THE CHALLENGE OF AUTHENTIC COMPUTER APPLICATIONS TECHNOLOGY EDUCATION IN PRACTICE

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The challenge of authentic
Computer Applications Technology education
in practice

by

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PRETORIA

DEDICATION

I would like to dedicate this work to

My husband Christo

My children, Suné and Henro

My loving parents, Sonette and André

Without your patience, understanding, support and most of all

your prayers and love,

the completion of this work would not have been possible

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DECLARATION OF AUTHORSHIP

I declare that this dissertation, which I hereby submit as partial fulfilment of the degree Magister Educationis at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

Christel Venter
April 2016

ETHICS CLEARANCE CERTIFICATE

DECLARATION OF OBSERVING ETHICAL STANDARDS

The author, whose name appears on the title page of this dissertation, has obtained, for the research described in this work, the applicable ethics approval. The author declares that she observed the ethical standards required in terms of the University of Pretoria's *Code of ethics for researchers and the Policy guidelines for responsible research*.

Computer technology has invaded almost every sphere of our lives and it is, therefore, inevitable that it would feature as a major component of education. I am the Head of Department and Computer Applications Technology (CAT) teacher and have a passion for the subject because it is meant to equip learners with knowledge, skills, values and attitudes to create, design and communicate information in various formats. It also makes it possible for learners to collect, analyse and edit data and to manipulate, process, present and communicate information to various sectors of society and thus provide solutions to real life problems (South African Department of Basic Education, 2011, p. 7). Although the National Curriculum Statement has explicated this as the purpose of Computer Applications Technology, the supporting curriculum documents and the teaching and learning materials provided, seem to regard the subject as a technical one that requires a rather technicist teaching modality.

This discrepancy prompted me to engage in an investigation to ensure that my education practice will be fulfilling that indispensable aim of CAT education of ultimately utilising computer technology software applications to solve real-life problems.

My literature review revealed that a philosophical perspective is crucial to our understanding of education. Education pivots around learning, which is a personal and individual act of pursuing our ontological authenticity (Barnett, 2007): finding out who we really are, and in the process, making sense of everything about real life. This exposed the vital relationship between authentic learning (Lombardi, 2007) with its constructivist underpinning (Von Glasersfeld, 2008) and how we as humans naturally learn through experiential learning (Kolb, 1984) according to the natural functioning of the brain (Zull, 2011).

I have engaged in a qualitative participatory action research project in order to ensure my engagement in, and improvement of, an authentic CAT education in practice. My research participants were Grade 11 and Grade 12 CAT learners as well as my fellow CAT educators with whom I conducted semi-structured interviews.

My initial investigation revealed a general complacency about complying to the current generally accepted required technicist CAT education practice from teachers and my learners' viewpoint. This irreconcilability with the intended aim of CAT education compelled me to take

on the challenge that faced me head-on. I had to sacrifice the security of all the provided support materials, through which I was in control of my good teaching, and took the courage to immerse myself in the daunting task of the professional practice of facilitating authentic learning.

It was difficult at first, and only through much effort and experience did it slowly become easier. Even though my CAT education in practice, even now, is far from perfect, my commitment to achieve my aim in accordance with the aim of CAT education, was a life changing experience to me and my learners, and impacted my school, the district and the wider community in ways that went beyond my expectations.

Key words:
- Computer Applications Technology education
- Authentic education
- Authentic learning
- Facilitating authentic learning
- Personal transformation of the highest order

TABLE OF CONTENTS

CHAPTER 1

BACKGROUND, RATIONALE AND RESEARCH CHALLENGE

CHAPTER 2
LITERATURE REVIEW

CHAPTER 3
RESEARCH DESIGN

CHAPTER 4
EMPIRICAL RESEARCH

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 6

BIBLIOGRAPHY

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

BACKGROUND, RATIONALE AND RESEARCH CHALLENGE

From the standpoint of the child, the great waste in school comes from his inability to utilize the experience he gets outside while on the other hand he is unable to apply in daily life what he is learning in school. That is the isolation of the school – its isolation from life."

(Dewey, 1915)

1.1   INTRODUCTION

Before the age of computers, humans had to their own computing. A brief history of computers shows this change (Meyers, 2001; Alton, 2011; Zimmerman, 2015). The abacus, a wooden instrument with bead, that humans use to calculate, was probably the first computer and which came into existence in Mesopotamia about 2 000 years ago. In 1642, the digital computer consist of mechanical dials appeared and in 1822 a steam-driven mechanical machine made computing easier and faster. In 1890, the punched-card computer, which could 'read' the information represented by holes punched into cards, was developed and the mechanical card-reading computer was replaced by its first electronic counterpart around 1942. With the discovery of magnetic-core memory and transistor circuits in the 1950s, the memory capacity and operating time of computers increased dramatically. In the 1970s, a major breakthrough took place. The microchip was developed and the large computers that were expensive and used only by large companies and institutions could eventually be transformed into the personal computer (PC). The development of the "floppy disk" allowed data to be shared between computers, however one of the most significant breakthroughs was the development of interconnectivity between multiple computers and other hardware through the Internet and the World Wide Web. From then on, there was pressure to produce smaller, more commercially viable and efficient computers with increasingly more memory and faster processing speeds. Around 1975 the production of basic software for computers started and computer operating systems came into being. Around the 1980s the simultaneous decrease in size and increase in memory capacity and processing speed became prominent developments, thus allowing for the development of the desktop computer to the laptop and later the notebook computer. The quest to combine the cordless telephone and computer to increase mobility produced smaller devices,

CHAPTER 1: BACKGROUND, RATIONALE AND RESEARCH CHALLENGE

larger memories and increasing operating speeds, transformed the computer into the smartphone – an all-inclusive, singular computer with the tablet as its powerful counterpart. The turn of the century brought Wi-Fi, allowing Internet access without wires. Soon thereafter, the production of computer applications (Apps) computerises the execution of a multiplicity of tasks (which was normally required to be fulfilled by the human being) – trivial as well as vital ones – to increase exponentially. One of the most recent developments is the Cloud, which allows for the storage of that which can be accessed through the Internet on servers instead of on a computer or smartphone. This enlarges the storage capabilities of a device to be, effectively, as large as the Cloud access there to – which is essentially the entire Internet, including an inconceivable amount of information (data) and an increasing abundance of computer applications – can be remotely achieved.

These developments are, no doubt significant and need to be considered with regard to Computer Applications Technology education.

1.2 WHERE ARE WE NOW?

Computers are continually and increasingly reinventing us and the world in which we live. They determine the way we live, work and play. They have penetrated, and are governing, almost every level of our lives in all domains, in the most powerful way. However, this is only possible through the functional interconnectedness that the technology has brought. The extent of the marriage between technology and the Internet has become a force that is difficult to contemplate. It is the utility value of the computer that has become paramount. The following describes some of the powers encapsulated in a computer, a device that may be as small as a smartphone:

- to access, collect, organise, analyse and utilise data and information of virtually all types and in virtually all formats;
- to share that data and information to communicate in a multitude of ways through emails, chat rooms, web sites, blogs, videos (YouTube) and the many other browsers and platforms of social media, such as Facebook, MySpace, Twitter, LinkedIn and Google-Plus+;
- to enhance one's working and private life;
- to connect instantly to a globalised world through the Internet;
- remotely to access a virtually infinite storehouse of information through the Internet;
- to capture information data and information in various formats: (i) cold, impersonal, objective numerical and text data; (ii) diverse, colourful, still, visual images and images with

minute movements; (iii) extremely intricate and complex animation, creating a virtual reality that is increasingly difficult to distinguish from actual reality; and (iv) recorded real-life videos and real-life and real-time events that transcend all kinds of previously inaccessible barriers that may expose the most sensitive private lives of mega institutions and single individuals – all streaming through cyberspace without the necessity of acquiring consent;

- to offer instant accessibility to virtually any topic, anytime, anywhere and by anyone at the touch of a button, providing the technology is available.

With the ever-increasing availability of more complex and dynamic operating systems, the use of a computer is limited only to the imagination and technical knowledge of the user. Nevertheless, it is the power and freedom that it has brought to each individual that is so significant and so well stated by Grulke (2000, p. 3) as far back as even fifteen years ago:

> This is the revolution of you, me, and the person next door ... The revolution of the empowered individual. Never before in the history of the world, have ordinary people held as much power, as much freedom, as much opportunity to accomplish extraordinary things. Never before have ordinary people been as capable of changing the world, of seizing the future and making it happen (Grulke, 2000, p. 3).

This leaves no doubt as to the value and importance of education in the field of computers.

1.3   COMPUTERS AND ITS CORRESPONDING EDUCATION

The extraordinary advances in technology have, and will in the future, contribute profoundly to the enhancement of our lives. Technology is not only convenient, but has also become an inextricable part of our lives without which we cannot live.

Considering that the use of computer technology occurs in almost every sphere of our lives, it is important that everyone has, at least, a basic knowledge of computer technology. The increasing demand for computer literacy us ordinary people going about their daily lives has compelled governments all over the world, including the South African Department of Education, to include this in their school curricula. From the mother discipline of Information and Communications Technology (ICT), the school subject of Computer Studies was launched in 1979. After a number of changes to its nature, and going through a few versions, ICT established into the subjects Information Technology (IT) and Computer Applications Technology (CAT), which

CHAPTER 1: BACKGROUND, RATIONALE AND RESEARCH CHALLENGE

were introduced through Outcomes Based Education (OBE) in 2006. Another iteration of the subject CAT was introduced by the new Curriculum and Assessment Policy Statement (CAPS) in 2011.

1.3.1 My introductory experiences and progress as a CAT teacher

I qualified as a teacher with specialisations in English, Computer Applications Technology and Remedial Education on Secondary School level. After my marriage, I needed a teaching position in the area where my husband was stationed and the only permanent teaching position that was available at the Secondary School in the area was the CAT position for Grades 10, 11 and 12. I had no formal experience in ICT and especially not in Computer Applications Technology. At that stage, I had an interest in these aspects that anyone, who wants to live efficiently in a technologically infused world, needed to have. In view of this background, I was somewhat surprised that I was considered for a teaching position in a subject I had no experience in. However, my personal circumstances and the fact that I am always willing to learn, prompted me to accept the position.

I had a shaky start − as anyone in my position would have had − but I was determined to make a success of my job and worked hard to achieve that end. My redemption came in the form of helpful teaching and learning materials that were provided in various forms and which, over time, improved in volume, variety, quality, and increasingly, in ready-made electronic formats, which I could use immediately. I realised how privileged I was to have them provided because producing them myself, and to the quality and standard that they are, would be practically impossible. In fact, they were so effective that I, sometimes, could successfully continue with a lesson without always fully understanding its content. This needed to be rectified immediately.
I must have succeeded in this endeavour. I have been teaching Computer Applications Technology to Grade 10, 11 and 12 learners at the same school for the past ten years and have developed a keen passion for the subject I teach as well as the learners in my classroom. Subsequently, my own professional development became my pursuit. With the introduction of the new CAPS curriculum and all the associated and supportive teaching and learning materials that were provided, I ensured that I comply with all the requirements and the suggested pedagogical interventions they were provided for. My committed diligence in this regard must have been the reason that I was promoted to the Head of Department: Computer Applications Technology after a relatively short while, assumingly, as a reflection of my progressive level of

expertise and leadership in this field of education within the Further Education and Training level of schooling.

1.3.2 My affinity towards CAT education

My affinity towards Computer Applications Technology education is first its currency in terms of the way in which the world we are living in is characterised by computer application technologies. It is fulfilling so many tasks – some simple but others very complicated and labour intensive – which we had to execute ourselves in the past. In that sense, it has made and is increasing making life so much easier, to the extent that it is likely that we may not be able to survive without it. It is also current because we are actually experiencing their continuing exponential development that astounds us every now and then.

