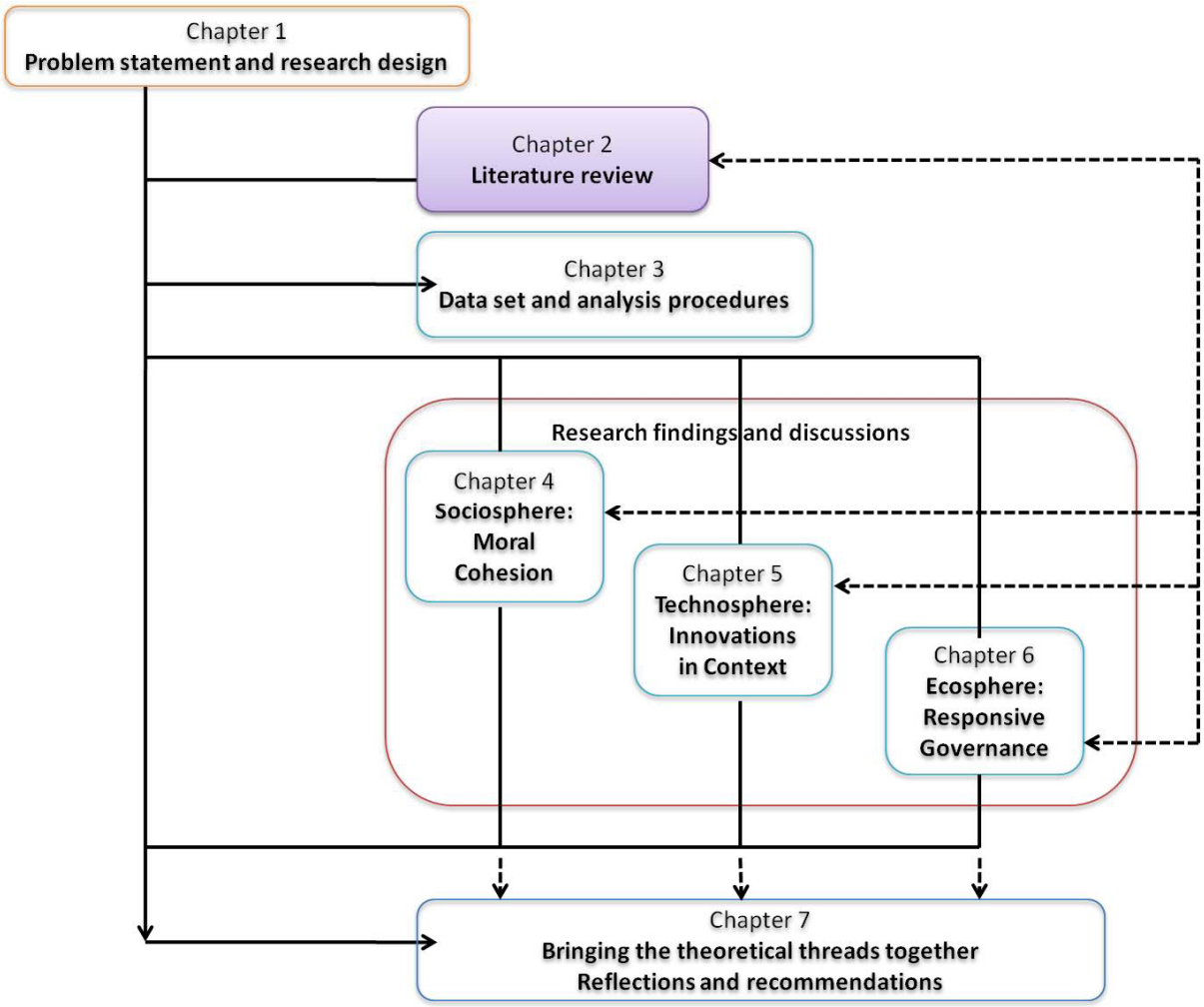
Chapter 1
Problem statement and research design
Chapter 2
Literature review
Chapter 3
Data set and analysis procedures
Research findings and discussions
Chapter 4
Sociosphere:
Moral
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Chapter 5
Technosphere:
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CHAPTER 2. TO ESTABLISH THEORETICAL SENSITIVITY

" Knowledge is emergent and contestable, part of the on-going project of humankind to establish and codify what is known." Somekh (2007, p. 30)

2.1 INTRODUCTION

Chapter 1 introduced the research problem to be investigated and presented the philosophy that supports the research approach. An outline of the research design and the historical backdrop and evolution of the Grounded Theory Method (GTM) was given. A motivation for the choice of the Straussian GTM to investigate the phenomenon of pedagogical efficacy when innovative teachers engage with emerging technologies was given. Knowledge gaps between theory and practice were identified and a research puzzle, which shed light on the topic under investigation, was formulated.

This chapter serves to sensitize the researcher and the reader towards the research problem and related literature. To achieve this objective, the researcher plans to examine the background of teaching and learning theory as well as the use of emerging technologies in schools in relation to new innovative pedagogical practices designed to engage both teachers and their learners in the process.

2.2 THE FRAMEWORK OF THE STUDY

The review also aims to identify the major contributors in this field and to document their perspectives so that these can be revisited during the conceptualization of the emerging categories which will be derived from data collected and analysed in this study. Findings from international studies are used to establish the current research context and existing models that have been used to structure this field of research are considered as sensitising instruments.

Zandvliet and Buker (2003) considers aspects of the learning environments and ICT as a field which requires continued research in order to determine tangible results. They further consider studies, describing psychosocial learning, as able to identify factors that may influence or determine learning with technology. Zandvliet and Buker (2003) also emphasise the interdisciplinary nature of conducting research in education because of the complexity of learning environments. To this end the framework designed by Gardiner (1989) is an appropriate choice to describe a general outline for contemplating the pressures which might drive change in these learning environments. Gardiner's model consists of three overlapping spheres which he describes as the *ecosphere*, the *sociosphere* and the *technosphere*. In this model he postulates that people generally deal with three dimensions in their existence namely: the natural world or the ecosphere, other people in their social world or sociosphere and the man-made artificial world or the technosphere. Human beings, located at the centre of these three spheres, are subjected to all three influences. The overlapping of these dimensions creates tension and these intersections give direction to future trends, hinting at how to manage the complexity of the post- industrial society.

