identify areas in their personal development that require more attention. Teachers can therefore pay closer attention to their own professional development and select appropriate training opportunities in an effort to become more innovative in their use of emerging technologies.

The substantive theory as presented earlier in Figure 7-4 can also be of value to school management structures. They can use it to identify the teachers in their midst that demonstrate potential for development and they can respond more appropriately to the innovative teachers as change agents.

7.3.6 Methodological contribution

The substantive theory being offered is the result of following the systematic Straussian Grounded Theory Method of analysing data, conceptualising emergent themes and finally framing the results in a visual manner. The use of this method in the domain of Computer-integrated Education is a novel approach especially pertaining to the practice of innovative teachers.

Consulting literature prior to entering the research field remains a contentious issue as discussed in Section 1.6.5.2. For the purposes of this research, literature was used in three ways. The first was to sensitize the researcher and the reader towards the research problem and related literature. The second and more controversial use of literature in following GTM was to construct a framework for the analysis of data and the presentation of the findings. This approach is not aligned with generally accepted guidelines when conducting grounded theory studies but a natural extension of the approach adopted by Diaz and Andrade (2009, p. 46) in which they encouraged researchers to take previous experiences into account and draw from existing literature to structure a preliminary theoretical framework.

The pre-existence of embedded categories within the Microsoft Innovative Teachers Forum Awards competition entries lent itself perfectly to adapt Gardiner's Three Interfaces of Adam, as seen in Figure 2-1, to accommodate areas necessary to consider when investigating the innovative teachers' practices hence the socio-, eco-, and technosphere constructs. The adoption of a framework in which to consider data analysis and through which to present the research findings is a fresh approach and a natural extension of the systematic design of GTM as presented by Strauss and Corbin with their prescriptive procedures. The framework designed for this research study was utilised as a device that enabled not only the analysis of data but was also a mechanism to present the actual findings in the field.

The third and last consideration pertaining to the use of literature remained true to the spirit of GTM research where it is considered as an additional data source. Literature was consulted continuously throughout the data collection and dissemination process in constant comparative analysis, thus additional insights gained from literature were included in the emergent theory throughout the study.

The main methodological contribution of this research study is in applying Straussian GTM in the domain of Computer-integrated Education as well as the extension of the procedure to use a framework constructed prior to entering the field as a mechanism for analysing and presenting the research findings.

7.4   REFLECTIONS

This section will provide details of the researcher's personal reflections on the applied methodology, how the researcher experienced different aspects of the methodology and what valuable lessons were learnt whilst applying the Straussian methodology of Grounded Theory.

7.4.1 Making sense of methodology

In an effort *to make sense of methodology* and *understand particular personal research perspectives and agendas*, Swann and Pratt (2003, p. 6) constructed several questions to guide fellow researchers to frame their particular study, express underlying assumptions and declare tacit biases. These questions are first posed and then discussed in relation to this research to

reveal the orientation of the researcher that acted as a guide in understanding the unfolding process of the study.

7.4.1.1 My Research Purpose

> What is the purpose of educational research? What is educational research for? What are the characteristics of good research in education? Why do I engage in research?

This research study was characterized by two overriding interests. The first interest was to empower my fellow colleagues in the teaching profession in articulating their innovative pedagogical practice and the second interest was to illuminate the changes organisations, such as schools, can undergo by claiming innovative teachers in their midst. Management can use their innovative teachers' expertise and vision to provide pedagogical leadership and to facilitate changes in the teaching and learning practices of colleagues still entrenched in traditional modes of delivery and assessment. A more ambitious aim is to liberate the minds of teachers and learners on the African continent to take their rightful place as active participants in developing discourse about preserving their indigenous knowledge and challenging existing practices, whilst conceiving new approaches to teaching and learning with emerging technologies. I acknowledge these interests to be overambitious and in reality I might affect change in only a few areas, but to be committed to research is to work with a purpose towards a set goal of knowing something with a deeper level of understanding and making it accessible to others with similar interests.

7.4.1.2 My Research Identity

> How do I characterise my research and myself as a researcher? How does the way I construe research, and myself as a researcher, affect the design and conduct of my research?