But what is most attractive to me is that it is so relevant. It was borne from and forms part of the broader knowledge domain of Information and Communication Technologies (ICTs) which is such an integral part of our lives. It equips learners with knowledge and skills to access, create, design and communicate information in various formats. It also makes it possible for learners to collect, analyse and edit data and to manipulate, process, present and communicate information globally to all sectors of society. But the most striking value of Computer Applications Technology education is contained in the acknowledgement of the CAT curriculum in CAPS which is the acknowledgement in its description: "Computer Applications Technology is the study of the integrated components of a computer system (hardware and software) and the practical techniques for their efficient use and application to solve everyday problems" (South African Department of Basic Education, 2011, p. 8).

1.3.3 Achieving the CAT education aim

I apparently have developed expertise in my CAT education practice in fulfilling its aim and was rewarded for it, as explained in a previous paragraph. One of the main contributors to this achievement was, no doubt, the CAT curriculum compilers who supplemented the CAPS document with excellent supporting documents and ready-to-use digital teaching and learning materials that are provided to the teachers and recommended textbooks are also supplemented in such a way. With the necessary knowledge of the technology and the way in which the supporting documents and teaching and learning materials are compiled and its use

recommended and/or implied, it was relatively easy to gain a sufficient level of knowledge and skills to become a successful teacher in CAT.

Having worked diligently at my professional development within this context and reaching the consequent level of expertise may have caused a kind of complacency to slowly take over. Although the Performance Assessment Tasks (PAT) are exciting, the idea of being able to accomplish it only after the teaching of several fragmented activities in small steps (while the target PAT is unknown) did not seem to me to cause the expected excitement when learners needed to execute it, neither with the success I expected from them. Even though it might not have been the intention, the execution of the many fragmented activities that included the same questions, has increasingly created the perception of unnecessary repetition especially from the learners' side. If this might cause a sense of boredom and even apprehension amongst learners – as I have become aware of in my CAT classes – it cannot be beneficial for the attractiveness of the subject for learners in the way it is taught. Within this context and despite the digital age we are living in, I tend to agree with educationists like Gardner (2008, p. 17) that "current formal education still prepares students primarily for the world of the past, rather than possible worlds of the future", and with Matijevic (2014, pp. 94-95) that, "[I]n spite of new didactic theories and results of research in learning and teaching psychology, schools are still dominated by methodological scenarios more suited to the previous than the current century".

The fact that CAT is not one of the subjects on the designated list of subjects required for university entrance is, according to Chiles (2012), the cause that CAT learner numbers are relatively low to start off with. But what is disturbing, he says, is that the number of learners taking CAT is "starting to decline", and I am witnessing that in my classes. I discovered that I am not alone in this experience. There may be a number of reasons for this, and Chiles (2012) is of the opinion that "chief of which is the difficulty of obtaining suitably qualified teachers". Through determination and commitment to fully comply with the suggested pedagogy so thoroughly supported by the provided excellent teaching and learning materials, I have become better qualified. In fact, I discovered – ass far as I could establish – that such a sustained compliance was the generally accepted pedagogy amongst qualified teachers. What is more is that my compliance was also recognised on such a level of expertise and even leadership by the corresponding authorities that had my promotion as a result. Besides the possibility of a shortage of qualified teachers, therefore, it is also likely that the decline in numbers of learners is also caused by the by the pedagogy in which the subject is expected and accepted to be taught.

CHAPTER 1: BACKGROUND, RATIONALE AND RESEARCH CHALLENGE

However, whatever the cause may be, my professional responsibility is to ensure that my CAT education practice will not be the cause of declining numbers of students, which CAT cannot afford, and this prompted my enrolment for a postgraduate degree as part of my professional development through the improvement of my CAT education practice.

1.3.4   A growing concern: What is education for?

I enrolled for a BEd (Hons) degree and during that time, I was exposed to a new awareness regarding the developments in education according to the challenges of the twenty-first century. There seems to be general consensus among many authors (like Liessmann 2006; Claxton 2008; Gardner 2008; Summerlee and Murray 2008; Education for change 1997; Gatto 2010; Matijević 2011, 2014 and many more) that today's education does not meet our learner's development needs that will enable them to flourish despite the perplexing demands of the twenty-first century.

Grounwater-Smith and Mockler (2009, p. 10) particularly warns about the increasing development of a compliance culture in education. They maintain that teacher professional development becomes increasingly 'training' orientated and expecting teachers to comply with instructional requirements, which may compensate for a lack in quality teachers. At the same time, such compliance makes both teaching and learning "quantifiable and easily measured or 'ticked-off' for quality assurance purposes", while the actual quality – benchmarked against international research results – may be questionable.

Claxton claims that the case for education to change is overwhelming: "It's education's core responsibility to prepare young people for the future, and it is failing in that duty" (Claxton G. , 2008, p. 184). There may be many reasons for this failure. Our learners who are surfing the Internet are exposed to an abundance of knowledge. This is of enormous benefit, as all of us may testify. However, especially within the context of education, it proposes a significant challenge:

- The amount of knowledge learners are exposed to is overwhelming. The main title of Weinberger's book (2012) epitomises this phenomenon: "Too big to Know".
- It causes not only an information overload but also a rapid increase of information ignorance – about that which I do *not* know.

- Knowledge is not only added at a dazzling speed, but it is also replaced – even on a level and in the domain of authoritative hard sciences – to the extent that "even for graduates, knowledge gained in a degree course is often out-dated even before graduation" (Dreyden & Vos, 2005, p. 31).

- Knowledge – especially on the Internet – is neither explicitly, nor necessarily validated as authoritative and/or credible especially because it is becoming increasingly "networked knowledge" (Weinberger, 2012, p. xiii) within which anyone and everyone can participate making it possible that for "every fact on the Internet, there is an equal and opposite fact".

- Weinberger (Weinberger, 2012, p. x) confirms that knowledge today "feels unbounded, overwhelming, unsettled, messy, linked and governed by our interests".

- Barnett (2012, p. 66) says we are living in a "supercomplex" world of knowledge of which there is "a multiplication of incompatible differences of interpretation".

- That is probably why the subtitle of Weinberger' publication calls for: "Rethinking knowledge now that the facts aren't the facts, experts are everywhere, and the smartest person in the room is the room" making his eventual comment within this context and in relation to education significant: "What we have in common is a shared world about which we disagree" (Weinberger, 2012, p. 182).

Since the acquisition of knowledge remains the focus of our education the decision about what to teach, may be perpetually subject to contestation. However, such a decision is inevitable and a limited selection of knowledge form the supercomplex whole becomes a curriculum requirement. The same challenge accounts for the limited selection of skills that are associated with the chosen knowledge. Besides this limiting choice, the CAT curriculum remains very full with no time for repetition. Although my education practice followed the expected and generally accepted strategy, my concern was ignited when I detected a sense of apprehension among my learners when they needed to do the successive activities, which they perceived as repetitive. When they needed to eventually execute the Performance Assessment Task (PAT) with these activities as its 'building blocks', they portrayed an insufficient 'recollection' of them.

Even though the purpose of the activities might have been a 'scaffolding' strategy, during my postgraduate studies, I was thoroughly confronted with the demanding challenges of twenty-first century education. I became aware of the work of Korthagen (2013) regarding holistic teacher education and the research of Joubert (2016) regarding the requirements for the kind of transformative learning the twenty-first century demands. Regarding the traditional perception of 'scaffolding', Korthagen (2001, p. 200) reveals a "fundamental misunderstanding" which may

be important to consider also in my practice: "Any attempt to use exercises and training elements after the introduction of theory, with the aim of promoting the transfer to practice, is like starting with the walls of a house and then laying the foundation. It amounts to turning the world upside down, which Freudenthal (1991) calls an *anti-pedagogical inversion*" [original emphasis]. It, therefore, seems as though my current CAT education practice is challenged by a saturated knowledge-based curriculum that my learners need to acquire in a limited time, and an inefficient subject associated skills acquisition.

It has also become increasingly evident in recent years that the subject related skills are not sufficient when learners enter the world of work. In this regard, there is a shift regarding those skills that are necessary for employment, and those necessary for employability. The latter are also called soft skills and these have become major considerations for employability of people. The challenges of a rapidly changing supercomplex world demands a much more elaborate set of required outcomes learners should acquire (Trilling & Fadel, 2012). They are the following four sets of skills:

- Understanding of academic content at a much higher interdisciplinary level.
- Learning and innovation skills.
- Information, media and technology skills.
- Life and career skills.

It is important to take cognisance of the fact that these twenty-first century skills have to be 'taught' through twenty-first century teaching. Like the way in which the knowledge needs to be acquired, the acquisition of twenty-first century skills is of utmost importance "because they are not explicitly taught and because they are more difficult to assess than factual retention" (Saavedra & Opver, 2012, p. 8).

Amidst the developments regarding these twenty-first century skills and their education, Barnett (2007, pp. 101-102) makes a radical statement: "However 'knowledge' and 'skills' cannot begin to offer us a sufficient set of ideas for … education for the 21st century…. At best, they offer just two pillars of an educational project. By themselves, these two pillars, which we may label the epistemological and practical pillars, will topple over: they need (at least) a third pillar – the ontological pillar – to ensure any kind of stable structure" (Barnett, 2007, p. 7).

This statement becomes much clearer when Ackoff and Greenberg (2008, p. xiv) explains it in the context of education itself: "Education is a lifelong enterprise, and it is a process enhanced by an environment that supports – or, more precisely, 'nourishes' - to the greatest extent possible the attempts of all people to 'find themselves' throughout their lives". It requires a "deeper learning" than skills – even beyond 21st century ones (Balanca, 2015). It is the attainment of human qualities and dispositions (Barnett, 2007, pp. 101-112) as primary educational venture because it is through them that "students have the capacities to acquire both knowledge and skills … Without dispositions and qualities, nothing else of any substance is possible".

That is why Barnett (Barnett, 2007, p. 40) declares that 'authenticity' is a key concept in the idea of education and that if education does not insist on authenticity in the learner it cannot be regarded as education. In this regard, he explicates what our educational aim is, and I paraphrase: It is, in principle, not an epistemological task of the acquisition of knowledge and skills, but it is, primarily, the ontological challenge of the transformation of the human being towards authenticity – nothing less (Barnett, 2012, p. 69).

I wanted to pursue this as the foundation of my CAT education practice. However, what I also need to consider as part of my CAT education practice is the other side of technology.

1.4   THE OTHER SIDE OF TECHNOLOGY

The advancements of technology are mind blowing – to say the least. The possibilities that technology can generate seems to be endless. Not only is technology an incalculable asset to our lives, it is doubtful that we will be able to survive without it. We cannot but celebrate what it has brought us in the past and what it brings to us every moment. Educationally speaking we have become richer than we could even imagine.

However, what we also cannot deny is that technology has brought with it challenges – many of which is of educational concern. One of these challenges is a perception that technology is the saving grace for all our problems and especially those of education. Although not everyone will agree with the results for various reasons, as educators we need to cognisance of authoritative international research. A global study from the Organisation for Economic Co-operation and Development (OECD) indicated that heavy investments in classroom technology have perhaps raised "too many false hopes". The study examined the impact of school technology on international test results like the PISA tests and 'no noticeable improvement in reading, mathematics or science could be reported. What follow is some highlights from the report:

- Students who use computers very frequently at school get worse results.
- Students who use computers moderately at school, such as once or twice a week, have "somewhat better learning outcomes" than students who use computers rarely.
- The results show "no appreciable improvements" in reading, mathematics or science in the countries that had invested heavily in information technology.
- High achieving school systems such as South Korea and Shanghai in China have lower levels of computer use in school.
- Singapore, with only a moderate use of technology in school, is top for digital skills.

One of the most disappointing findings of the report is that the socio-economic divide between students is not narrowed by technology, perhaps even amplified.

Closely associated with the perception of technology being the solution to all our problems is the phenomenon of virtual reality. "Virtual reality has been notoriously difficult to define over the years". However, within the very sophisticated NASA context virtual reality is defined as follows: "Virtual reality is the use of computer technology to create the effect of an interactive three-dimensional world in which the objects have a sense of spatial presence". What is exactly meant by 'virtual reality' is very well and simplistically explained: "'virtual reality' means 'to have the effect of concrete existence without actually having concrete existence'". What is most significant about this definition of virtual reality within the context of education is the following: "There is no requirement that the virtual environment matches the real world" and "we do not require that the virtual reality experience be 'immersive''. (Bryson, 2014). Hu, Fu and Zhang (2016) as well as Kim (2015) concur in this regard.