As was the case in previous studies in technological settings (Zandvliet & Buker, 2003), the researcher uses a conceptual model derived from Gardiner's *Three Interfaces of Adam* model and relates the original conception of the joint influence of the sociosphere, ecosphere and technosphere to consider the areas of potential influence where teachers (in their quest to exploit emerging technologies through innovative pedagogical practices) rely on their awareness and knowledge of critical philosophy, professional and organisational learning including aspects of teaching and learning theory, and emerging technologies as presented in Figure 2-1 below:

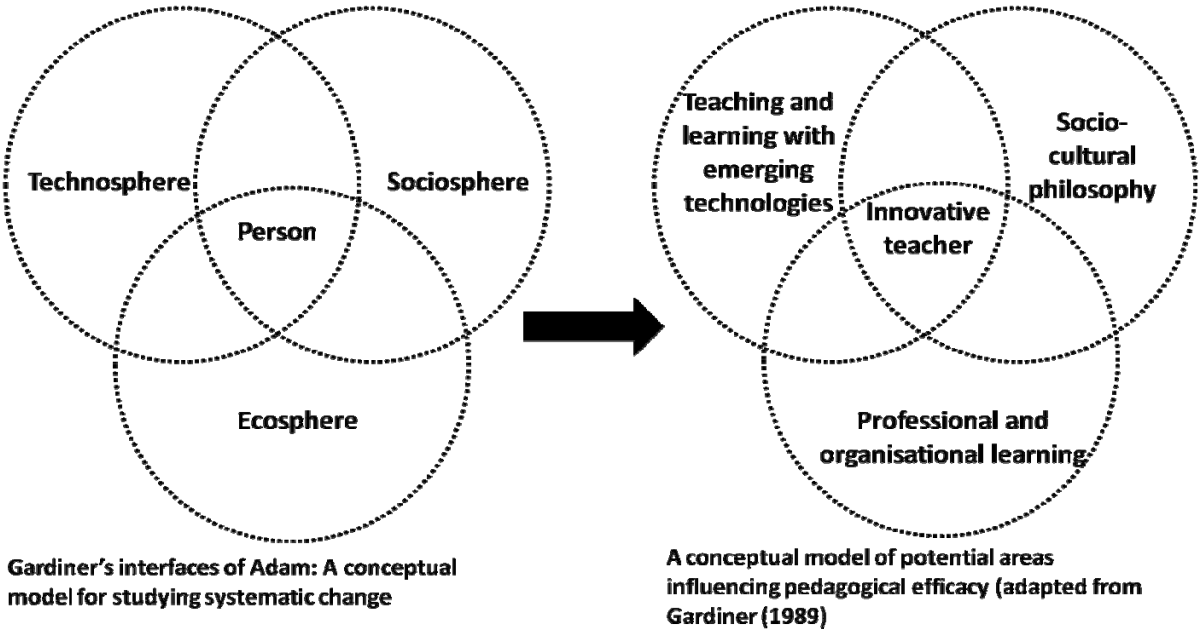


Figure 2-1: Framing the literature review of this study

Teachers are reflective beings by nature and use their own systems of beliefs to pursue solutions to existing problems as determined by their contexts (Bernstein & Solomon, 1999). In the past critical theory has been used to examine the ethical situation of educational technology in society and how critical theory can be used to exacerbate unequal social relations which result in the exclusion of groups of people in the process (Driscoll & Rowley, 1997). Critical theory is also a way of thinking about and transforming the relationship between classroom teaching and the production of knowledge (MacLaren, 2000).

In this study, the *technosphere* contains the affordances potentially offered by emerging technologies, the *ecosphere* demarcates the learning surroundings and the tendency to exploit technology in the learning environment affecting organisational systems and the *sociosphere* encloses the area of critical philosophy, informing the discourse that guides decisions and actions of members within a community. As these three intersecting spheres come together in a shared space and influence each other, the dynamic interchange leads to new knowledge creation and informs our understanding of innovative teaching and learning.

Historically, learning was situated in the industrial society but it is currently moving towards a more post-industrialized society dominated by knowledge workers. The technosphere is starting to encroach on the other dimensions with direct consequences for the remaining two spheres (Kerr, Fisher, Yaxley, & Fraser, 2006). Separating these three components or spheres (emerging ICT, teaching and learning theories and critical philosophy) is an analytical act and one that is difficult to untangle in practice. In actuality, these components exist in a *state of dynamic equilibrium*. The philosopher Thomas Kuhn (1996) proposed a different context namely *a state of essential tension*. To unravel this dynamic interplay would require a nuanced understanding of specific contexts and not a perusal of each sphere in isolation as they are so interdependent on one another (Mishra & Koehler, 2006). Despite the intricate dependencies within these context spheres, it is imperative to gain a better understanding and negotiate a shared meaning for each one.

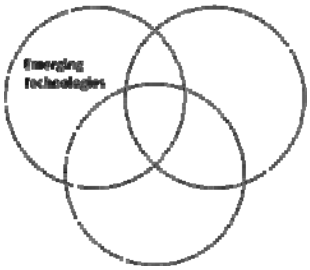
In presenting the literature, this study draws on the proposed conceptual model (Figure 2-1 above) to establish a shared understanding that recognises the need to establish the interrelationships between practice, practical knowledge and the theory of teaching and learning with emerging technologies. In order to understand the fit between these concepts the following should be considered:

- The position of *emerging technologies* in teaching and learning (*cf.* Section 2.3).
- The coverage of current *teaching and learning theory* through which the rich descriptions for innovative, technology based pedagogical practices are to be viewed (*cf.* Section 2.4).
- The aspects of *critical philosophy* need to be elaborated upon as they foster an appreciation for the personal theories, beliefs and practical knowledge teachers draw on in their innovative uses of ICT in their teaching and learning (*cf.* Section 2.5).

Each of these concepts mentioned above interact with one another and thereby create new dimensions and properties. The resultant new spaces draw on elements from the original spheres, as mentioned in Figure 2-1 above, and can be viewed as one part of the individual spheres or on its own. The next section will present the man-made technosphere focusing on emerging

technologies. The problem of language and the establishment of a shared understanding of terminology as well as the existing trends of using ICT in innovative ways to affect teaching and learning are then discussed.