First and foremost I am a former teacher, a recognised innovative teacher within the boundaries of teaching and learning with varieties of ICT and a facilitator in innovative teacher development. I have received accolades on local, national and international forums for my innovative teaching practices. I am a mobile learning specialist who conceptualizes and executes learning events that pilot new technologies in formal teaching environments in collaboration with

research institutes and research partners. I work towards increasing awareness of the unharnessed potential that mobile devices present in the teaching environment. I encourage school leadership to be more active in articulating their stance on integrating emerging technologies in the classroom and support them by developing guidelines and policy when employing mobile technology in schools. I am an educational researcher with an interest in how the face of education is constantly changing. I share in the pressures teachers endure when required to continually adapt their practice as required by changes in practice and policy.

7.4.1.3 My Research Influences

> What influence has my research had on educational policy and practice? What influence might it have in future? What form has collaboration taken in my research work?

My most significant contribution to the field of computer integrated education is in the area of mobile learning drafting policy and guidelines which included the setting of standards for teaching and learning with mobile phones as best practice classroom guidelines in partnership with NOKIA. I also collaborated in the drafting of e-safety guidelines for the National Department of Education. These guidelines pertain to the *acceptable use policies* of mobile phones in the formal school environment. My collaboration with fellow researchers has taken the form of mentorship and participation in ongoing studies of mobile learning user experience as well as in studies contemplating tutoring via the mobile phone using social Web2.0 applications. This has led to participation at conferences with the subsequent publication of short and long papers documenting the research process. My contributions have also stimulated debate and interest in the arena of educational policy and practice and future teacher development.

7.4.2 Delayed methodological mastery

Some reservations existed throughout the research as to the suitability of the Grounded Theory for this study. There are different applications of the Grounded Theory Method and all three methods had to be studied and fully understood before a decision could be made on how to best proceed and which one would be the most appropriate for the study. The choice to use the Straussian method of Grounded Theory was justified with the emergence of the initial core

categories. At some point one of my critical reviewers suggested changing the research design from a *Grounded Theory method* to a *case study* design because of the prolonged period of confusion that persisted. One of the greatest challenges I experienced during this study was to determine the adequate level of conceptualization needed. Recognizing patterns in data were essential to conceptualization and a more experienced researcher would be more adept at this skill. Glaser (2001) clearly upholds that the classical Grounded Theory is all about *conceptualization* rather than *description*. However, an issue that is yet to receive the attention it deserves is the acceptable depth of conceptualization expected in a Grounded Theory study. This issue requires the researcher to be sensitive to data emergence by constantly comparing data to data and incident to incident (Ng & Hase, 2008, p. 162).

7.4.3 Regarding coding

Because English is not my home Language, I found coding during analysis to be quite challenging. I initially agonised over different terminologies and words in an effort to choose the precise and correct code to capture a concept. I found my vocabulary store lacking the depth needed and I was not satisfied with the *many words* I sometimes had to use to capture *one* concept. However Glaser, with the assistance of Holton (2004), reassures that the inability to capture exact codes early on in a study is a phenomenon well documented in novice researchers and not unique to this study and therefore I was encouraged to persist in my efforts. I had to rely on continuous reading and verification of my approach in data analysis and had to redirect and revisit the data set numerous times. After reading an article on coding, I became aware that I was rather to focus on the processes than line by line coding. This was the turning point of the data analysis and the procedure of coding became much clearer after revisiting the data set. As the journey of engaging with the dataset moved along, I grew in confidence for the emergence of the key concepts brought to light the appropriateness of making the choice of adopting the Straussian Grounded Theory approach. The more time I spent coding, the less concerned I became and finally decided to rather use more words to capture the exact thought than to sacrifice clarity for the sake of brevity as the created codes could be revisited and reconceptualised at a later stage.

Another textual challenge was that my initial analysis focused on line by line coding accompanied by memo writing and quote selection, however, this approach was very time consuming and did not yield many relevant codes as I got bogged down in the details. On revisiting Strauss and Corbin (1998) I was reminded of the need to code actions and processes within the phenomenon. Instead of redoing all the previous codes, I decided from that point onwards not to be restrictive with the text but to look out for the behaviour captured within the dataset.

7.4.4 Theoretical saturation

The last challenge which faces the researcher using the Grounded Theory methodology is early closure of the data collection process. According to Glaser and Strauss (1967, p. 67) "theoretical saturation" is the criterion used to judge when to stop collecting data. In addition, Strauss and Corbin (1990) state that theoretical saturation can occur at three junctures in the research. Firstly, when no new data reveals new categories; secondly, when each category is richly and densely described and all of its properties have been revealed; and thirdly, when the relationships between categories are well established and validated by data. It is therefore suggested that researchers avoid premature closure by looking out for the point of diminishing returns where the data adds nothing new to what the researcher already knows about a category, properties and its relationship to the core category (Ng & Hase, 2008, p.164).