This is in stark contrast with the 21st century constructivist (Von Glasersfeld & Ackerman, 2011) and experiential (Kolb & Kolb, 2006) learning requirements, which culminates so efficiently in the statement of Holt and Farenga (2003, p. 6): "What children need is not new and better curricula but access to more and more of the real world".

The incredible developments in Learning Design that culminated in the Lanarca Declaration (Dalziel, J; Conole, G; Willis, S; Walker, S; Bennet, S; Dobozy, E; Cameron, L; Badilescu-Buga, M, 2016) as well as the contributions of many others in this regard, as well as the enhancements in blended learning – to blend online learning with classroom interaction – through the contributions of Horn, Staker, and Christensen (2014) and many others are, no doubt, pursuing the ultimate in twenty-first century education. However research about exactly

what the 'mix' between online and classroom interaction is, is not clear, and the concern about the effect of virtual reality is not sufficiently addressed (Partridge, Ponting and McCay, 2011; Bruer, 2015). It seems as though the research is concerned about the interaction between learners in a classroom setting but with the focal point the virtual reality that is projected by the computer.

The problems that learners are confronted with seem to be primarily 'conceptual' ones that could be resolved through cognitive operations of information processing with mouse or hand and finger movements. This may confirm a perception that, after the completion of the manipulated computer operations and shows a satisfactory result that a concrete problem has actually been solved. The consequence of such a perception is well illustrated by Hawken (2009) who is an environmental scientist: "When asked if I am pessimistic or optimistic about the future, my answer is always the same: If you look at the science about what is happening on earth and aren't pessimistic, you don't understand the data". Not having experienced the hands-on concrete, real-life interaction with the authentic data, not secondary one's, one cannot fully understand the context and consequences of 'what is happening' – and subsequently act appropriately and preventatively in order to improve the quality of life as a result. This should be a human quality that the smallest child has to muster. For this reason, Barnett (2015, pp. 63-76) claims that it is the *pragmatic* actions of learners in the *real world* that constitute their pedagogical being human.

Besides the preceding very specifically educational challenges, there is enough evidence of the consequences of virtual reality in our lives to justify other concerns. "When it comes to technology enabled learning, some worry about dehumanising environments, a lack of teacher and student agency, and narrowed outcomes". One of these concerns is what may be called a loss of identity. Although there is nothing wrong with identifying with a role model on and through the Internet such an identification might be detrimental rather that beneficial. Emma Sadlier, a South African social media ethics and law expert, made the following alarming statement in relation to a loss of identity on *Carte Blanche*, a television journal programme on 12 July 2015: "We are breeding digital natives who do not know life other than what is online" (Sadlier, 2015).

There is no doubt that technology is rapidly changing our social lives. We are transforming from a face-to-face society to a face-to-screen society to the extent that one might find friends sitting next to each other in a public place, reciprocally texting one another on trivial matters. There are

also signs that we may become increasingly socially inept and emotionally stunted (Valudez & Duran, 2007, pp. 31-44). This is the consequence of abusing the interface of a digital screen and the safety of a virtual reality to escape taking responsibility for the consequences of one's behaviour. The epotome of such a phenomenon is found in cyber bullying, with information and images being captured, shared and even sold on the Internet valued by its extremist destructive quality (violence, ridiculousness, injustice, etc.), which may have serious consequences and even death in extreme cases. Something else that is also much more educationally relevant and of serious concern is what is "the surge in 'digital dementia' a term coined in South Korea – meaning a deterioration in cognitive abilities that is more commonly seen in people who have suffered a head injury or psychiatric illness" (Ryall, 2013). It pertains to the overstimulation and development of the left working brain, which because of its limiting capacity is only capable of superficial information processing to make quick decisions (like what is required in gaming) at the cost of the cognitive time necessary for assimilation and accommodation in the brain at the deeper information processing level required for problem solving (Spitzer, 2013) – which inevitably activates whole brain "high reasoning" processes and corresponding 'high level' actions (Zull, 2011, p. 57).

In view of the preceding paragraphs and in particular the 'false hopes' that technology might have brought as well as the possible adverse consequences that is evident, Drucker (2000, p. 8) provides a profound perspective. He says that, if the history of our time would be written from a long-term perspective "it is likely that the most important event those historians will see is not technology, no the Internet, note-commerce. It is an unprecedented change in the human condition … For the first time they will have to manage themselves … And society is totally unprepared for it".

I would want to ensure that my CAT education practice will not overestimate the possibilities of the computer and its applications at the cost of what is primarily our educational aim: It is the change in the human condition which is the transformation of the human being. It is, fundamentally the pursuance of authenticity, for which each individual learner has to ultimately take full responsibility for and control over. This is an education that "poses radically different challenges … and that is why we require a qualitatively different approach to teaching in the twenty-first century" (Hargreaves, 2003, p. x).

I am making this the focus of my CAT education practice.

1.5 WHAT DOES THE FUTURE OF TECHNOLOGY HOLD?

The race to outsmart the ultimate information and communication technology in the form of the smallest, singular, all-encompassing, but most efficient device is continuing. It appears as though the smartphone as a device has reached its limit regarding its capability for technology. The number of variations of Apps is overwhelming, and it seems that we are moving towards a position that whatever we want to do, there will be an App to do it. In this sense, the smartphone has already become an instrument through which we are able to manipulate the larger world inside and around us. Unfortunately, the convenience of mobility is limiting the growth of this device in this regard. The development of devices beyond the smartphone in any shape, size or function (robots) is beyond imagination. The smartphone has become the device through which these robots can be activated and manipulated remotely to do what we were accustomed to do. However, what is so shockingly significant is the rapid advancement of these robots to become completely self-sufficient and independent of humans, even via remote control, rendering human intervention increasingly redundant. In fact, humanoid machines are capable of being 'human' in ways never thought possible:

> As the Pepper robot from Softbank scurries about your home or office, it reads your emotions by your words, tone of voice, facial expressions, and body language. It responds in all those ways: its hands and posture in particular are remarkably expressive. If you thought emotions were beyond the competencies of robots, you were right for a long time. But no more. (Colvin, 2015, p. 37)

These advances are amazing but real. If computers are able to do what we as humans are accustomed to do, the question posed by Colvin (2015, p. 38) is significant: "How will we humans add value?" Colvin's (2015, p. 43) answer is profound in the context of education: "[T]o become more essentially human, to be the creatures we once were and were always meant to be".

All the preceding paragraphs have serious implications for education as a whole but more specifically for education in Computer Applications Technology. Consequently, this poses an incredible challenge to my professional development and to ensure an authentic Computer Applications Technology in practice.

1.6   RESEARCH CHALLENGE

My own professional development forms the basis of my research challenge. I want to ensure that my education practice will fulfil the requirements of an authentic Computer Applications Technology education in practice.

1.7   RESEARCH QUESTIONS

From the preceding background and rationale, the following research challenge could be identified.

1.7.1   Primary research question

How can I ensure that my education practice will fulfil the requirements of an authentic Computer Applications Technology education in practice?

1.7.2   Secondary research questions

In order to explore the primary research question, the following secondary research questions should be addressed:

- What are the current curriculum requirements and the current dominating education practices in Computer Applications Technology?
- What constitutes an authentic Computer Applications Technology education in practice?
- How can I improve my education practice to ensure that it fulfils the requirements of an authentic Computer Applications Technology education in practice?

1.8   LAYOUT OF THE STUDY

Chapter 1 provides the background, rationale and research challenge in general and also formulates the primary research question and the subsequent secondary research questions that need to be addressed.

Chapter 2 consists of a literature study that explores existing research and how it relates to the first two secondary research questions. This exploration will also provide the framework within which the empirical research will be executed in order to address the third secondary research question.

Chapter 3 frames the empirical research prompted by the research in Chapter 2 and provides the layout of the proposed research design with its research premises, research design, sampling, data collection, analysis and interpretation, as well as the limitations, challenges and ethical considerations that the research required.

Chapter 4 contains the empirical research. Since the research was executed in a participatory action research mode, it contains the execution of the action research cycles with its iterative action interventions and the collected data, its analysis and interpretation. Chapter 4 concludes with what has been achieved.

Chapter 5 provides an overall conclusion of the study and presents recommendations for future research.

On the next page, I have included a summary of my research design.

1: Table 1.1: Research design considerations and corresponding choice for the study

<table>
<tr><th colspan="3">RESEARCH DESIGN CONSIDERATIONS</th><th>CORRESPONDING APPROPRIATE CHOICE FOR THE STUDY</th></tr>
<tr><td rowspan="5">Research premises</td><td>Ontological assumptions</td><td>Theory of being</td><td>I will concentrate on the subject Computer Applications Technology (CAT) in education with the main aim of developing an authentic CAT practice. My research study initially starts by placing focus on the Grade 11 CAT learners, but then continues into the following year, with the same group of learners, but now in my Grade 12 CAT class.</td></tr>
<tr><td rowspan="2">Epistemological assumptions</td><td>Anti-positivist view (Interpretative)</td><td rowspan="2">I will make use of an interpretive view and an interpretive paradigm in order to get a clear understanding of all the aspects concerning the research.</td></tr>
<tr><td>Interpretative paradigm (from a socio-constructivist perspective)</td></tr>
<tr><td>Methodological preferences</td><td>Ideographic approach</td><td>I will concentrate on the Ideographic approach because it focuses on the individual and the understanding of individual behaviour.</td></tr>
<tr><td>Assumptions about human nature</td><td>At a point between Determinism and Voluntarism</td><td>I will work between these two opposites (determinism and voluntarism) in order to accommodate and or discriminate by including individual as well as environmental influences in order to ensure that my assumptions about human nature are as accurate as possible</td></tr>
<tr><td rowspan="2">Mode of inquiry and research design</td><td rowspan="2">Qualitative mode of inquiry</td><td>Participative Action Research
6 steps:</td><td rowspan="2">I will make use of a qualitative mode of inquiry for my research study. I will make use of participative action research as my research design by using the 6 steps of action research.</td></tr>
<tr><td>1. Identify   4. Observe
2. Plan   5. Reflect
3. Act   6. Review</td></tr>
<tr><td>Research Site</td><td colspan="2">Secondary, English medium government school that consist of 76 Staff members and 1360 learners of various races, religions and gender</td><td>My research is taking place at an identified secondary, English medium, government school located in Gauteng.</td></tr>
</table>

Describing the sample	Qualitative mode of inquiry: Purposive sampling (non-probability or deliberate sampling)	Stratified purposive sampling	I will be making use of stratified purposive sampling. I plan to do my study at an identified secondary, English medium, government school located in Gauteng where my focus will be on ten Grade 11 CAT learners, but then continues into the following year, with the same group of learners, but now in my Grade 12 CAT class. These learners will be of both sexes, male and female, and various racial groups, which includes members of all four main population groupings: white, black, coloured and Indian learners.
Data Collection techniques (research methods) and data analysis strategies	Literature Study	Latest books, academic journals, articles in periodicals, conference proceedings, internet	The researcher conducted the literature study as widely as possible.
	Observation	Participant as observer	I will be observing my Grade 11 CAT learners by using the participant as observer method. When recording my observations, I will be making use of the running records method in order for me to capture the description of what I observed and my reflection about what happened.
	Interview	Focused or semi-structured interviews	I will be making use of semi-structured interviews when interviewing the respondents. They will be asked a series of pre-established questions, with pre-set response categories as it allow for the probing and clarification of answers. When interpreting my data, I will search for emerging patterns, associations, concepts and explanations with the ultimate aim to come to findings and draw conclusions. Each conclusion will be based on substantiated findings from my variable data.
Data verification	Credibility (Truth Value)		Findings of the study will be tested either from where the data was drawn or with people who are familiar with the phenomenon being studied.
	Transferability (Applicability)		It will be established if findings fit into similar context outside the study situation.
	Dependability (Consistency)		Variability will be explained either in terms of the informants, the researcher or the context.