2.3 THE TECHNOSPHERE: EMERGING TECHNOLOGIES



Chapter 1 provided a brief historical glance on the role of technology in education. This discipline may currently be one of the most fluid in the academic world and therefore the role, concepts and definition of this discipline are constantly changing (Kozma & Anderson, 2002). The continual renewal of new applications and devices further complicates the research of ICT integration in education. A plethora of new releases are fiercely marketed every year and customers often anticipate the newer and better version of some earlier model. All of these technologies are grouped under the umbrella terms *new technologies* or *emerging technologies* (Cox, 2009). The first step when conducting research is to define a common understanding of terminology especially in an area as diverse as Information and Communication Technologies (ICT) in education. The use of terms can differ from one context to another and this is largely due to historical and political legacies embedded within systems. Information Technology (IT) describes items of equipment (hardware) and computer programmes (software) that allow us to access, retrieve, store, organise, manipulate and present information by electronic means (DOE, 2004). Information and Communication Technologies (ICT) recognise the convergence of information and communication technologies, where appliances for computation and communication contain similar components and are increasingly capable of providing both facilities to people using them. Information and communications technologies (ICT) reflect the common understanding that a computer's potential is significantly enhanced by connecting to a local network and even more so by connecting to the Internet. In South Africa the term ICT is used in both the e-Education White Paper (DOE, 2004) and the SITES[4] (Howie, Muller, & Patterson, 2005) report on South Africa. The White Paper defines ICT as follows:

[4] SITES = Second Information Technology in Education Study

"[ICT is] the convergence of information technology and communication technology. ICT is the combination of networks, hardware and software as well as the means of communication, collaboration and engagement that enable the processing, management and exchange of data, information and knowledge" (DOE, 2004, p.16).

The term ICT is generally used in this study and refers to both the hardware and the capabilities that it provides, except in the case of direct citations or quotes.

Hawes (2008, online) reminds us that emerging technologies are in a state of change and once adopted by learners, they change our understanding of what learning is all about. Hinostroza *et al.*, (2008) suggests the grouping together of these emerging technologies, based on intention, into one of the following three groups:

- *Expanding* new learning opportunities which result in anywhere anytime learning,
- *Creating* new learning scenarios in traditional contexts and
- *improving* the teaching and learning process (Hinostroza, et al., 2008, p 90).

Harper (2010) speculates that one of the acceleration factors driving emerging technologies is the need for uniqueness that sets them apart from all other technologies or ideas. The benefit of diverse technologies available to teachers is that the curriculum can be delivered in a variety of ways.

2.3.1 Modes of curriculum delivery

Modes of curriculum delivery and interactions can range from face-to-face interactions, online or e-learning, m-learning, blended modes or a combination of all of these. Other than face-to-face instruction, each of the above modes of delivery is briefly explained in the following section.

2.3.1.1E-learning

E-learning is an inclusive term that can comprise all forms of electronic learning. It incorporates individual as well as collaborative, online and offline and synchronous or a-synchronous

interactions. To fully utilise the advantages of e-learning in a subject, the entire structure of the subject needs to be designed and directed carefully. So many tools and technologies are available and therefore the authenticity of a subject can get lost amongst a myriad of gadgets and "nice-to-haves" (Romiszowski, 2004, p. 5-11). A balanced approach, which ensures that the technology is a tool and medium but not the message, should be emphasized (De Villiers, 2005).

In e-learning the conscious decisions of learning theory, principle and strategy is even more important than in face-to-face interactions as the distance between learner and teacher emphasises any shortcomings, weaknesses or limitations. E-learning brings a richness and flexibility to teaching and learning that could not be achieved with traditional strategies only (Callaghan, 2008).

Mobile learning is differentiated from e-learning in its ability to liberate the user from a fixed infrastructure and limited accessibility as characterised by the more traditional modes of curriculum delivery (GSMA, 2010).

2.3.1.2 Mobile learning

Young people in our modern society have access to a wide range of digital devices and little is understood or known about the transfer of skills acquired in informal learning environments to the more formal settings (Cox, 2009). Despite the increase in ownership of mobile enabled devices amongst the youth, many are finding that the skills they are developing informally to manage their own learning is unvalued within the formal school environment (Pearson & Naylor, 2006). Teachers are increasingly challenging this embedded mindset and are capitalizing on the affordances offered by this technology. Educators are forging new ways to extend the inter-relationships between learners, the curriculum and the more personalized learning environments and thereby they are encouraging a move towards more self-regulated learning (Webb, 2009).

Mobile learning means different things to different communities. The Kaleidoscope Mobile Learning Group situated within the Technology Enhanced Learning European Advanced Research Consortium (TELEARC) views mobile learning as:

- learning with portable technologies, where the focus is on the technology (which could be in a fixed location, such as a classroom),
- learning across contexts, where the focus is on the learner's interaction with portable or fixed technology and
- learning in a mobile society, with a focus on how society and its institutions can accommodate and support the learning of an increasingly mobile population.

A generally accepted definition of mobile learning is:

> "Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies" (O'Malley, et al., 2003).

Pachler, Bachmair and Cook (2010) are of the opinion that mobile learning can only be understood against the backdrop of societal and cultural transformations, even when the individual enlists it for his or her own personal learning. Therefore mobile learning cannot just be limited to content delivery only, but is valuable in navigating the components within differing learning environments.

Taking into account the societal and cultural contexts, mobile learning in Africa is seen as a *lifeline* when compared to other more developed societies where mobile technology's value is perceived in terms of its ability to facilitate convenient, personal and mobile connectivity. In Africa, and specifically South Africa, these values are not only experienced in terms of the mobility provided by and through the technology, but it also encompasses the concept of *ability*. The concept of *ability* is seen as the capacity of users to access and contribute to the World Wide Web, to be included in virtual collaboration, to gain access to specialist information and to develop skills needed to function in a technological society. These very skills are becoming paramount in today's world (Botha, Batchelor, Van Der Berg, & Islas Sedano, 2008).

When considering the *learning* aspect of *mobile learning* (mLearning) one needs to distinguish between *general information* being made accessible to users and *content that is educational* and

has been developed to teach the end user a skill or to provide new knowledge. Consequently, learning activities should enable the achievement of stated objectives and learning outcomes as mapped in a content area school curriculum. Although the delivery method will influence the learning format, learning and educational resources should focus on content and not content delivery. The Development Fund has devised a framework for mLearning (Figure 2-2 below) to help categorise the many options in this expansive and complex landscape.