7.4.5 Mastering the software during data analysis

Despite access to the tutorials I still experienced great difficulty in grasping the fundamental aspects of coding, memoing and managing my primary documents. It is easy to underestimate the amount of time it takes to master the ATLAS.ti software package. This time consuming effort leave one with a feeling of vulnerability and the anticipation of doom. At one stage, after months of coding, I managed to lose some material after tidying my folders and inadvertently moving the root files of the primary documents. It took two days to recover the lost material as I had to reinstall primary documents one by one from previous backups. This time consuming and frustrating exercise could have been avoided if I had spent more time thoroughly studying the tutorials.

A great help in this time of uncertainty was a series of 12 instructional videos I downloaded from YouTube. These videos covered all the main aspects of ATLAS.ti usage (namely assigning documents, code management, networks, quotations, core elements, query tools, use of the margins and remaining objects) and are designed to run for about 4-5 minutes. The following link is to the video which explains how to go about doing axial coding. http://www.youtube.com/watch?v=s65aH6So_zY .

Whenever I got stuck or experienced some difficulty with an aspect of ATLAS.ti I reverted back to the manuals and the videos for troubleshooting. This was a great help and ensured that I kept moving forward in the analysis process. I must admit that I exported all the codes, quotes and memos on a regular basis in the form of a text document as a backup procedure. The research journey can be very lonely when experts are not readily available but online assistance is only a click away through social media in the form of mailing lists and support groups. The Glaserian Grounded Institute (http://www.groundedtheory.com/) provides access to seminars where you can post particular questions about Grounded Theory to the forum, however, as the name implies it is only relevant to those following the Glaserian method.

The Word documents became very useful at one stage as I was experiencing some difficulty assigning the multitude of generated codes to families. Having to scroll through in excess of 500 codes became too overwhelming and at that point I decided to print all the codes and cut them into separate little pieces as seen in Figure 7-5 below. I spent a morning sorting them into related groups as shown in Figure 7-6 below. This immediately gave me a sense as to where the areas of emphasis were and I returned to ATLAS.ti with a better idea of the categories and the associations between them.
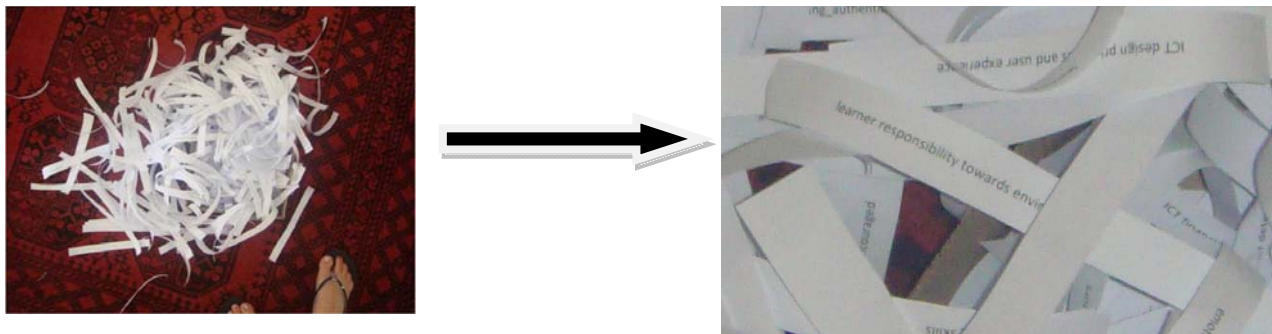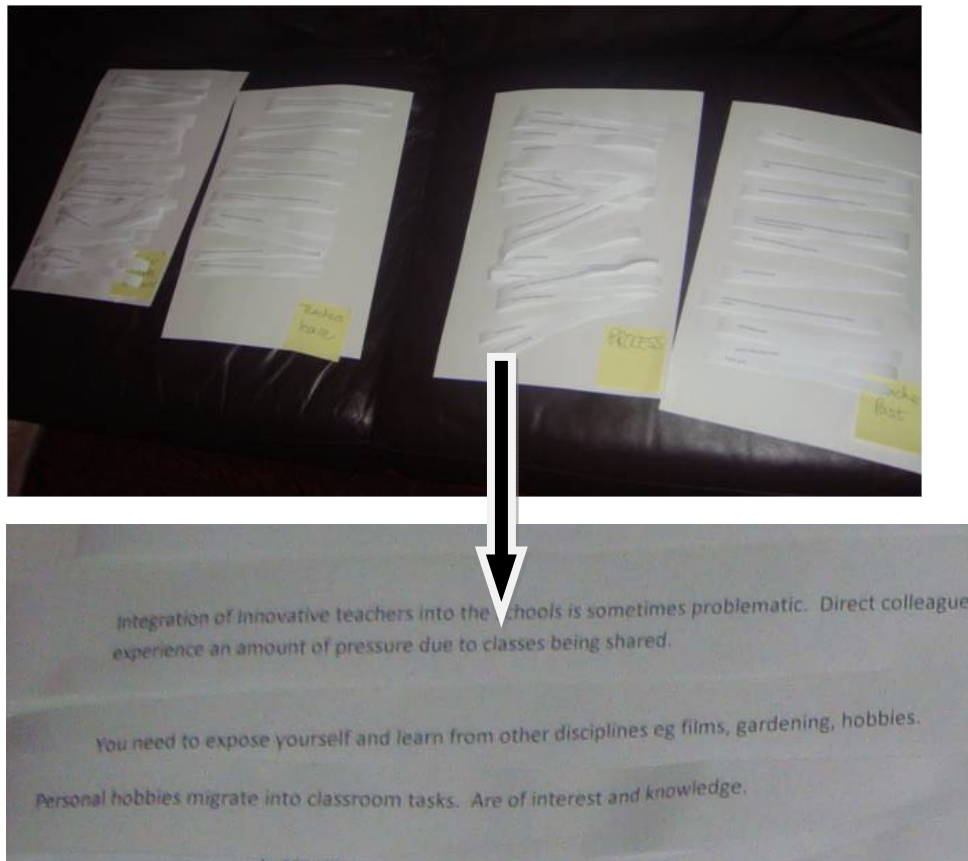