	Crystallisation		In this study, I will compare the literature study, observations and interviews to validate the data and enhance the trustworthiness.
	Peer examination		I will discuss the information found in the research with my colleagues who also teaches CAT to ensure the reliability of the data.
	Collaborative research		Discussing the outcomes of the data with the participants and incorporating their opinions to my research will add validity of the data.
	Researcher bias		By clarifying my assumptions, views and theoretical orientation beforehand, I intend to overcome clear research bias.
Possible contributions of the study; my role as researcher; ethical consideration	In this study the researcher will:	Create a comprehensive literature study	In the sample proposal, the strategic outcome could be to create an authentic Computer Applications Technology curriculum. This does not, however mean, that I want to create new activities for the subject or rewrite a textbook. I want to create real-life problems in the class environment, exploring the possibilities of computers and the benefits it may hold for society. My focus will be on how learners should be taught, but more importantly, what should be taught to them in order to make a positive impact in society and develop a passion towards lifelong learning. Any research, which involves other people in some way, has ethical implications. The object of the protocol is to ensure individual rights are not infringed and to promote fairness in the interpretation of data.
		Be a participant that will act as an observer	
		Compile and manage all the observations	
		Prepare, structure and conduct interviews	
		Analyse and crystallise the data	
		Combine all the information into a sensible research report	
Delimiters of the study	The list of proposed delimiters will be used as a checklist of possible shortcomings and weaknesses.	Naturalistic enquiry	Only Computer Application Technology learners from an identified secondary, English medium, government school located in Gauteng will be used in this study.
		Inductive analysis	Only one person (the researcher) will perform data collection and analysis.

		Holistic perspective	Since human subjects are involved in the research, the 'Hawthorne effect' must be considered. It may influence class dynamics, environmental influences and learning dynamics.
	It will also serve as a measurement of validity in the research	Qualitative data	Detailed descriptions are made possible by means of qualitative data collection methods; however, an individual performs this task.
		Personal contact and insight	Findings may be criticized in terms of the Hawthorne effect and personal bias.
		Dynamic systems	There are continuous changes in the classes being investigated, due to newcomers and learners leaving the course.
		Unique case orientation and context sensitivity	The context is focused only on self-directed learning. Environmental influences could affect behaviour may not be known.
		Empathetic neutrality	Observation may be strange to individuals and/or classes and may thus influence behaviour.
		Design flexibility	Structural research requirements may influence the nature of the flexibility associated with this study.
Possible limitations and challenges of the study	Potentially limiting issues of the research study includes:	The digital world	The possibilities of what the digital world has to offer are endless. In order to explore these possibilities and incorporating them into real-life problems in the classroom, will be challenging.
		Learners may not take the research (and interviews) seriously	I will let the learners know well in advance of the importance of my research and create an awareness of the advantages of the study for themselves.
		Cultural differences	Observations and interviews will be planned carefully in order to identify problems relating to cultural differences

CHAPTER 2

LITERATURE REVIEW

> *Education is not a preparation for a future life. Education is life itself.*
> (Dewey, 1915)

2.1   INTRODUCTION

This exploration of existing research has to be done with a vivid consciousness of the background and rationale depicted in Chapter 1. Everything explored in chapter 1 of the research has essential bearing upon its remainder of this report. As indicated in Chapter 1, this chapter will address the following subsidiary research questions:

- What are the current curriculum requirements and current dominating education practices in Computer Applications Technology education?
- What constitutes an authentic Computer Applications Technology education in practice?

The following explores the current curriculum requirements and its education practices.

2.2   CURRENT CAT CURRICULUM REQUIREMENTS AND EDUCATION PRACTICES

The key official document that stipulates the curriculum requirements and suggests its education practices is the Computer Applications Technology (CAT) National Curriculum Statement (NCS) which includes the Curriculum and Assessment Policy Statement (CAPS) of the Further Education and Training (FET) phase, Grades 10 – 12.

2.2.1 CAT curriculum requirements

The purpose of this exploration is not to conduct a comprehensive analysis of the relevant documentation but to highlight those aspects that specifically pertain to its suggestions for the required education practices in order to explicate the broad curriculum and its requirements.

Besides the introduction that Chapter 1 provides to explicate the subject of Computer Applications Technology, its purpose and its aims in developing learners according to the National Curriculum Statement (South African Department of Basic Education, 2011), it is the proposed outcomes that it intends to achieve that are most significant.

The figure below illustrates how the main topic areas of the Computer Applications Technology subject support the development of digitally enabled learners (South African Department of Basic Education, 2011, p. 7).
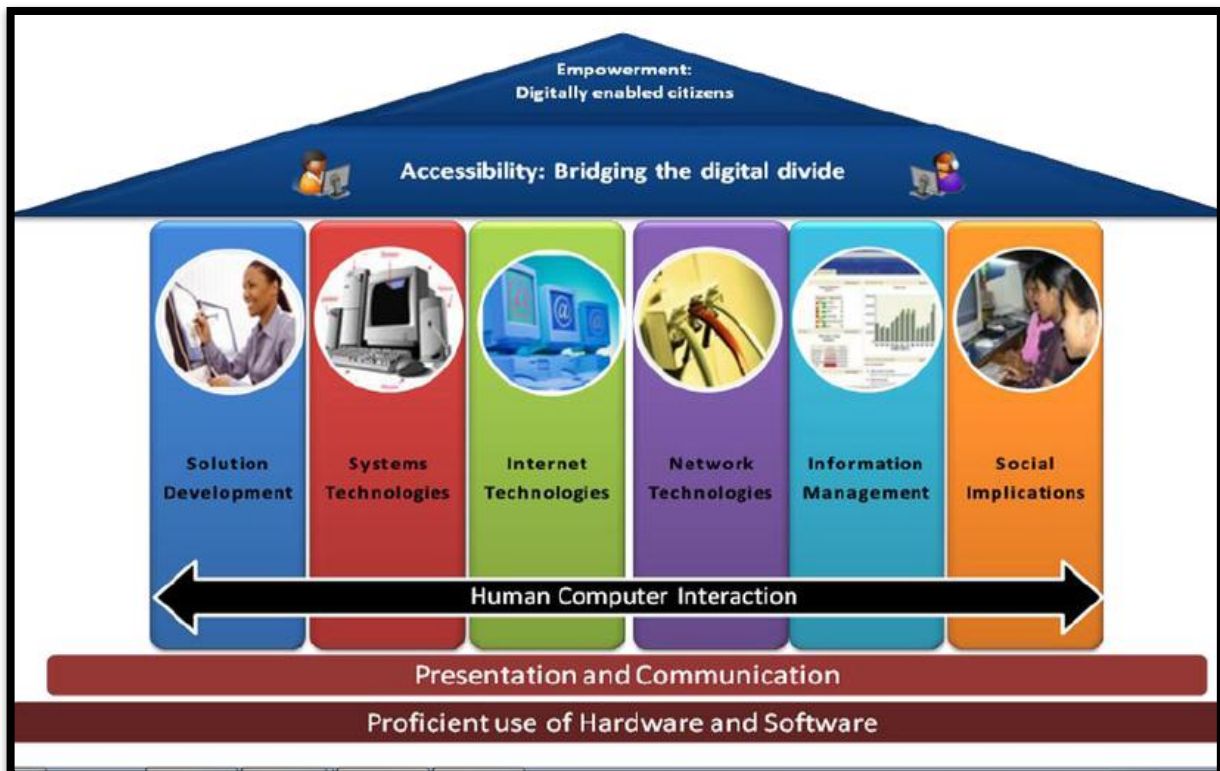
1. **Figure 2.1: Computer Applications Technology supports the development of digitally enabled learners (South African Department of Basic Education, 2011, p. 7)**

The new CAPS for Computer Applications Technology (South African Department of Basic Education, 2011, pp. 7-15) states that a learner will:

- Be able to use software applications proficiently to produce solutions to problems within a defined scenario:
  Solution development is the actions and processes involved in developing a computer-based solution by utilising appropriate tools such as application packages to solve a variety of problems represented by real-life scenarios. These applications include word-processing, spreadsheets, databases and presentation applications (South African Department of Basic

Education, 2011, p. 9). Learners should exhibit computational thinking (CT) – the mental activity of perceiving and formulating a problem to subject it to a computational solution (Wing, 2006, pp. 33-35). Twenty-first century skills and the accompanying eight domains of key competences should be added to cope with the challenges of an unknown future and a rapidly changing knowledge society (Hamilton & O'Duffy, 2009, p. 335). These are indicated in Table 2.1 below.

2. **Table 2.1: 21st century skills identified vs. the eight domains of key competences**

21st – century skills	The eight domains of key competences
1. Creativity and innovation 2. Critical thinking 3. Problem-solving 4. Communication 5. Collaboration 6. Information fluency 7. Technological literacy	1. Communication in the mother tongue 2. Communication in a foreign language 3. Mathematical literacy 4. Basic competences in science and technology 5. Digital competence 6. Learning-to-learn 7. Interpersonal and civic competences 8. Entrepreneurship and cultural expression

(Source: Hamilton & O'Duffy, 2009, p. 335)

The International Society for Technology Education (ISTE & CSTA, 2001, p. 1) includes the following characteristics (qualities):
   o   confidence in dealing with complexity;
   o   persistence in working with difficult problems;
   o   tolerance for ambiguity;
   o   ability to deal with open-ended problems; and
   o   ability to communicate and work with others to achieve a common goal or solution.

- Understand the concepts of information communication technologies (ICTs) with regard to the technologies that comprise a computing system:

System technologies refer to the physical and non-physical components of a computer system. The components of the system are independent units that are designed to perform particular functions. These components, which include hardware, peripherals and software components, are connected as a unit to perform the basic functions of a computing system

and include input, processing, output, storage, communication and transfer of data in an electronic format (South African Department of Basic Education, 2011, p. 10).

- Comprehend the Internet and the World Wide Web (WWW) as well as the role that the Internet plays as part of the global information superhighway:
Internet technologies include the WWW and all interrelated processes in the digital presentation of multimedia data on a web page. Internet technologies are defined as a set of related and interconnected technologies that enable the establishment of global networks for various purposes, such as collaboration, electronic data interchange, electronic commerce, electronic communication and social networking (South African Department of Basic Education, 2011, p. 13).

- Understand the various technologies, standards and protocols involved in the electronic transmission of data via a computer-based network:
Various network technologies facilitate the management and dissemination of digital data from one point to another. Network technologies also refer to the electronic systems used for electronic data interchange, which is used to facilitate information dissemination between various individuals or groups at a single point or dispersed locations (South African Department of Basic Education, 2011, p. 12). Have the ability to find authentic and relevant information, to process the information, to draw conclusions, to make decisions and to communicate the findings in appropriate presentation media:
Information management refers to the techniques and technologies involved in the collection, storage and processing of data into information that leads to knowledge and decision-making. It includes the use of appropriate communication and presentation tools to communicate new knowledge and to make recommendations (South African Department of Basic Education, 2011, p. 14).

- Understand how the use of ICTs affects modern-day living, recognise the legal, ethical, environmental, social, security and health issues regarding the use of ICTs and use ICTs responsibly:

Social implications refer to issues relating to the digital age and bridging the digital divide and include issues that lead to the responsible use of ICTs. This section of the CAT curriculum should consider the impact that computer technology has on everyday life (South African Department of Basic Education, 2011, p. 15).

The achievement of the preceding outcomes of Computer Applications Technology is in fact not a 'nice to have' but a necessity for the education of learners for their private and corporate futures (Evans, 2012).

There is little doubt that the CAT curriculum covers all the essential aspects that should be contained in such a curriculum and that its aims are relevant. Unfortunately, the statement of the aims carries major concerns.

2.2.2 Suggested education practices of CAT

The aims of the CAT curriculum, as with the aims of any other curriculum, contain the context requirements within which they are to be achieved. If this is the case with the first aim, it implies the overarching context for all the subsequent aims. The following section examines the first aim to discover the required context in which it is to be achieved since this represents concern.