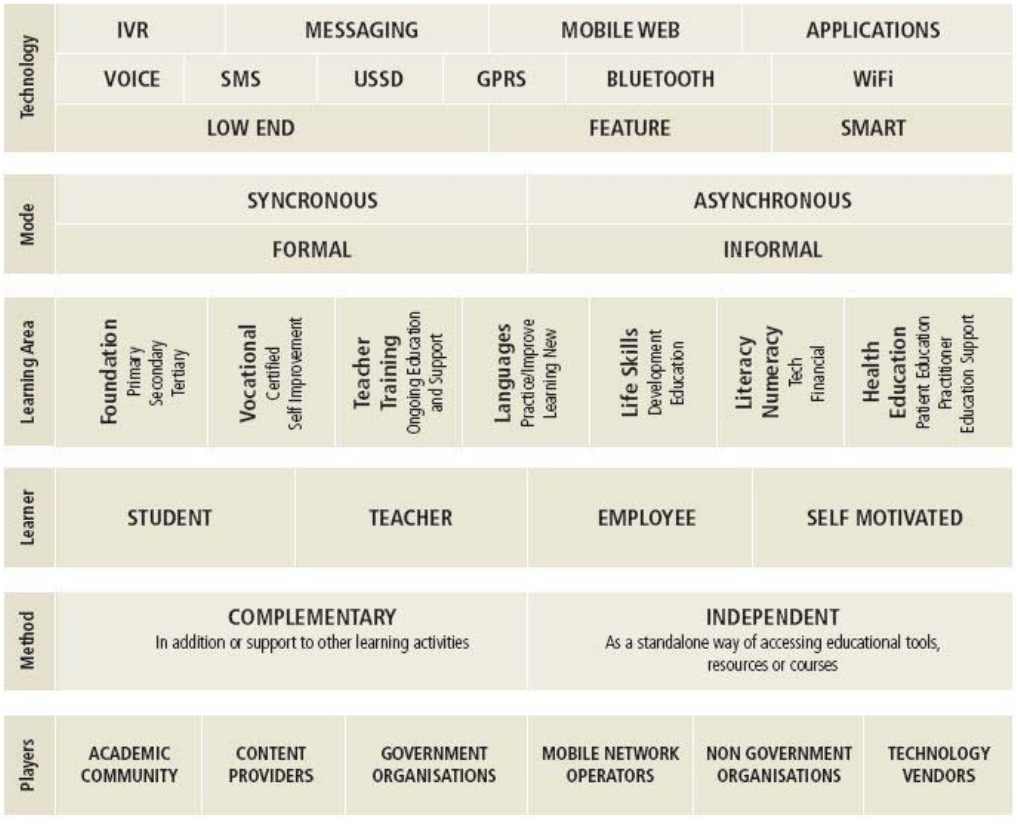


Figure 2-2: mLearning framework (GSMA, 2010)

Because of the complexities facing the developing mobile learning landscape, there is no one-size-fits-all solution. Each context is dependent on a different set of variables and therefore the results between service usage and uptake of offered applications differ greatly. It is however critical, when planning and executing solutions, to take all the levels of the framework into account as this increases the sustainability of the desired solution. This framework also serves to

categorise and find similarities between projects and therefore it can determine a product niche or identify gaps in the market.

When considering mobile technology, the notion that learning can take place at any time and in any place, leads to a much broader conceptualization of the use of computers in education (Voogt & Knezek, 2008a). Six years ago, Wagner (2005, p. 44) encouraged educators to prepare themselves for the use of mobile technology in learning stating that: "Whether we like it or not, whether we are ready or not, mobile learning represents the next step in a long tradition of technology-mediated learning." As a society we have embraced mobile technology in our personal lives and only now are we ready to take the step towards formalising mobile learning into South African schools (Souter, 2011).

Methods of delivering a curriculum can combine elements from both the mobile and e-learning environments resulting in a mix of learning strategies and methods.

2.3.1.3 Blended teaching and learning

Blended teaching is not restricted to simply supplementing classroom teaching with ICT tools but also to extend the boundaries of face-to-face instruction scenarios with on-line synchronous and asynchronous instances and instructional resources. This approach increases the flexibility of teaching and learning in a variety of scenarios and with multiple delivery methods. Thorne (2003 p, 17) states that "blended learning should be the ultimate perfect solution to tailoring learning to fit not only the learning need, but also the style of the learner". The success of blended learning is mainly dependent on matching the delivery methods with the planned learning events and thereby maximising learning opportunities (Valdez, 2001). Collins & Van Der Wende (2002, p. 7) found that ICT has firmly been established as part of a blend, "gradually stretching the traditional ways of teaching and learning" and Allen & Seaman (2003) relate that the majority of academic leaders in institutions of higher learning are already under the impression that the learning outcomes for online education are on par, or even exceed, those of face-to-face instruction. Garrison and Vaughan (2008) report that learners are embracing the flexibility and relevance of blended learning educational experiences and environments.

Currently the International Journal of Mobile and Blended Learning (IJMBL) provides a forum for researchers in this field where they can share their knowledge and experience of combing e-learning and mLearning with other educational resources. The potential of blended learning is vast and can accommodate not only individual learning styles but also allows for experiential learning which can be highly individualised, depending on personal needs.

2.3.2 Summary of technosphere: Emerging technologies

This section looked at the characteristics of emerging technologies and the current modes of curriculum delivery in educational institutions ranging from e-learning, mobile learning and blended learning scenarios. The ecosphere section will cover teaching and learning theory and how they are influenced to keep pace with technological developments.

2.4 THE ECOSPHERE: PROFESSIONAL AND ORGANISATIONAL LEARNING

The aim of this section is to cover *teaching and learning theory* to provide an update to current contexts against which one can consider the use of emerging technology to change and amend pedagogical practices. School organisational structures cannot remain unaffected when innovative teachers as staff members employ emerging technologies in their teaching and learning practice. In-service training of teachers through formal and informal continuous professional development creates opportunities for the diffusion of practices and a level of skills transfer.

Pedagogy refers to instructional matters, strategies and methodologies associated with teaching and learning. Fraser, Loubser and Van Rooy (1990) consider teaching to be an intentional and reasoned act which takes place across differing contexts. They further state that at the core of teaching is the desire to enhance the success of learning. In turn, Anderson and Krathwohl (2001) view learning as a universal, life-long activity during which individuals change their behaviour to adapt to their environment. The learning activity is greatly improved if the learner is focused on benefiting from the teaching process. Biggs (2002) put forward the notion that teaching and learning should not be limited to the classroom environment, but should integrate

all aspects of teaching to support higher level learning. More recently Lai (2008) states that the teaching and learning environment, that is comprised of people (teachers and learners), technology, materials, classroom layout (or the virtual classroom) and the environment, is central to the pedagogy.

The following section explores how teaching and learning theory has developed over time to accommodate different educational approaches to learning. Teaching and learning theories are grouped into broad categories: behaviourism, cognitivism, constructivism and social constructivism. Each of these approaches to learning is briefly described as well as how they influence the choice of technology solution in relation to learning.

2.4.1 A chronological view of teaching and learning theories

Behaviourists, such as Skinner and Tennant, assumed that behaviour was shaped and moulded according to measured and objective standards. Immediate feedback, which reinforced positive responses by giving a reward or dissuaded negative stimulus by meeting out punishment, was employed to reinforce a correct response (Dabbagh, 2006). Facts, concepts and theories had to be learnt and learners had to be able to demonstrate acquired procedural skills. Knowledge and skills were transferred as learned behaviours, relying on extrinsic motivation in the mastering of the required skill set. Earlier computer-assisted-instruction (CIA) capitalised on this learning pattern and was used by teachers to reinforce learning, keep track of performances and provide feedback to those involved in the process (Dede, 2008). Factual knowledge was emphasised in these programs by repetitive drill-and-practice exercises. Used today, this form of computer-assisted-instruction, will most likely be found lacking as a technique in the current curriculum.