Figure 7-5: Snippets of code

Figure 7-6: Ordered codes

Working with computer-aided qualitative data-analysis software (CAQDAS) has definite advantages as articulated earlier (*cf.* Section 3.4.1) but at the same time it can be very time consuming as technical aspects crop up time and again. Managing and overcoming these obstacles became more of a limitation and a barrier than an enabler and I had to decide whether to continue with ATLAS.ti after the initial coding, memoing and identifying of relevant quotes to use. The greatest difficulty I encountered was organising the codes into categories as the family manager does not remove a code from the list once it has been used. I found this to be very confusing as I had to wade through the same codes each time to formulate a new category. In the end my strategy was to export all codes to an excel document. In order to get a clear idea of where they belonged, I first sorted the codes into groups before turning to the family manager within ATLAS.ti.

7.5   JUDGING THE CREDIBILITY OF STUDY

The criteria used for judging the soundness of research depends on whether a *quantitative* or *qualitative* approach was followed. Researchers hold differing perspectives, supporting either the one or the other approach. In considering research, qualitative researchers reject the framework of validity commonly accepted in more quantitative studies in the social sciences. They reject the basic realist assumption that there is a reality external to our perception of it. It therefore appears to be illogical to judge the worth of qualitative data by considering whether an observation is true or false based on an external reality. Trochim (2001, p. 162) proclaims the need to consider the underlying assumptions involved in much of qualitative research and in Table 7-1 below proposes alternative criteria to evaluate qualitative research.

Table 7-1: Criteria for judging research quality from a more qualitative perspective (Trochim, 2001, p. 162)

Traditional criteria for judging quantitative research	Alternative criteria for judging qualitative research
Internal Validity	Credibility
External Validity	Transferability
Reliability	Dependability
Objectivity	Confirmability

As demonstrated above, the concepts of credibility, transferability, dependability and confirmability are more suited to establish quality in research. Each of these criteria, and how it was applied in this research, is discussed in the following section.

7.5.1 Credibility

The *credibility criteria* involve establishing that the results of qualitative research are credible or believable from the perspective of the participant in the research. The participants are the only ones who can legitimately judge the credibility of results because the purpose of qualitative research is to describe or understand the phenomenon of interest from their viewpoint. In this research the actual words and documents of the participants were used to illustrate and substantiate claims and interpretations made by the researcher. During subsequent theoretical

sampling episodes, participants were granted additional opportunities to review some of the interpretations and conceptualisations of the researcher and correct any misinterpretations or elaborate even further on identified issues.