"Be able to use software applications proficiently to produce solutions to problems within a defined scenario" (own emphasis) (South African Department of Basic Education, 2011, p. 7). The use of "software applications" defines the essence of the subject to which there can be no objection, But it is the phrase "to produce solutions to problems *within a defined scenario*" (own emphasis) that is troubling (South African Department of Basic Education, 2011, p. 7).

The answer to the question: What is Computer Applications Technology? in the official curriculum document reads as follows:

> Computer Applications Technology is the study of the integrated components of a computer system (hardware and software) and the practical techniques for their efficient use and application *to solve everyday problems* [own emphasis]. (South African Department of Basic Education, 2011, p. 7)

As far as conventional language is concerned 'everyday problems' mean the real problems that we encounter in the course of our everyday lives (private, work and play) since they present themselves at any time without warning in uncompromising supercomplexity (Barnett, 2004, p. 249). There is no doubt that Computer Applications Technology is the subject that educates learners to resolve any challenge in real life and at any time. A scenario is, at most, a *description*

of a real-life event, but it is *not* real life itself. It does not present the learners with all the participants, animate and inanimate and including the unpredictable interactions that involve unforeseen risks and consequences regarding the responsibility that learners have when attempting to solve a real-life problem. What removes the requirement of resolving real-life challenges into further obscurity is the condition of *a defined* scenario. This implies that the scenario will be very particular and *well* defined – *not* how real-life challenges are presented. The requirement of the problem being such a defining scenario may well support uniformity in education practice to afford the required result but may encourage a teacher-centred education practice in order to comply with the curriculum document.

It seems as though the curriculum document is appropriately aligned with achieving the aims – in the theoretical sense. However, the prompt to engage in a quite different and particular education practice comes from the way in which the curriculum document suggests support to the teacher and the way in which this is confirmed by the provided teaching and learning support materials. This support is provided in the curriculum document in the form of a suggested teaching plan, which indicates the minimum content to be covered per term. In addition to this, completed work schedules are also provided. These indicate to the educator the content to teach per term as well as define an appropriate sequence and pace. Teacher manuals, worked out lesson plans, PowerPoint presentations, activities and solutions to these activities are given to the CAT educators.

The teacher is also supplied with a package of learning and teaching support materials when purchasing the (unofficially prescribed) textbook, which includes the learner book and the educator guide with its accompanying DVD. The DVD includes PowerPoint presentations of all the topics to be discussed throughout the year, a study guide and more than 100 systematic video clips that explain how most activities in the textbook should be done.

Examining the teaching and learning support material and the guidelines provided for using them, it is difficult to deviate from such a prescriptive, finalised education practice for every lesson amidst the vast amount of content and practice that needs to be covered. It would be no surprise if the education practice for a lesson in CAT would show the following characteristics, which are also encouraged during professional education sessions by the Department of Education:

- The teacher will announce the topic.

- The teacher will show a PowerPoint presentation of topic/content to be discussed. (This can be found on the given DVD when purchasing the textbook.)
- The teacher will indicate to learners which activities in the textbook they will have to do for that specific lesson.
- The teacher will show learners the video clip(s) on the smart board/overhead projector. These explain exactly how they must do the activity. (This is supposed to serve as a demonstration and/or explanation of all practical applications but is in fact giving the learners the answers to the activity before they have attempted it themselves.)
- The teacher 'allows learners to do the remaining activities' from the textbook, despite the learners having already seen the answers to the questions.
- The learners may be requested to complete outstanding activities for homework.

The preceding paragraphs provided only a partial answer to the first of the subsidiary research questions of this project. What the dominating education practices in CAT education are will be investigated through empirical participatory action research described in Chapter 5.

2.3 WHAT CONSTITUTES AN AUTHENTIC CAT CURRICULUM IN PRACTICE?

From the previous paragraph, there seems to be a discrepancy between the intended curriculum as it is contained in certain sections of the CAT curriculum documents and the enacted curriculum as is suggested in the way in which support is provided to the teacher and in the teaching and learning support materials that are recommended and encouraged to be used. This situation is not conducive to the quality of education that is envisaged for our learners. In order to resolve this challenge, it is important to establish the foundations of a CAT curriculum as it is to be enacted in practice in order to ensure that our learners are provided with the quality of education that they deserve and are entitled to, especially in the contemporary world of the 21st century.

2.3.1 Acknowledging the reality of a digital world

It is important to acknowledge the reality of the digital world. The digital age of the 21st century has brought about a growing distinction between digital natives and digital immigrants or aliens. A digital native is a person who was born during or after the introduction of digital technologies

and who has a greater understanding of their concepts and functions through interacting with digital technology from an early age (Prensky, 2001, pp. 1-6). The digital native embraces natural competence regarding digital technologies and may even seek out opportunities for implementing them in increasingly new and innovative ways (Rideout, Foehr, & Roberts, 2010, p. 19). Digital immigrants, on the other hand, are the opposite of digital natives and were born before the widespread adoption of digital technology or born after the inception of digital technology but not exposed to it from an early age (Prensky, 2001, pp. 1-6). It is difficult, if not unlikely, for digital immigrants to reach the same standard as digital natives in their digital technology competence, and this can cause a digital divide (Prensky, 2001, pp. 1-6).

The digital divide between digital native learners and digital immigrant educators has significant implications for education (Jenkins, 2007, p. 285). According to Singh (2004, p. 6), the digital divide in South Africa is extremely evident, even among learners: Although not being exposed to digital technologies from an early age and/or not being exposed frequently enough, fortunately, digital immigrant learners from the same digital era are much more likely to reach the same standard as their digital native counterparts because of an inescapable digital native environment. They also show progression in drawing closer to the level of digital natives because of frequent exposure to and confrontation with real-life problems that require resolution through digital technologies. The digital divide must be bridged and according to Singh (2004, p. 9), the following steps can be implemented to do so:

- *Develop a technology culture in schools*. Educators need to empower themselves in order to provide leadership for their learners to follow. If the educators are using technology, their learners will follow and adopt technology as well.
- *Dispose of outdated technology and provide all staff with Internet-capable computers.* For educators to provide technological leadership, they must be equipped with the latest technology. Educators can use the Internet for research and can inculcate the same values among their learners by referring them to valuable websites.
- *Provide professional development for all staff.* Schools need to develop the skills of their employees. Competent, skilled staff can provide confident, technological leadership for their learners.
- *Develop an e-learning culture in which educators post notes and links on their personalised websites.* If homework is presented online, learners will be forced to use the Internet with a purpose rather than 'surfing' aimlessly when they have free time.

- *Develop an e-research culture in which learners are taught and encouraged to use the Internet for research purposes.* The Internet is a world of knowledge that expands one's knowledge horizons. Learners need to be introduced to the various online library resources.

- *Make facilities available 24 hours a day, over weekends and during holidays.* At most schools, computer facilities are underutilised after hours and during holidays due to the possibility of security risks. Schools need to provide after-hours security in order for learners to have access to the facilities.

- *Introduce computer literacy and web-based research across all faculties*. More laboratories need to be built and equipped to provide computing skills to learners from all faculties and disciplines. All learners must be proficient in using an operating system, a word processor, a spreadsheet, presentation software, database software, a web browser and email. Over and above facilitating the use of a web browser, learners must learn search skills in order to use the Internet more effectively (Singh, 2004, p. 9).

The school must reflect contemporary digital society in its nature and structure in order to provide the best conducive environment for its education. Unfortunately, this achievement will be on going because of the rapid advancements in technology. For schools situated in poor socio-economic environments, this may be a major obstacle. However, the challenge is not that one is without what you need, but how to ensure that what is needed can be acquired. After obtaining even a fragment of what is needed, the challenge is how well one will take advantage of what is now available, thus creating and maintaining the most conducive digital environment possible. This is a real-life challenge for teachers and learners that needs to be resolved. However, even if the technology is available and well utilised, *it* cannot solve this real-life problem, or any other real-life problem that may be encountered. This predicament exists in all education, particularly in CAT education, and this must be acknowledged.

2.3.2 Acknowledging the essence of CAT education

If, in general terms, the purpose of Computer Applications Technology education is to find solutions to real-life problems, its pedagogy must correspond (Brierley, 2003, p. 4) in order to ensure meaningful learning (Jonassen, Howland, Marra, & Crismond, 2008). Such meaningful learning has become possible through the all-encapsulating learning systems in which learners engage with all aspects of CAT, thus fulfilling its purpose (Dvorak, 2011, p. 366). Pedagogical expertise is required (Harris, Mishra, & Koehler, 2009, pp. 393-416) to translate technological

potential into solutions to pedagogical problems that will challenge learners to solve real-life problems in new and innovative ways (Yelland, 2007, p. 4).

This process of exploration and collaboration in a cohesive social context while struggling with finding solutions to real-life problems is where *the corresponding pedagogy and not the technology is the primary concern* (Kirkwood & Price, 2005, pp. 257-274). It is the foundation of this corresponding pedagogy and its eventual professional practice that is pursued in these paragraphs.

2.3.3 A philosophical perspective on education – from a century ago

In 1915, famed educator, John Dewey, wrote a book entitled, *Schools of Tomorrow,* in which he complained that the conventional public school "is arranged to make things easy for the educator who wishes for quick and tangible results" (Dewey, 1915, p. 18). Dewey (1915, p. 20) argues that the ordinary school limits the learning opportunities of the learners by pressing them into a restricted area, causing them to be silent and adopt forced attitudes of submission rather than fostering personal growth.

In criticising the academics of his day, Dewey (1944, p. 167) claimed that 20th-century schools should reorganise their curricula, emphasise freedom and individuality and respond to changing employment requirements. Failure to do so would be detrimental to young people. In one of his most widely quoted commentaries, Dewey predicted, "[I]f we teach today's learners as we taught them yesterday, we rob them of tomorrow" (Dewey, 1944, p. 167)

It can be contended that Dewey (1944) proposed a definite and constant reconsideration of teaching and learning methods due to new developments. Written nearly a century ago, it would have been inconceivable for him to envision the current world of electronic resources, digital textbooks, instructional games, interactive blogs and social media. Yet his basic message remains highly relevant today. Schools need to re-invent themselves to educate learners to occupy valuable vocations that pare presently unknown.

2.3.4 A contemporary philosophical perspective: The aim of education

A philosophical perspective on education is essential, according to Barnett (2007, p. 3). The reason for this is that such a perspective provides the foundation for "getting to grips with

understanding what it means "to *be* a student in the contemporary world, and with the kinds of human being that are appropriate, indeed, called for in a contemporary world that is full of perplexity". Such a perspective, therefore, also sets the framework for formulating a congruent aim for education.

This study identified a fundamental philosophical perspective on education for the 21st century and beyond. From chapter 1 it should be clear that the acquisition of knowledge and skills was and never will be contested in education, but, since they emanate from the past (albeit recently) the focus of education is effectively directed to the past (Gardner, 2008, p. 17; Claxton 2008 p. 184; Gatto 2010; Matijević, 2014). It is, therefore, not *that* knowledge and skills have to be acquired which is in dispute, but it is *how* they should be acquired that is fundamental to education in the 21st century. What is much more important, however, the current focus of education on these two pillars (knowledge and skills) is misplaced because Barnett (2007, p. 7) warns that they, and subsequently our educational project, "will topple over". It is the ontological pillar, the fundamental pillar of the transformation of the human being through the attainment of human dispositions and qualities that has to be the focus of our education *in practice* that will stabilise the structure of our educational project.

These essential human qualities cannot be taught but require "a transformatory curriculum and pedagogy … This is a curriculum that is aimed at the transformation of the human being; nothing less" (Barnett, 2012, p. 69) – this is the aim of education: a quest for authenticity.

2.4   AUTHENTICITY

We are born into this world with unimaginable potential, which constitutes our authenticity. Unfortunately, according to Heidegger (1962), we are born into a world with unavoidable, external, detrimental stimuli that overwhelms and suppresses our authentic self to come to fruition. Because our inherent authentic potential is still latent, we succumb to living inauthentic lives to protect ourselves from the aversive onslaughts of life. Nonetheless, our dormant authenticity calls us, in the most simplistic terms to live our lives true to our deeply centred selves in character or spirit despite the continuous onslaught of external forces to conform to a deceptive, inauthentic identity. Authenticity is indeed an innate drive to find out who we really are, what we are actually capable of, and what our ultimate purpose is - and *to live accordingly*.