Cognitive theorists, amongst them Piaget, Hutchins and Wenger, advocate an approach which focuses on *internal cognitive growth* with the pedagogical focus being the *transmission of information* (Conole, et al., 2004). Today the power of ICT is harnessed to create learning connected opportunities which are rich in resources, where knowledge is shared and cognition distributed.

The Constructivist theory is based on the assumption that the learner will self-instruct according to his level of awareness and mastery. This theory is further based on the supposition that learners discover skills through experimentation and practice. Earlier learning theories mainly focused on the progress of individual learning and the acquisition of cognitive skills whilst neglecting the social dimension (Chan & van Aalst, 2008).

During constructivist learning activities teachers are encouraged to act as *guides* and learners as *sense makers.* The role of the teacher must be altered from *authoritative* to *collaborative*. Different components of constructivism can be emphasised and a parallel can be drawn between the radical and social aspects of this theory. Von Glaserfeld (1996), supported by Dabbagh (2006), stipulates the underpinnings of both aspects as follows:

- knowledge as a whole, not only the learner's subjective knowledge, is deliberated;
- methodological approaches are required to be more reflexive;
- the focus of the learner concern is broadened to include cognition, beliefs and conceptions of knowledge;
- the focus of teacher concerns includes diagnostic skills, beliefs and personal theories;
- others have realities independent of our own and these realities cannot be accepted as being fixed and
- an awareness of the social construction of knowledge.

Alessi and Trollip (2001) direct designers of constructivist learning events to create educational environments that enable the construction of knowledge. They suggest ways of accomplishing this goal and emphasize the *actions* and *thinking* of learners in the process of *active learning*. They advocate the use of discovery or guided approaches to learning which in turn are anchored in the real world, thereby drawing on authentic learning environments.

The social constructivist theory relies heavily on the collaborative nature of learning, encouraging co-operation amongst learners often resulting in many group work activities.

Variables impacting on the effectiveness of the group include size, dynamics, gender, cultures, language skills and levels of competence in the set task. During a collaborative learning event each individual member of the group has the opportunity to add value to the final product (Panitz, 1997). The collaborative approach has a lot to offer due to its rich history of theory, research and use within the classroom. Collaboration maximizes learning, which in turn ensures healthy cognitive and social development, amongst other many other important instructional outcomes (Johnson & Johnson, 2000).

In short, *behaviourists* believe that learning can only be measured in altered behaviour whereas *cognitivists* believe that learning occurs when learners add new concepts and ideas to their cognitive structure. In contrast, constructivists hold forth that learners individually construct knowledge for themselves. All three learning theories have significant implications when designing learning events and activities (Reddi & Mishra, 2003).

In Table 2-1 below, Christensen (2001, p. 4) gives a comparative summary between major learning perspectives by looking at motivational and instructional strategies and labelling the role of learner as performer, processor, explorer or collaborator. She neglects to state how she perceives the role of the *teacher* but does refer to the role of *instruction*. This comparison does not take into account the changing role of the teacher as *instruction* is a *performed action* whilst a *teacher* is in essence a *facilitator*.

Table 2-1: Major Learning Theory Perspectives (Christensen, 2001, p. 4)

	BEHAVIOURISM	**CONSTRUCTIVISM**	
		COGNITIVE	**SOCIAL**
MAIN METAPHOR	The Black Box - focuses on inputs and outputs (behaviours); and not worried about what is happening inside	The Rhizome – focuses on root-like (unlimited) growth and development through interaction with environment and/or others	
NATURE OF KNOWLEDGE	Knowledge is "out there" and needs to be acquired and used	Knowledge is individually "constructed" through interaction with environment and others	Knowledge is "co-constructed" through interaction with others
ROLE OF LEARNER	Performer—acquires and demonstrates use of knowledge	Explorer—interacts with environment and others to make individual discoveries	Collaborator—creates meaning through social negotiation, interaction and cooperation

		CONSTRUCTIVISM	
ROLE OF INSTRUCTION	To transmit knowledge by managing and supervising the learning environment	To provide experiences and resources so students gain personal understanding	To provide meaningful social contexts for co-constructing knowledge
MAIN INSTRUCTIONAL STRATEGIES	• Present knowledge • Define actions • Correct mistakes	• Create puzzlement • Provide opportunities to experiment and articulate ideas	• Create social learning environment • Provide opportunities to interact and articulate thinking
MAIN MOTIVATIONAL STRATEGIES	Provide positive (or negative) reinforcement	Stimulate interest or curiosity in an anomaly	Create authentic, inherently challenging situations

These are not *unified theories* but rather *a collection of theories* that are distinct from one another, but associated by a common set of fundamental assumptions (Dede, 2008). Today all learning theories propose that learning involves mental processes but they differ on how best to encourage these processes and in how to evaluate them effectively. Both behaviourism and constructivism offer definite ideas of how instruction or rather scaffolding of learning should occur and agree that existing knowledge should be used as a foundation from which to advance constructs. New knowledge is evaluated in a concrete way to assess whether learning has taken place. All learning implies that *information* has been transformed into *knowledge*. This transformation takes place according to an absolutely individual process which is based on the learner's foreknowledge, experience and cognitive potential (Lauridsen, 2009).

2.4.2 Principles of learning

In a recent study Callaghan (2008) researched teaching principles which contribute to the success of learning. She selected four well documented sources and compiled a list of the ten most common teaching principles. These sources cover the fields of Higher Education, Primary and Secondary Education and online instruction with regards to distance education. Table 2-2 below presents the ten teaching principles researched and then re-applied to different educational

settings (including online teaching and learning, computer-assisted teaching and learning, teaching and learning in various subject fields).

Table 2-2: Teaching Principles Summary and Descriptions (Callaghan, 2008 p. 93)

PRINCIPLE	DESCRIPTION
Activity	The learner should be actively involved in the learning process.
Motivation	This includes extrinsic as well as intrinsic motivation, intellectual excitement and the demand for quality.
Socialisation	Learner-learner contact and the social context.
Diversity	Recognising and incorporating learner differences in the learning process.
Contact	This entails learner/facilitator/management contact and learner support.
Control	The monitoring of the learning process as well as assessment and feedback.
Planning	Well organised learning processes and material.
Perception	Linking learning material to previous experiences and to real life applications.
Totality	Presenting a holistic picture of integrated learning content. Help students to *organise their knowledge*.
Science	Subject matter built on existing knowledge of the topic and presented based on sound teaching and learning practices.