It is essential to deal with issues of rigour when conducting Grounded Theory research in order to increase the credibility of the study. Given the variations in Grounded Theory methods, how the theory is applied across differing contexts, the level of subjectivity attached to it and the manner in which qualitative research is carried out as these are important in articulating the processes of how a substantive theory about a phenomenon is generated. Charmaz (*cf.* Section 3.2.4) proposed a set of common criteria when doing Grounded Theory research to increase the trustworthiness of the process and resultant findings. The decisions and actions taken in this research were matched to these criteria and presented in Table 3-2 on page 85.

7.5.2 Transferability

Transferability refers to the degree to which the results of qualitative research can be generalized or transferred to other contexts or settings. Transferability can be significantly enhanced by providing a thick description of the research context and assumptions central to the research. *Thick descriptions* have their roots in ethnography where it was important to describe a phenomenon sufficiently by explicitly stating the underlying cultural and social relationships enabling the research findings to be transferred to other times, situations, settings and people (Holloway, 1997; Lincoln & Guba, 1985). In this study the researcher made the contextual background to the projects considered for inclusion available and provided the actual words of the participants in quotes and documents. Even though the research participants were drawn from an annual competition, additional theoretical sampling explored notions beyond the scope of the competition and therefore the results will be transferable to contexts within the Pan-African region.

7.5.3 Dependability

In quantitative research reliability is determined by the ability to replicate the study and obtain the same or similar results. *Dependability* of qualitative research is a complex issue because of the inability to observe the same thing twice as each event is singularly unique because of ever-

changing contexts (Hammersley, 1990). It is problematic to control peoples' behaviour in natural settings and the research focus can be on many different aspects within the same setting. These settings are not stagnant and the researcher needs to account for these fluctuations and reflect on how these can affect the research approach (Cohen & Crabtree, 2006). This research was conducted over a period of 4 years, allowing ample opportunity to seek confirmation and clarification on developing concepts. Because of the rapid technological advancements in the environment of the participants, the research emphasis was on the tacit knowledge development of innovative teachers and less on the technology itself.

7.5.4 Confirmability

Confirmability refers to the degree in which the results can be confirmed or corroborated by others (Trochim, 2001). In quantitative research the criteria is described as the objectivity of the research. In qualitative research the researcher brings a unique perspective and an inherent subjectivity to the research. Techniques for establishing confirmability in qualitative research are to make use of access to a clear audit trail, triangulation and reflexivity. Using a single data set can never adequately shed light on a phenomenon and may jeopardize the credibility of the researcher and that of the study undertaken. In this research triangulation involved the use of multiple data sets in an attempt to validate the findings resulting in robust accounts rich in detail which generated a deeper understanding (*cf.* Table 3-4). The researcher documented a clear set of procedures for gathering, checking and rechecking data throughout the study (*cf.* Table 3-8).

One tool which is available to increase the trustworthiness of research is to conduct bracketing interviews prior to initiating interviews. These bracketing interviews allow the researcher the opportunity to be interviewed about the topic of study enabling him/her to be more fully open to the research encounter (Finlay, 2008; Leong & Austin, 2006). Bracketing interviews can be described as *reversing the researcher role* by asking another researcher to use the same set of question designed for use in the study and to administer it to you as the principal researcher. This interview is then transcribed and can be used later as the study progresses through data collection and interpretation. An interpretive research group can be used to analyse the bracketing interview to aid trustworthiness (DeMarrais, 2004). In reference to this study, a fellow PHD candidate familiar with the study was approached to fulfil the role of conducting the

interview and collaborated with the researcher to code it. The bracketing interview is a powerful tool and can aid the researcher to identify assumptions and interpretations to the extent that their own beliefs might interfere with the interpretations. The bracketing interview was also included in the dataset and, along with related literature, it was considered for analysis and interpretation.

 The trustworthiness of the research was further enhanced by cross-checking different versions of events as reflected in the text, visual evidence and post-interview data. In order to increase the validity of the study, the following will be taken into consideration:

- Existing meta-data including competition entries, post competition radio interviews, media publications and competition blogs.

- Personal diaries and memos of reflection.