Authenticity, like all other concepts related to 'self', is contentious (Korthagen, 2013). Authenticity has been the subject of criticism (Varga & Guignon, 2014) because of it being a "critical concept" in that the focus on one's own qualities "may breed a self-centred preoccupation with oneself that is anti-social and destructive of altruism and compassion toward others". However, Taylor (2007), Guignon (2004) and Varga, (2011a) among others, revealed the philosophical roots, fundamental characteristics, and the critical inquiry potential of authenticity that restored it to the pervasive *ideal* (Taylor, 2007) that emanated from Kierkegaard (1980) and Heidegger (1962).

Pursuing our authenticity is not only an ideal, it is a purpose (Han, 2015). Since this purpose is finding ourselves, we are clearly pursuing the ultimate meaning of life. In that sense we do not have a purpose, we are the purpose. We thus have an inherent drive towards being authentic through our *will*: "Will, we must say and not shirk from saying it, is ontological through and through. Without will, the idea of a person cannot get off the ground. Without will, too, the idea of student cannot seriously have meaning (Barnett, 2007, p. 18). Frankl (1984) puts this incessant drive towards authenticity in perspective:

> Man's search for meaning is the primary motivation in his life and not a 'secondary rationalization' of instinctual drives. This meaning is unique and specific in that it must and can be fulfilled by him alone; only then does it achieve a significance that will satisfy his own *will* to meaning. (p. 121)

Since authenticity is a potentiality of being human, our authentic self also represents our human potential to be realised (Deci, E L; Ryan, R M; Schultz, P P; Niemiec, C P, 2014). In this sense we have not only been endowed with the power (will) to become the purpose we potentially already are, but it is also an ethical imperative to pursue that potential because not doing so is too awful to contemplate. Although from four decades ago, the significant statement of Hall (1976, p. 4) in this regard, we are witnesses of its increasing prevalence today:

> According to some of the most distinguished and thoughtful students of the mind, one of the most devastating things that can happen to anyone is to fail to fulfil his potential. A kind of gnawing emptiness, longing, frustration and displaced anger takes over. When this occurs, whether the anger is turned inward on the self or outward towards others, dreadful destruction results.

Since our authenticity is continually under threat by the ego (our inauthentic mind) and the confirmative powers of society, it "has to be fought for, won and sustained" (Barnett, 2007, p. 40). Obviously, this requires a special type of work that demands courage, honesty, integrity, determination and resilience. We first must recognise, acknowledge and denounce those inauthentic characteristics that we have adopted from society. Only then can we move forward.

> At this deeper level, our living organism is a system tingling with purpose … the deep organic programming that underlies our sense of what is 'right' for us … And just as each of us is a unique expression of our genetic code … we are each, similarly, a unique expression of our cellular commitments … These cellular commitments are the burning fuse of purpose that snakes through our lives, always focused on the explosive realization of our full human potential and eventual self-transcendence. (De Quincey, 2005, pp. 57-58).

This process of excavation and (re)construction of our authenticity represents its pivotal context. "Authenticity is not just something that exclusively rests within myself…for authenticity to be meaningful it needs to be sought in relation to issues that *matter crucially.*" [original emphasis] (Kreber, Klampfleitner, McCune, Bayne, & Knottenble, 2007, pp. 40-41). What matters crucially is that authenticity is at the same time an intensively *personal* self-transcendence and an irreducibly *social* coherence virtue (Guignon, 2008, p. 155). Since authenticity carries with it "an obligation to contribute to the maintenance and well-being of a particular type of social organization and way of life (Guignon, 2004, p. 161), it is an issue of "moral-psychology, identity and responsibility" (Varga & Guignon, 2014). At the same time, it is a moral virtue of flourishing (Han, 2015) and because we live in "a morally bashful age" we need "virtues of uncertainty" to ensure that our authenticity will blossom (Ortwein, 2015). Taking this into consideration and in view of Taylor's (1991) "Ethics of authenticity" and Hursthouse's (2013) "Virtue ethics", we may come to the conclusion, like Taylor (1991) and Varga (2011b), that authenticity as an ethical ideal. Since it seems that virtues, according to the concept emanating from Aristotle , is so generously associated with authenticity in pursuing that ideal, virtues may be the key to becoming and being authentic. In addition, there is an obvious similarity between "certain kinds of human qualities" (Barnett, 2012, p. 69) and "certain personal qualities" (Oakes, Lipton, Anderson, & Stillman, 2013, pp. xv-xvi) that are essential for human development (Korthagen, 2013, pp. 256-259) and corresponding human virtues. These essential human qualities may, therefore be called fundamental human virtues. What is quite interesting about the distinction between the kinds of virtues (moral, intellectual, ethical) is that, when Ortwein

(2015, pp. 7-12) describes the "nine master virtues" – which are regarded as intellectual virtues – its moral bases cannot be denied. This is not surprising, though, a virtue as it is derived from Aristotle have a moral connotation, which means that each fundamental human virtue may be defined as "an ethical competence of moral excellence" (Slabbert, de Kock, & Hattingh, 2009, p. 92). These fundamental human virtues constitute our authentic human potential, which is our authentic human potential. In this sense, authenticity has become the ultimate measure of value and a common currency in contemporary cultural life" (Varga & Guignon, 2014).

One of the most profound statements about attaining these fundamental human virtues is that "it characteristically comes only with experience of life" (Hursthouse, 2013). It is, therefore "the *nature* of the human experience" that that is responsible for the human's transformative potential. "The *human experience* is that which is true for all human beings" [original emphasis] (Neill, 2007, pp. 5-6) and that is, essentially, the potential of the fundamental human virtues that we share with all human beings. These, in terms of potential, are not unique to us. What is unique in terms of the potential of each individual is the *context* within which we experience the confluence of all these virtues that reveals to us, from time to time, a deep sense of 'this is who I am!' For Mother Teresa, for instance, it was the concrete human experience of caring and comforting the lepers, the homeless, and the poorest of the poor – often dying in her arms – in the slums of Calcutta. That is why personal human experience of real life in its uncompromising supercomplexity is an imperative for education.

When Palmer (2007, p. 2) makes the profound statement that "we teach who we are", he emphasises the reciprocal nature of pursuing authenticity by both the teacher and the learner in education:

> That kind of knowledge does not come easily – it must be discovered and learned, and for many teachers that takes sustained effort. The effort to achieve authenticity in teaching is worth making, because teaching that shares what is genuine and real about the person is teaching that challenges students to pursue their own authenticity. It is teaching that goes beyond changing what students know—it can change who they are (Weimer, 2011, p. 2).

In order to make this a reality Oakes, Lipton, Anderson and Stillman (2013, p. xv) declares that "an emphasis on 'good teaching' alone is not enough", but what is necessary is that learners should be exposed to "*rigorous, authentic learning experiences*" [original emphasis] that

"requires of teachers certain personal qualities – integrity decency, the capacity to work very hard, and so on, while our educational challenge will demand the same from the learners.

Authenticity is, no doubt, an all-encompassing *holistic* concept – in particular on two accounts: The first is that we are born into a world where the uncompromising holistic super complexities of real-life threaten our authenticity to come to fruition. The other account is that our authenticity cannot come to fruition if the whole of who we are is not personally, concretely, firsthand and actively participating because "*the system needs to learn more about itself from itself ...* whatever facilitates self-discovery …The whole system … must be involved in this work" (Wheatley, 2006, pp. 145-146). Thus, we should explore the system of the human being as a whole in its pursuit of its authenticity.

2.5   THE HUMAN BEING (THE "I") AS AN AUTHENTIC WHOLE

There are many authors that have contributed towards the construction of what my constitute the human being in its essence like Maturana and Varela (1992), Varela (1999), Zohar and Marshal (2000), Dimitrov and Wilson (2002), Covey (2004), De Quincey (2005), Bar-On, Maree and Elias (2007), Palmer (2007), Mark (2010), Gavin and Moore (2010), Pandya (2011), Zull (2011), Brackett, Rivers and Salovey (2011), Kambaskovic (2014), Conley (2012), Friedman and Hartelius (2015), Claxton (2014) and Buss (2015). What is important about these and other contributors is that their combined work encapsulates a vast 'physical' timeline from the philosophers through to the Enlightenment (Kambaskovic, 2014) and through a vast 'scope and depth' (Mark, 2010) of research in the not so readily accepted interrelated fields like neurology (Pandya, 2011), embodiment (Rhode, 2010; Claxton G. , 2015), transpersonal psychology (Friedman & Hartelius, 2015) and evolutionary psychology (Buss, 2015). In view of the work of these contributors, it seems as though it is safe to conclude that *body*, *mind*, *soul* (emotion, including will) and *spirit* are the four vital, inseparable constituents of our human nature, responsible for the integrity of our human individuality (Dimitrov & Wilson, 2002, p. 48). These constituents have been referred to in the literature as gifts, capacities, alternate states, and levels of consciousness. It seems as though it has become increasingly popular to call them intelligences, but because the many different already identified intelligences may fit into each of these four categories, Slabbert, De Kock and Hattingh (Slabbert, de Kock, & Hattingh, 2009, p. 74) have coined them become fundamental domains of intelligence. The significance of calling them the fundamental domains of intelligence is in the realisation that they have been called

"ways of knowing" (epistemology) and "realms of being" (ontology) (De Quincey, 2005, pp. 239-241) and, therefore, domains of authenticity:

- Body: Physical Intelligence (PQ)
- Mind: Mental Intelligence (IQ)
- Soul: Emotional Intelligence (EQ) (including social intelligence)
- Spirit: Spiritual Intelligence (SQ)

Although these are inseparable constituents of our being, it is important to recognise each constituent's transformational requirement within the context of education.

2.5.1   Physical intelligence (PQ)

The physical intelligence is the body's intelligence enabling to act consciously and unconsciously as the operational interface between the internal and external environment with not only the senses, but also the entire body as a sensory and motor organ respectively. Being such an operational interface makes it a vital constituent of our being (Claxton G. , 2015) and the necessity of continuous "self-atonement" in order to ensure its increasing optimum functioning (Gavin & Moore, 2010). It is also the expression of intelligence in terms of the kinaesthetic actions that constitutes the experience of the external environment as well as creating a life enhancing and flourishing one while continually becoming and being authentic. Within CAT context how well the sensory function of the physical intelligence operates to cope with the overwhelming number, variety and quick succession, and animated changes in stimuli will be of critical concern.

2.5.2   Mental intelligence (IQ)

The mental intelligence is traditionally regarded as intelligence *per se*. However, this is the centre of cognitive intelligence responsible for the following:

- Learning. The acquisition, retention, and use of knowledge is an important component of intelligence.
- Recognizing problems. To put knowledge to use, people must first be able to identify possible problems in the environment that need to be addressed.

- Solving problems. People must then be able to take what they have learned to come up with a useful solution to a problem they have noticed in the world around them.

Kauffman (Kaufman, 2013, pp. 303-305) postulates his theory of intelligence as follows in its foundational tenets:

- the self is a core aspect of human intelligence;
- engagement and ability are inseparable, dynamically feeding off each other as we engage in the world; and
- both controlled and spontaneous cognitive processes can be adaptive for acquiring a personal goal – eventually that of authenticity.

Sternberg (2007) and Sternberg and Kaufman (2011) define intelligence as a mental activity directed towards purposive adaptation to, selection, and shaping of, real world environments relevant to his life. With his diarchic theory of intelligence with its componential-analytic, experiential-creative and practical-contextual intelligences is a telling contribution to what intelligence is. He exposes the interdependentness of intelligence, creativity and wisdom (Sternberg, 2003) and he postulates that intelligence is there for achieving success (Sternberg, 2015).

Within the context of CAT, it would be profitable to expand on the exploration of this intelligence especially because of the relationship between the information processing in CAT context and the information processing function of the brain.