Untangling the principles of teaching that contribute to the success of learning becomes more complex when one harnesses the emerging technologies in teaching and learning. A significant contribution to this area of interest is the study conducted by Kerns, Elhoua, Sterling, Grant, McGowan, Rubash, Neelly and Wolfe (2005). They found that all the principles mentioned in Table 2-2 above, can be amplified with the use of appropriate technology that aligns the teaching and learning activities and relevant assessment tasks which gauges the learner's processes of meaning construction.

Contemporary beliefs regarding learning have moved away from knowledge transmission models which advocate the mere imparting of information to generative knowledge models where knowledge is negotiated between parties and transformed learning occurs (Chan & van Aalst, 2008). In the process of meaning-making, technology is roped in to support the communication and co-construction of new knowledge resulting in new communities of practice (Lave & Wenger, 1991).

Meaningful social contexts for co-constructing knowledge within social learning environments provide opportunities to interact and articulate thinking. Technology offers the means to access and interact within these social environments. Knowledge is co-constructed in collaboration with other people during a process of social negotiation, interaction and cooperation which creates a shared understanding. The main motivational strategies employed are the stimulation of interest and curiosity and the creation of authentic, inherently challenging situations which give rise to transformative learning.

Technology, due to its inherent characteristics, has the ability to represent content, engage with learners, model skills and asses a learner's progress, this all resulting in more effective and quality learning. A particular technology can provide affordances that concurrently influence the content, the pedagogy and/or the assessment of a curriculum (Dede, 2008; Voogt & Knezek, 2008a). These theories of learning inform the goals and models associated with instruction, which in turn influence perspectives on the use of technology in teaching and learning (Dabbagh, 2006; Dede, 2008). To better understand how far we have progressed in integrating technology into our learning and where we are headed, we need to reflect on where it all started.

2.4.3 ICT in Education. Where did it all start?

When the computer was first used in the classroom, it was viewed as a type of assistant taking over some of the teacher's tasks. With the convergence of various technological systems such as satellites, video and audio and advances in computer hardware and software, a powerful new medium was created with capabilities to transform teaching and learning. Electronic learning materials could be accessed and delivered through the internet, CD/ROMS or the television giving rise to the term e-learning (Voogt & Knezek, 2008a). *Elearning* was initially more suited to the field of *distance learning*, as materials could be easily distributed through the post or the internet but had limited uses in classrooms.

In the early 1990's the learner computer ratio was still very low in the school environment and access were to computers was limited to dedicated computer rooms. Consequently it was very difficult for teachers to integrate electronic media and instruction into the curriculum. Increased

ICT penetration rates in schools, as a direct result of more affordable hardware and software, as well as better training opportunities for teachers affected change on a larger scale (Souter, 2011).

Today the software and hardware used *in* class directly reflects the tools used daily in the world *outside* the school environment. The technologies, as illustrated in Figure 2-3 below, depict a wide spectrum of ICT devices and their functions which can be used for capturing, interpreting, storing and transmitting information.

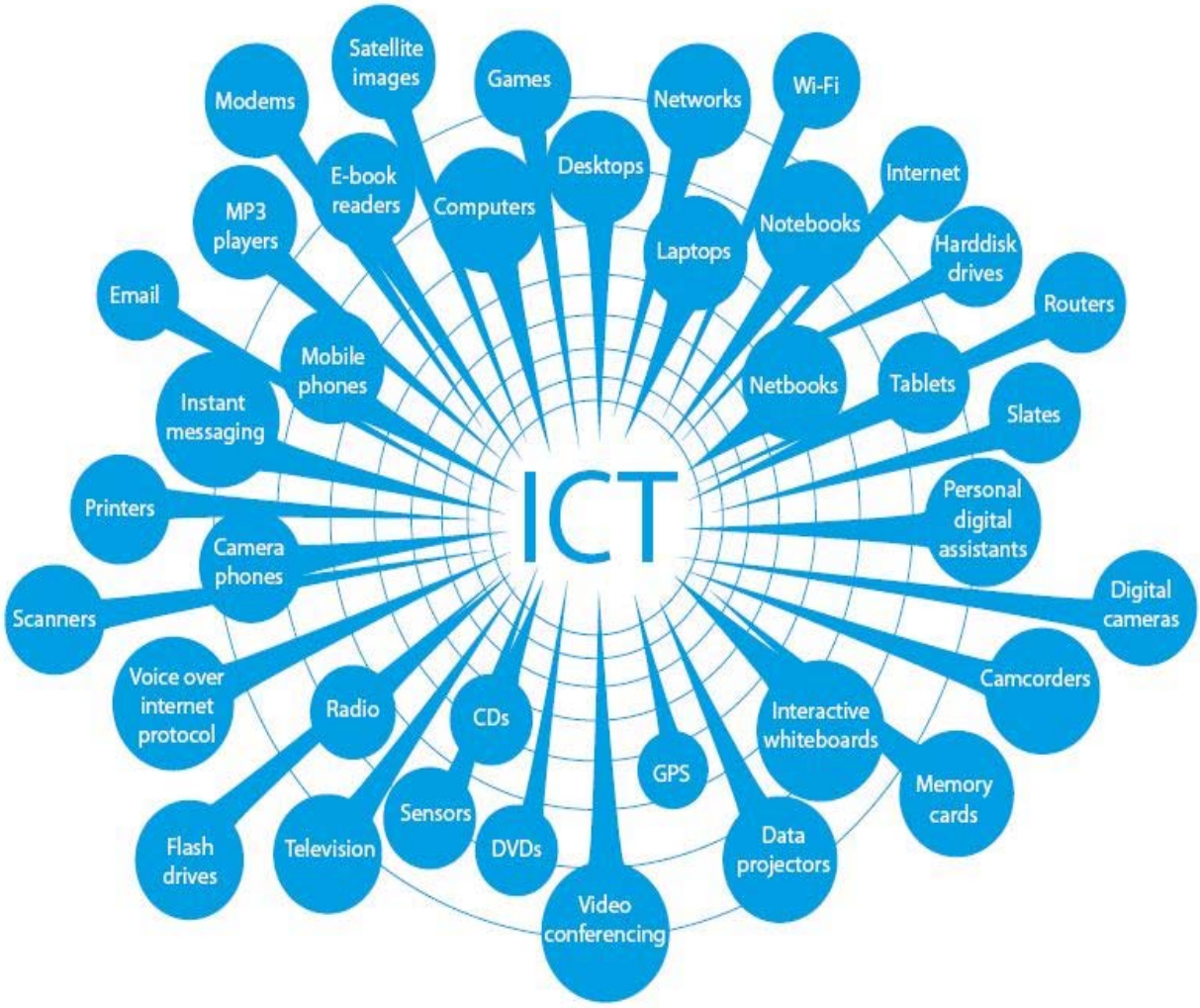


Figure 2-3: ICT spectrum (Anderson, 2010, p 13)