- Being a fellow entrant gave me unparalleled access to peer presentations. This allowed for first hand exposure to the entrant's thought processes at the time of presentation. Because of time constraints, the entrants distil the essence of their entry to a few short minutes. It therefore gives a glimpse as to what they perceive the essential contribution made by their project was.

This section considered criteria for judging the trustworthiness of qualitative research and considered aspects such as credibility, transferability, dependability and confirmability. Decisions made and actions taken during the research as well as the prolonged engagement was offered as evidence towards the trustworthiness of the research.

7.6   WRITING SEQUENCE OF THE STUDY

The non-verbalised but generally accepted form is to write Chapter 1 last, however in this study it was written partly in the beginning of the study revisited towards the middle and tidied up at the end. Much confusion reigned over the inclusion of a literature review as it is a debate highly contested in a Grounded Theory study. The section covering the research process forms the backbone of this study and gave it direction along with the research design. Initially it was captured in a chapter of its own before being integrated in Chapter 1. At this point I was beginning to feel very insecure as the complexities of doing Grounded Theory became more

apparent with noted discord amongst members of the research community (Borgatti, 2008; Fernandez, 2004; Luckerhoff & Guillemette, 2011; Onions, 2006). The data collection is not predetermined and is driven by the emerging theory, therefore the writing up of the thesis does not conform to the traditional format and this resulted in some confusion for the researcher. The writing up of the research findings did not follow at the end of data analysis but is interwoven as a continuum to develop the substantive theory. The chapters were therefore not written in a sequential way.

7.7   PERSONAL REFLECTION: COMMENTS ON THE PRAGMATIC SIDE OF THIS RESEARCH

My PHD research journey started in mid 2007 soon after completing my master's degree at the University of Pretoria (UP) under the guidance of Prof Johannes Cronje. My dissertation covered my participation in the MobilED (2006-2008) project aimed at designing formal and informal teaching and learning environments that are meaningfully enhanced with mobile technologies and services (Batchelor, 2007). MobilED is an open-source and open content initiative that creates the ability for all to access and, more importantly, contribute their knowledge to shared online information repositories. MobilED partners included the Meraka Institute of the South African Centre for Science in Research (CSIR), Cornwall Hill College, South African Department of Trade and Industry, Nokia and the Media Lab: University of Art and Design Helsinki, Finland. I presented my findings at the 2006MLearn Conference in Banff, Canada (Batchelor, 2006). This was my first entry into the world of academic conferencing and it provided a platform to not only showcase the work we were doing in South Africa, but to also interact with the experts in mobile learning. At the conference I was introduced to John Traxler, a renowned specialist in the field of mobile learning with an interest in developing contexts having worked on projects in the African continent. He was invited to visit South Africa to lead a workshop at UP, arranged by Prof Johannes Cronje, which was well attended. About four months after I started my PHD my supervisor and mentor, Prof Johannes Cronje, was offered the position of Dean of the Faculty of Informatics and Design at the Cape Peninsula University of Technology (CPUT). I found myself in the unenviable position of having to find another supervisor in order to proceed with my study. It was extremely difficult to find someone in the Faculty of Education willing to take on another student because of departmental restructuring,

increased workload as well as the lack of competencies in the area of mobile learning. I went through a limbo period in which I proceeded, without supervision, to look at new areas of mobile learning in developing contexts and worked on my own projects exploring design criteria for multimedia learning artefacts as articulated by learners working on dissection class projects (Batchelor & Botha, 2009a). It was during this time that my interest in teacher innovations with mobile technologies was triggered. I started to read publications focused on teacher interests and pedagogies around educational technologies and found a void in the research which I wanted to explore further. In March 2008 Prof William Fraser from University of Pretoria's stepped in with the understanding that he would guide me though the process of crafting the proposal and defending it at departmental level which took place in August 2008. Subsequently we started searching for a supervisor and co-supervisor that could assists as subject matter experts. We first approached Prof John Traxler from the University of Wolverhampton UK because of his expertise in mobile learning and affinity to and knowledge of the African continent and its researchers. Prof Traxler agreed to act as co-supervisor. It was, however, more challenging to find a local supervisor but midway through 2009 Prof. Marlien Herselman from the Meraka Institute, CSIR was appointed as supervisor. She is a highly competent researcher and was awarded the accolade of the South African Scientist of the Year in 2010.