From the work of many contributors (Bergen & Bergin, 2014; Snowman & McCown, 2014; Zimmerman and Schunk, 2014; Cheung, Kwok & Yang 2015; Cline, Guilfod & Birch, 2015; Buss, 2015; Smith, Cowie & Blades, 2015) the cognitive information processing model of Slabbert et al. (2009) could be confirmed. The following cognitive information processing constitutes this model.

a. *Impressions (from the outside) to reception (through the senses)*

In these learning tasks, learners are confronted with real-life challenges, which have to be researched and conducted on the computer. "Intentional learning starts when impressions from the outside appeal to the senses. Whatever the form of these impressions, they transmit sensory

signals the learners reception through their sensory organs." (Slabbert, de Kock, & Hattingh, 2009).

b. *Observation image*

The sensory organs receive certain sensory signals embracing the senses of looking, hearing, touching, smelling or tasting and an image is formed in the short-term memory, the area where only peripheral "thinking" occurs. This observation culminates in observation images created through the senses, which is called reception learning (Slabbert, de Kock, & Hattingh, 2009). Learners are now doing research by going on the internet, reading information about careers and job opportunities or conservation and looking at images of different logos of universities, companies, and nature reserves.

This is the most active aspect of the mental intelligence in terms of language and visual stimuli.

c. *Perception image*

When the observation images display some consistency identified by the learner, a perception image is created. Perception is a consequence of learner focus on a specific aspect in an endeavour to create meaning. Generalisations can take place and meaning can then be constructed. Two key elements needed to be taken into account and they are consistency and permanency. Once the knowledge has become permanent, new perceptions can then occur, which play a vital role in deciding on what exactly "truth" resembles for the individual. His/her interpretations might involve viewing these perceptions as the truth. (Slabbert, de Kock, & Hattingh, 2009). The learners perceived some common characteristics among the different real-life challenges they were researching. Perception learning occurred when learners started finding relevant information on the internet (or any other form of media) about the real-life challenges and saving the bulk research into their folders created.

Unfortunately, the speed and amount of stimuli that bombards the senses in any particular point in time is so overwhelming that the formation of a conceptual image becomes increasingly difficult – and so does the formation of every other subsequent aspect of the information processing model. Thus only the peripheral part of the working memory is overstimulated at the cost of the activation of the subsequent parts of the working memory with no activation of the

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internal long term memory. It is at this point of information processing that digital dementia (Spitzer, 2013) gets its hold.

d. *Contemplation image*

A contemplation image is created when a learner becomes aware of some consistency or permanency of the observation image(s) from the outside. He/She also contemplates this through drawing on some previous applicable inner experiences by referring to his frame of reference in the long-term memory, and arrives at consistency or permanency (Slabbert, de Kock, & Hattingh, 2009). In this study, learners worked through the previously collected research by selecting (highlighting) common characteristics of careers and conservation, or important and relevant information in the documentation, taking screenshots, and saving these into their folders.

e. *Concept formation*

The mental activity moves to the long-term memory where a concept is formed, since the learner summarises the information and moves from the concrete to the abstract in his effort to create consistency or permanency. Whether it originates from the perception image or a possible contemplation image, the learner labels it. This results in the construction of meaning. Concept formation is therefore, linked with the construction of meaning (Slabbert, de Kock, & Hattingh, 2009). The learner now becomes more objective, and starts asking different questions, pitched at various levels of intelligence, which are typed out.

f. *Accommodation and assimilation*

The learners have to assimilate or accommodate their newly acquired concepts (constructs of meaning) and adapt to adopt these as part of their frame of reference by altering or elaborating on it to acquire the new concept. Accommodation and assimilation are both regarded as functions of the long-term memory. (Slabbert, de Kock, & Hattingh, 2009). The learner now discovers his/her own constructed meaning and it contains fundamental understanding of the concept of the real life challenge. Learners must now find the "answers" to these questions they created by making use of the research done. They realise now that certain information would be better to obtain from their peers and consequently creates an electronic form for their peers to complete.

g. *Extraction*

Succeeding the elaboration of the learners' frame of reference through accommodation and assimilation, they have to reveal the quality of their construction of meaning in mastering the new concept. To this end, they have to extract relevant aspects from the frame of reference to illustrate the understanding and ability to use this novel concept to their own advantage. (Slabbert, de Kock, & Hattingh, 2009). An example of implementing extraction in this study is when learners created electronic forms (learning task 1) and a website (learning task 2).

h. *Presentation*

"The newly obtained concept or construction of meaning must now be subsumed (included) in a mental presentation. This occurs when mental activities move from the long-term into the short term memory, where the presentation is formed." (Slabbert, de Kock, & Hattingh, 2009). With the first real-life challenge, an electronic form was created by the learners, and completed by his/her peers on the learners' desktop computer. The learners then compared the researched information with the completed electronic forms and captured all the data in a database. With the second real-life challenge, the presentation was much more intensive. They had to write a formal report on their findings and included a working website to display (present) their findings.

i. *Representation and recreation*

Without the relevant motor movement, the learners are not able to display their understanding and ability to use the newly adopted concepts (knowledge). The demonstration of the newly acquired concepts is thus achieved by a representation (graphics, language, and gestures) or a creation of a model. Creating new products or new learning provides evidence of higher order thinking, as new concepts are created. (Slabbert, de Kock, & Hattingh, 2009). A working website to display (present) their findings on conservation can be the outcome of this. This cognitive information processing model is depicted in figure 2.2
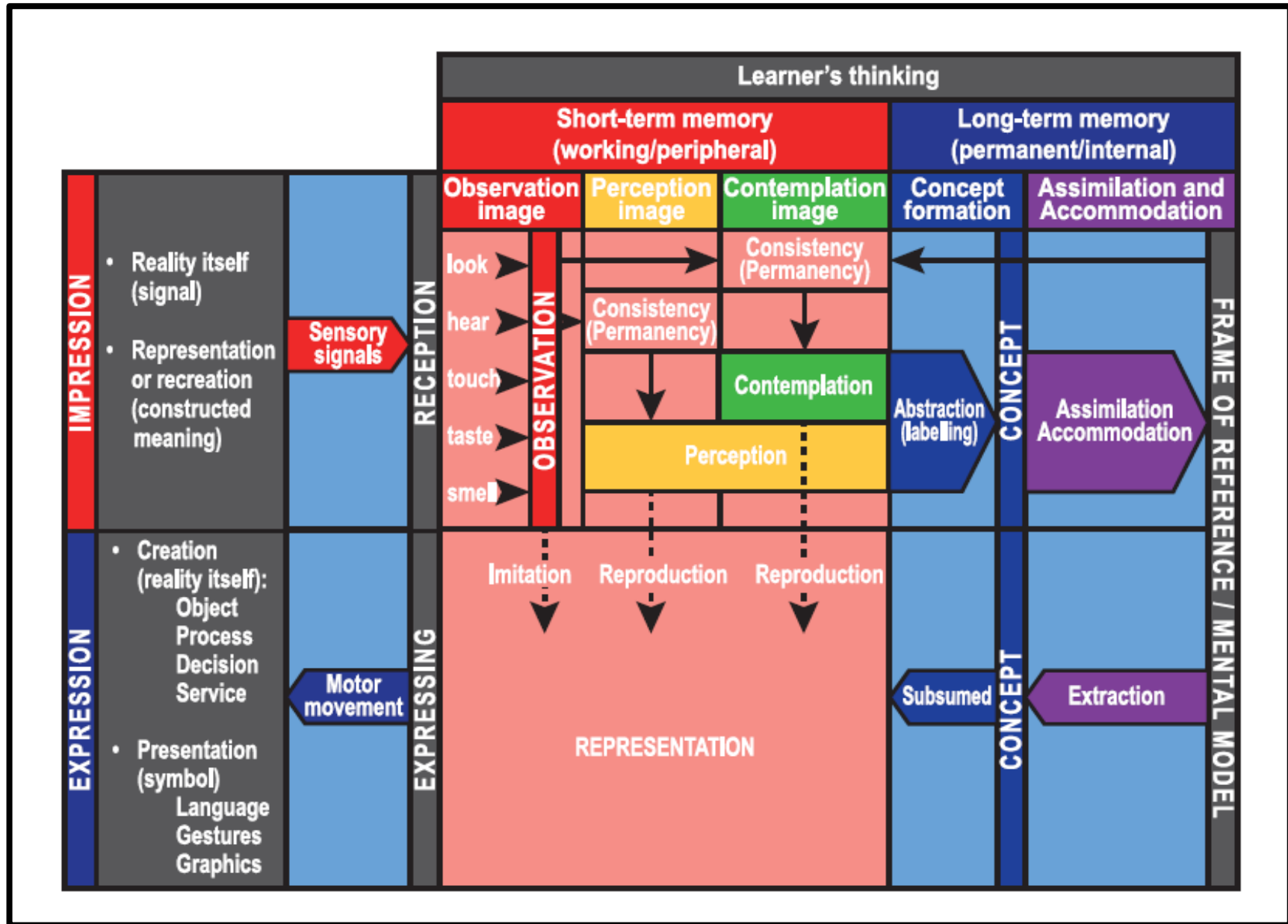
2. **Figure 2.2: A cognitive information processing model**

2.5.3 Emotional Intelligence (EQ)

The major proponents of emotional intelligence are Mayer and Salovey (1997), Bar-On (1997) and Goleman (2009a) with its closely associated social intelligence (Goleman, 2009b) and even ecological intelligence (Goleman, 2007). Goleman, (2009a) claims that EQ may matter more than IQ and this is confirmed in various ways by many other authors, like   Berenson, Boyles and Weaver (2008), Brackett, Rivers and Salovey (2011), Conley (2012) Chirayath and Elizabeth (2013), Mohzan, Hassan and Halil (2013) and Kanoy (2014) in terms of EQ being the best or better predictor of personal, social, academic and workplace success.

Macnamara (2015, p. 2) regards emotional intelligence (EI also known as EQ) as a way of thinking and an endeavour to apply the intellect. Two types of emotional intelligence are recognised: trait based emotional intelligence (EQ) and ability orientated emotional intelligence. Trait EQ is deemed a constellation of perceptions of the individual about himself/herself at the lower level of the personality. EQ is also regarded as a learned ability of self-awareness, which involves the ability to marshal emotions to achieve the intended goal, and is also linked with self-motivation, and the ability to handle relationships by managing the emotions of others in a subtle and sensitive manner.

Emotional Intelligence (EI or EQ) is also regarded as the affective ability to associate and relate things and other humans to ourselves. It deals with the awareness and understanding of feelings, both those of ourselves and those of others, as part of an effort to construct meaning by managing our feelings appropriately, showing empathy towards others (Slabbert, de Kock, & Hattingh, 2009, p. 75).

The cognitive information processing model is depicted in figure 2.2.

This model is crucial in view of what Huddleston (2013) calls "the dark side of technology" and its relationship with technological information processing and the unavoidable use of technology for that purpose in the CAT classroom. The vibrantly animated variety and quick succession of images and events that comes through technology to the screens of our devices, stimulates the brain to excrete dopamine which have us experience pleasure and that is what we want. But with continued stimulation the brain becomes overloaded with dopamine and the brain builds a dopamine barrier to protect it. The loss of dopamine excretion deprives us from the pleasure we love, and we try to rectify the situation with exposing it to more and longer technological

stimulation that will give us pleasure. However, the more we stimulate the brain the stronger the dopamine barrier becomes. Eventually the barrier becomes so strong that no dopamine can circumvent it to give us pleasure – no matter how much stimuli we try to feed the brain. The pleasure centre of the brain becomes numb and we do not experience pleasure anymore. This is the same result as what happens with heroin addiction. In terms of the model, the long term memory and the frame of reference loses its emotional dimension.

In addition, the short term memory is very limited in the amount of stimuli it can process at a time. The frequency and quick succession of stimuli from our screens prevent the stimuli to be processed and we are left with the ability only to reproduce the stimuli that had entered our brains. This means that our long term memory increasingly less used and this inaction is effective the cause of memory loss. What is more important is that the brain's accommodation and assimilation function where new possibilities are generated becomes inactive (Huddleston, 2013; Spitzer, 2013).

These are serious considerations where the brain is involved with cognitive information processing through technology.