Teachers found the improved instructional design of materials, which better accommodated different learning styles, resulted in greater learning benefits for the end users as individualised

instruction was possible. The rich interactive multimedia materials, which utilised more than one media simultaneously, stimulated interest in learning and held the attention of the learners for a longer period of time. Assessment and immediate personalised feedback resulted in self-paced and self-directed learning (Anderson, 2008) which allowed the user control over the *when*, *what* and *how* elements. Learners could thus dictate their learning journey, resulting in a greater uptake of the learning aids (Reddi & Mishra, 2003).

Over the last few decades, information technology has become more mobile, personal and connected (Traxler, 2009). Daily inventions of new technologies provide a major challenge to implementing educational strategies and have the potential to change our concept of education as it is no longer limited to one physical environment (Anderson, 2008; Kukulska-Hulme, Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2009; Voogt & Knezek, 2008b). It is therefore imperative to explore the affordances offered by these new technologies in order to understand the potential and implications for teaching and learning and how these affordances impact upon the continuing professional development of teachers. As a result of this ever-changing technology, new literacies which include and elucidate upon perceptions and understandings linked to new modes of presentation and representations are changing the emphasis and the balance in terms of the production, content and meaning of educational resources. This shifting landscape is often not understood by teachers and researchers (Cox, 2009).

Recently, Beetham and Sharpe, in the introduction to their jointly edited *Rethinking Pedagogy for a Digital Age*, proposed that bridges need to be built between technology and the transformation of education through "a reconsideration of the pedagogical practices that underpin education" (Beetham & Sharpe, 2007, p. 1). Even in 2007, such bridges were still envisioned as a future occurrence and not as a fait accompli.

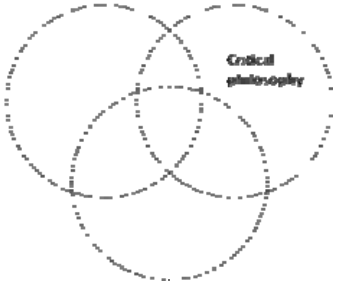
2.4.4 Summary of ecosphere: Professional and organisational learning

This section provided a chronological view of how the teaching and learning theories developed and covered the main tenets for each. This process resulted in the formulation of a table of comparison between the major theories of *behaviourisms* and *constructivism*. Ten principles of learning that contribute to the success of learning aligning activities and assessments were

presented. The integration of ICT in the classroom was covered and the development of new literacies, due to the pressure that emerging technologies exert on teaching and learning theory, was highlighted.

The next section will look at the remaining sociosphere and the role of critical philosophy in addressing the tacit knowledge of innovative teachers in their communities and society as a whole.

2.5 SOCIOSPHERE: CRITICAL PHILOSOPHY



The role of critical philosophy in this study is to understand the complex character of technology within a social setting such as a school environment. Friessen (2008) finds that critical theory remains largely unrecognised and underutilised in areas of practical research on the use of ICTs in educational institutions. Critical theory questions the established power relations within social settings, recognises the true interests of advantaged groups and privileged individuals but actively promotes the empowering of the restricted members of a society (McLaren, 1998). Critical theory is not meant to only highlight the negative but it can also be used to reveal positive and hopeful aspects of life and therefore it is imperative to take the innovative teachers' position in their communities into account when considering any aspect of technology use in education. Critical philosophy thus considers the cultural-historical context of innovative teachers for it takes into account issues of empowerment captured within pedagogy. It is in this cultural-historical context that critical pedagogy raises the consciousness and questions the value of *educational theory* over the value of *educational practice.*

2.5.1 Cultural-historical context

The expansion of the expert knowledge base is central to the concept of empowerment with Henry Giroux, a leading figure in the field of critical pedagogy who currently holds the Global Television Network Chair in English and Communications, remaining steadfast in the belief that *knowledge must be shared through education and other technologies of culture*. He maintains that shifting historical contexts challenge dominant teaching practices and that there is a more pronounced global pessimism today. He further challenges teachers to become engaged intellectuals who actively linking pedagogy to social change (Giroux, 2003). The cultural-historical context is echoed in studies by Paolo Freire who holds forth that symbolic meanings have particular power and relevance today and the illumination of these has to be an act of

"historical un-forgetting" (MacLaren, 2000, p.16). Freire's viewpoint reinforces our own belief that our knowledge about education is particularly bound to context (Carr & Kemmis, 1986). The learning curriculum needs to reflect societal changes and then only can it be successful in assisting in the transformation of the workplace and facilitating the rise of new occupational areas and the decay of others.

The manifestations of educational technology in the social learning domaine can reveal dependencies on culture, history and embedded power relationships (Nichols & Allen-Brown, 1996). The hidden effects of teaching and learning can be uncovered by objectively searching for clues to unlock the mystery surrounding the infatuation with new technology and its use in educational settings and the development of teachers' tacit knowledge that encapsulate their inherent personal belief systems (Brown, 2009).

The concept of *tacit knowledge* can be liberating as knowledge workers become empowered but it can also easily become a thinly disguised veil for the abuse of power. Bordum (1999) calls for *tacit knowledge* to be *made explicit* as the notion of non-communicable knowledge can pose a threat to rationality. If tacit knowledge remains encoded and inaccessible, it can lead to the abuse of power where knowledge is purposefully withheld in order to manipulate others. However, once open and accessible to all, knowledge can result in the growth of other individuals within an organisation.

Anderson (2008) points out the implications for education, when attempting to harness technology in the knowledge era, requires a deeper understanding of the tools and their contexts. These contexts stretch well beyond the limits of the educational milieu to include the social contexts as well. Therefore the need to understand the underlying influences within the overall system is an essential tenet to the concept of the information society.

2.5.2 The information society

It is a widely recognised fact that our society is changing from *an industrial* to *an information* society (Voogt & Pelgrum, 2005). This shift necessitates the development of skills to sift, manage, process and disseminate large amounts of information with the use of ICT. In an effort

to classify the key skills needed to encourage the capacity of "learning to learn" Voogt and Pelgrum (2005) indicate the desire of education to journey this transition. They show the pedagogical approaches in the industrial and information societies by using the words *less* and *more* to indicate this shift. Table 2-3 below provides an overview of the differences in educational approaches as manifested in the industrial and the information society.