The first step in the research process was to seek ethical approval for this study from the Faculty of Education Research Ethics Committee at the University of Pretoria. Because I was interested in researching the innovative teaching and learning practices of the participants to the annual Microsoft Innovative Teachers Awards, I approached Microsoft South Africa for their consent to use the multimedia entries for the competition as well as gaining access to interview the participating teachers. During the ten months I waited for the *letter of consent* from Microsoft Head Office in Atlanta USA (*cf.* Appendix B), I spent the time familiarising myself with the nuances of Grounded Theory. I also acquired the software package ATLAS.ti and started to familiarise myself with its functionalities making use of the tutorial provided online. I furthermore worked on the logistical issues of data gathering, handling and storing. As soon as the ethical process at the University of Pretoria was completed (*cf.* Appendix A), I commenced with the analysis of the first Virtual Classroom Tours.

7.8   LIMITATIONS AND RESTRICTIONS OF THE STUDY

Educational research is bound within a specific environment which comprises the learners, teachers and structures of management. Gaining access to schools across South Africa on a national level proved to be a prolonged and ultimately futile exercise and therefore this study focused mainly on the experiences of innovative teachers as captured and related through their entries in the Microsoft Innovative Teachers Award.   A reservation regarding this research study was that the original dataset was generated through an annual competition. Although a large portion of the initial data set was coded, analysed and interpreted, theoretical sampling was used to fill in the gaps that still existed in the data with literature proving to be a rich additional data source. At no time were any learners or the management of schools approached for their input. Findings rest on the provided documentation of recorded events, the perceptions of the innovative teachers and the interpretation of the researcher. Transferring findings, which are rooted within the context of the Pan-African Microsoft Innovative Teachers Forum Awards competition, will be difficult to achieve but can be viewed as the starting point for further investigations.

In addition to the environmental restrictions of context and circumstance as given above, this research posed methodological limitations. The initial formulation of the research questions was found to be inadequate in addressing the research problem sufficiently and changed with the construction of the research framework as articulated in Chapter 2. The deepening of the researcher's engagement with the data finally resulted in reformulating the main and sub-research questions.

A limitation of a methodological nature was to conduct Grounded Theory Method research without a mentor. This *minus-mentoring* state, a term coined by Phyllis Stern, refers to a situation where researchers find themselves "doing grounded theory in a context where there is no one available to train them how to do it" (Glaser, 1998, p. 5). My own understanding of the use of this method grew as the study progressed. Initially I was bogged down in coding without conceptualising the data. I gained some comfort from the prescriptive guidelines proposed by Strauss and Corbin (1998) and managed to progress to the end of the study which culminated in

a substantive theory of innovative teachers' pedagogical efficacy in their use of emerging technologies.

7.9   POSSIBLE FUTURE RESEARCH

The following areas can be considered for future research:

- Due to the exploratory nature of this research and the contextual limitations associated with this work, future studies may seek to explore the extent to which the components of the substantive theory transfer to contexts outside the Microsoft Innovative Teachers Forum Awards and the African continent.

- Whilst a substantive theory is proposed in this research, additional investigation of the components of this model may aid researchers in designing new studies in proposing and testing hypothesis. Thus, one contribution is the provision of a conceptual framework for testing variables and reflexive processes under more controlled conditions.

- Another possible direction that will extend the findings is research that seeks to explore how individual teachers, at the subject area level within a particular school environment, can further organisational change through their use of emerging technologies in their practice. By looking closely at individual teachers' naturalistic and situated work practices, researchers should be able to capture how their practice can bring forth collective behavioural patterns within an organisation.

- The proposed substantive theory can also be broken down into separate nodes or components which can then be studied more in-depth.

- Future studies can determine the various patterns by which the components of substantive theory shift and stabilise over time.

- It remains important to continue research in the use of *emerging technology* as well as the *traditional use of ICT* in the education environment as this furthers our understanding of how to translate and transfer skills from the emerging to the traditional in a more sustained way.

7.10 CONCLUDING REMARKS

This research provided a substantive theory of the way in which innovative teachers' tacit knowledge manifests when they engage with emerging technologies to achieve pedagogical efficacy in a developing context.

In the epigraph of this chapter, Durkheim illuminates the

> "discord that underpins the teaching encounter - a *doing* versus *thinking* conundrum. The key is for teachers to begin to see themselves as active participants in shaping how teaching and learning are conceived, to build upon their knowledge about being a part of society, and to generate new theories and practices (praxis) that can help transform and advance human nature" (Jaramillo, 2010, p. 38).

Charcoal drawing on cardboard: Diek Grobler 2006