Table 2-3: Overview of pedagogy in the industrial versus the information society (Voogt and Pelgrum, 2005, p. 158)

ASPECT	LESS (Pedagogy in an industrial society)	MORE (Pedagogy in the information society)
Active	Activities prescribed by teacher Whole class instruction Little variation in activities Pace determined by the program	Activities determined by learner Small groups Many different activities Pace determined by individual
Collaborative	Individual Homogeneous groups Everyone for self	Team work Heterogeneous groups Support each other
Creative	Reproductive learning Apply known solutions to problems	Productive learning Find new and innovative solutions to problems
Integrative	No link between theory and practise Separate subjects Discipline based Individual teachers	Integrative theory and practice Relation between subjects Thematic Teams of teachers
Evaluative	Teacher directed Summative	Student directed Diagnostic/ Formative

ICT can be implemented to facilitate the demands and competencies as identified in Table 2-3 above. It is therefore essential to incorporate these said elements into learning environments if one wishes to foster the development of the listed competencies. The Horizon report (*The Horizon Report*, 2006) states that skills essential to critical thinking, research and evaluation of content and to cultivate creative demonstration of mastery or knowledge, need to be developed. These particular skills are reportedly underdeveloped in many students. In the pedagogical environment *group work* is on the increase and this specific teaching method asks that pupils be able to find, navigate and assess relevant information from the array of resources available both on- and offline. As these *crucial skills* are acquired and honed, the entry barrier into the e-World

slowly diminishes and this, in turn, creates more opportunities for learners. The process of knowledge acquisition, sharing and reflecting is continuous and life-long for every human being (Garai & Shadrach, 2006, p.13).

Pinter (2008) discerns three closely interrelated approaches to the information society as presented in Table 2-4 below. These approaches differ in three aspects namely: timeframes, advocates and the content.

Table 2-4: Three approaches to the information society

DEFINITION	ONSET	ADVOCATES	CONTENT
Theoretical (descriptive, exact)	After World War II, up to and including the sixties and seventies	Theoreticians, social scientists, researchers	Technology Employment structure Economy Spatio-temporal structure Cultural values and norms
Political (promotional Program-like)	From the nineties of the 20th century forward	Politicians, technocrats, entrepreneurs and expert advisors to business and governments	Political program "Revolution from above" Modernization as the main objective Those lagging behind shall drop out
Everyday prosaic (amorphous, utopian)	Not before 2010 or 2020 forward	Mainstream media, participants of utopian controversies, sci-fi movies	Ubiquitous and total information and communication technologies

When investigating the phenomenon of innovative teachers it is therefore necessary to not only include the visible aspects of technology integration but also to expose the underlying social relations and the political agendas, especially towards development.

For the purpose of this study the concept of *information society* needs to integrate all three approaches; theoretical, political and the everyday prosaic. Technology plays a central role in the information society along with the concepts of a *networked society* and a *network economy*. The use of technologies also results in new types of communities; of continuous adaptation to the ever-changing environment; of new kinds of inequality; and globalisation. The political agenda promotes the narrative for development as is demonstrated in the following extract from a recent presentation articulating the South African Vision for ICT in 2015:

> "South-Africa is an inclusive information society where ICT-based innovation flourishes. Entrepreneurs from historically disadvantaged population groups, rural communities and the knowledge-intensive industry benefit and contribute to the well-being and quality of life of our citizens. South-Africa has a strong national ICT brand that captures the vibrancy of an industry and research community striving for excellence, characterised by innovative approaches to local and global challenges, and recognised for its contribution to the economic growth and well-being of our people and the region" (Maredi & Neethling, 2010, p. 12).

To accommodate the above vision the following strategic objectives were set:

- Strengthen research activities at Higher Education Institutions and Research and Development institutions to create recognised world-class research competencies in the country.
- Create strong and robust innovation chain which results in increased ICT patenting, improvements in digital divide indicators and a vibrant hi-tech ICT Small Medium and Micro Enterprise (SMME) industry and
- advance human resource capacity to achieve a marked increase in the ICT skills base thereby enabling focused research and innovation.

It is towards these strategic objectives that it becomes imperative to not only look at what is happening in the classroom with the technology, but to also consider the wider social contexts of the teacher that influences the progress and the type of research required in this field.

> "The key phenomena might be the visible diffusion of information and communication technologies, the continuing fundamental socio-economic transformations, the political programs for development, or, finally, the results of scientific research being carried out in this field" Pinter (2008, p. 222).

2.5.3 Summary of sociosphere: critical philosophy

This section looked at the role which critical philosophy plays in exposing the undercurrents of power that drive development agendas. In this regard cultural-historical contexts challenge dominant teaching practices and emphasise the importance of articulating tacit knowledge to avoid the potential unequal positions of power in the education space. The move from an *industrial* to an *information* society has resulted in the networked and connected members of that society sharing in the advancement of and the burden for skills development placed on the education system.

This chapter made use of a conceptual framework for literature review to examine the background of teaching and learning theory and the use of emerging technologies in schools in relation to new innovative pedagogical practices designed to engage both teachers and their learners in the process.

The three areas considered for review were derived from Gartner's *Interfaces of Adam*. They were the techno-, eco- and sociosphere (Zandvliet & Buker, 2003). The *technosphere* takes into account the affordances potentially offered by emerging technologies. The *ecosphere* demarcates the learning milieu and the ways in which technology is appropriated within the learning context. The *sociosphere* encircles the area of critical philosophy, informing the discourse that guides decisions and actions within the school education system. A brief overview of the literature review is provided in Table 2-5 below.

Table 2-5: Overview of literature review

Gartner's Interfaces of Adam	Area of research	Focus of literature review

Technoshpere	Emerging technologies	Characteristics of emerging technologies: Expanding new learning opportunities (learn anywhere anytime); Creating new learning scenarios in traditional contexts (tools for learners focused on improving learning in schools) and Improving teaching and learning process (tools for teacher focused on improving teachers' classroom teaching (Hinostroza, et al., 2008, p 90). Modes of curriculum delivery E-learning Mobile learning Blended learning
Ecosphere	Organisational learning	Presented a chronological view of teaching and learning theory Principles of learning ICT integration in education
Sociosphere	Critical philosophy	Cultural-historical context Information society Vision for ICT in South Africa

Chapter 3 presents the data set and the background information to the Microsoft Innovative Teacher Forum from which the research participants were sourced. The researcher explains the application of the *Straussian Grounded Theory Method* with its limitations and describes the qualitative instruments that were used to gather data. Finally, data analysis strategies are shared and consideration is given to the emerging themes for this study.