Probably the most important aspect of EQ is that it constitutes our ontological *will* and it is the powerhouse of energy supply that we need to fight the battle for our authenticity. Within educational context, Smilkstein (2011) says "we're born to learn' and thus we are endowed with the *will to learn* as our foundational human disposition or quality or virtue and all other dispositions build on the will to learn (Barnett, 2007, p. 101). In addition, will defines a student:

> A student is someone who gives something of herself, who throws herself into her studies. … The idea of will, therefore, bears on the student as a person … It indicates that a student is committed, is energised, is giving of herself in a first-hand way. It indicates much more, too; for example, as to matters of responsibility and other virtues that we must come onto. Where the will is present, everything is possible (Barnett, 2007, pp. 18-19).

When Claxton (1999, p. 15) claims that "learning itself is an intrinsically emotional business", Zull (2011, p. 17) explains that we "realise that all thought is emotional. We can't get rid of emotion". He then goes on to say: "In education, the challenge is not to create emotions, but to unearth them (Zull, 2011, p. 63).

When education achieves this because the challenge is beyond the learner's current capability, Barnett (2007, p. 18) explains that access to the spiritual intelligence is eminent: "It provides internal energy – spirit even" (Barnett, 2007, p. 18).

2.5.4 Spiritual Intelligence (SQ)

Some of the proponents of spiritual intelligence are Zohar and Marshall (2000), Mark (2010), Painton (2010). These and other authors like Koening (2012) and Maziere, and Gunnlaugson (2015), emphasise the importance of correlation between spiritual intelligence and that of physical and mental health and general well-being and well-being and spiritual intelligence.

Spirituality may be a controversial issue to some people, but whatever you may label it, the existence of such a realm beyond the limitations of our finite rationality is an existential and ontological reality. In addition, spirituality is not religion, although religions may have arisen from it. SQ is the pursuance of the perennial question of our existence: What is the meaning of life? But this translates to the personal questions of who we really are, what we are actually capable of and what our ultimate purpose is - as well as where do we come from and where are we going.

"Scientific evidence – largely from the field of neuroscience which concerns our basic biology and how our brains develop – shows that the human child is 'hardwired to connect'. We are hardwired to connect to other people, to moral and spiritual meaning, and openness to the transcendent" (Glenn & Blankenhorn, 2003) – a realm way beyond ordinary experience: a higher order of being, more wise, more powerful and more trustworthy than our frail and finite ego's. Across virtually all dimensions of life "there is a growing recognition that spirituality – not religion necessarily, but the more broadly defined concern for the meaning and purpose of life – is a fundamental part of the human condition – [and] may be wired into our brains" (Pink, 2006, p. 221). We have to take spiritual intelligence seriously because of its experienced based ability to improve our lives. Mitroff, Denton and Alpaslan (2009) found that companies that acknowledged spiritual values and aligned them with company goals outperformed those that did not. Even world-renowned higher education institutions are embracing SQ in hard-core scientific research. "Like EQ, SQ is becoming more mainstream in scientific enquiry and philosophical and psychological discussion" (Covey, 2004, p. 53). This should not be any surprise, as Zohar and Marshall (2000, p. 124) explain: "Spiritual intelligence, in essence,

represents a dynamic wholeness of self in which the self is at one with the self and with the whole of creation".

With the SQ being the ultimate, highest level of being and *the* source of our existence, what is available from that source is the question. "Deep spirituality, the deep spiritual centre of the self, is about potential" (Zohar & Marshall, 2000, p. 239), but not only is it *about* potential, it "is the domain of pure potential" (De Quincey, 2005, pp. 239-240). Most extraordinary, however, is that our spiritual nature is "endowed with limitless potential" (Dimitrov & Wilson, 2002, p. 14) that generates "replete and inexhaustible power" (Zohar & Marshall, 2000, p. 155) and is characterised by "infinite possibilities" (Dooley & Luce, 2010).

Although the spiritual intelligence 'houses' our potential in terms of the fundamental human virtues, we are reminded that this immeasurable potential will come to fruition only under certain conditions. Through the dynamic interplay between the four inseparable constituents of our human nature – body (PQ), mind (IQ), soul (EQ) and spirit (SQ) – that needs to be "simultaneously activated … while in constant, dynamic interaction with the environment … and thus constantly creates and re-creates us" (Dimitrov & Wilson, 2002, pp. 68,48) only through experiencing real life (Hursthouse, 2013).

This is the challenge of authentic learning.

2.6   AUTHENTIC LEARNING (AL)

If learning has taken place, it is the evidence of education even if the education occurred with no particular purpose and without an educator. Therefore, in an educational context, learning itself always has a particular purpose (to become authentic), and something in particular must be learned (how to become authentic). The purpose of learning in education is to achieve the highest possible quality of learning that is within the realm of moral excellence, nothing less. To achieve this kind of learning, a significant other is necessary to mediate the learning.

Claxton (1999, p. 11) provides a very simplistic yet significant definition of learning: "Learning is what you do when you don't know what to do." Slabbert et al. (2009) define learning within a constructivist context as follows: Learning is the construction of meaning by the learner self, who then uses it to do something creatively new. In this regard, (Heyligen, 1997) explains that constructivist epistemology highlights that learning is not a passive phenomenon but requires

active involvement of the learner with the environment. In addition, Heyligen (1997) focuses on the fact that knowledge cannot be transferred optimally by mere teacher-centred instruction. Piaget (1970, p. 715) is regarded as the pioneer of constructivism, and he is of the opinion that the consequences of constructivism in education are not recognised. He posits that if the teacher pre-empts learning by providing the information that the learner could have personally discovered, the learner is prevented from inventing new knowledge, constructing meaning and understanding the information completely (1970, p. 715). Constructivism is not merely a theory but represents the neuro-scientific functioning of the brain because when learners are involved in the crucial activities of exploration, experimentation and discovery, a significant change occurs as their neural networks are growing and connecting. These physical structures or neural networks are also regarded as the higher level of intellectual operation, equipping the learner with new skills (Smilkstein, 2011, p. 76).

Learning, therefore, subscribes to an ontological, neuroscientific and constructivist epistemology.

2.6.1 Authentic learning as a constructivist, experiential epistemology

Purpel and McLauren (2004, p. 176) and Acoff and Greenberg (Acoff & Greenberg, 2008, p. xiv) declare that in education, learning is not about finding things but it is, finding ourselves. This is valid, especially within the supercomplex, 21st-century context in which education has become an endeavour of learning for an unknown future in which the knowledge and skills that will be required in such an unknown future are not available (Barnett, 2012, pp. 247-260). The notion of education as 'learning to know' must be replaced with 'learning to be'. Barnett (2007, pp. 257-259) maintains that learning, which keeps abreast of novel developments and change, thus anticipating future learning approaches, compel the teacher to take cognisance of more than skills and knowledge but also considers the human dimension when designing an appropriate pedagogy. Education, therefore, is not an epistemological task but an ontological challenge that brings the issue of authenticity to the fore. Barnett (2007, p. 40) asserts that authenticity is central to the deep structure of education. It is imperative that learning should be authentic and that learners are confronted with novel challenges to grow and develop.

The type of learning required in the context of the ontological challenge of education must be distinguished. Research on learning is, therefore, pivotal in construing the pedagogical task. Dochy, Gijbels, Segers & van dn Bossche (2001, pp. xii-xv) provide an overview of the state-of-the-art contemporary learning theories, and Coffield, Moseley, Hall and Ecclestone (2004) have

reviewed 71 learning theories/models. After analysing the 13 major theories, Kolb's (1984) experiential learning theory, so well underscored by Walker and Boud (1992, pp. 43-57), is still the most influential and most frequently used. Despite the critique to which all theories are normally subjected, it is not difficult to understand why Kolb's (1984) experiential learning cycle (ELC) is so appealing. It is a holistic model of the learning process and development that is consistent with our knowledge regarding how we naturally learn, grow and develop.

Kolb (1984) postulates that in learning, the learner undergoes four stages of an experiential learning cycle. The initial stage is one of concrete experience (CE) by becoming involved (feeling); the second stage is one of reflective observation (RO) through observation and reflection (listening, watching); the third stage comprises abstract conceptualisation (AC) that takes place through constructing (thinking); and the final stage involves active experimentation (AE) through the making of decisions (doing).

Concrete Experience
(CE)

FEEL

Active Experimentation
(AE)

DO

Reflective Observation
(RO)

THINK

Abstract Conceptualisation
(AC)

CONSTRUCT
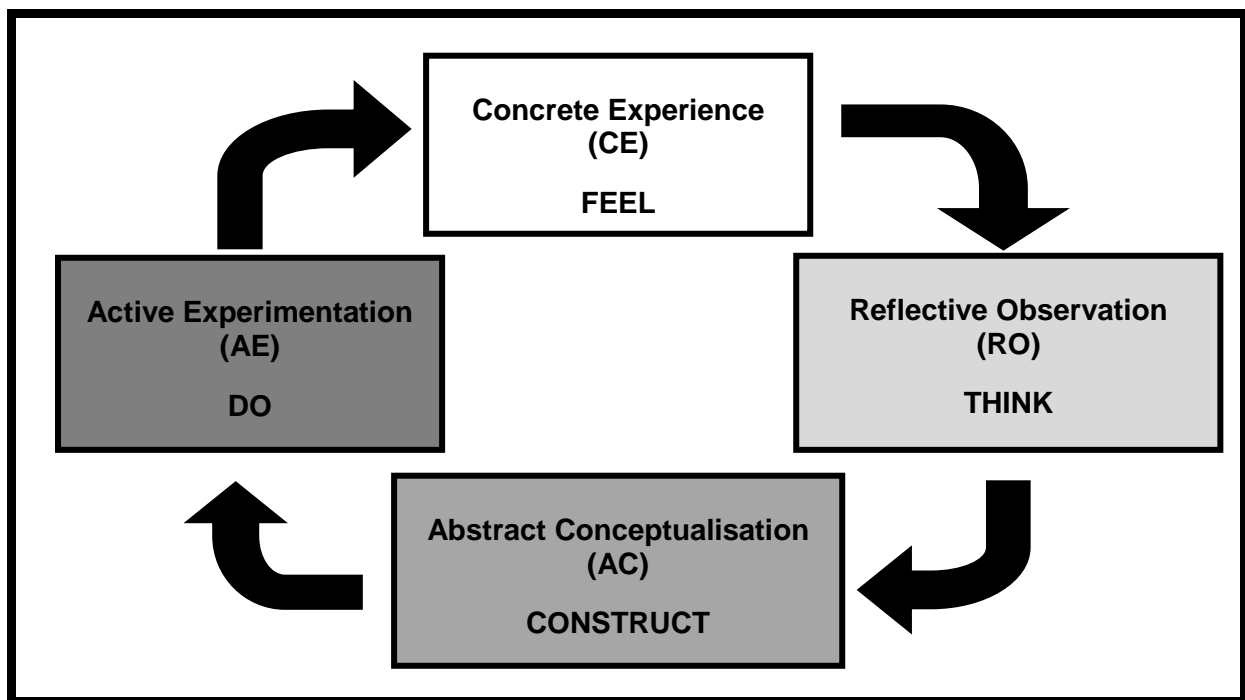
3. Figure 2.3: Kolb's experiential learning cycle

(Source: Adapted reproduction from Kolb, 1984 p. 21)

Within the realm of experiential learning, Van Merriënboer and Paas (2003, p. 36) expose the following pedagogical principle regarding the design for learning: "The starting point for design is not an analysis of the content, but rather in the study of the process of learning". Since the process of learning revealed by Kolb (1984) as authentic – how a learner naturally learns and develops – the following statement from Brown, Collins and Duguid (1989, p. 38) should not be

a surprise: "Learning methods that are embedded in authentic situations are not merely useful, they are essential".

Besides its comprehensiveness, what makes experiential learning more significant is that it has been developed from the knowledge of how learning occurs naturally or authentically in human beings. Slabbert et al. (2009, pp. 68-76) utilised Kolb's experiential learning to identify the characteristics of authentic learning.

Authentic learning is a process in which learners are immersed in a challenging real-life experience, followed by reflection on that challenging real-life experience and during which the challenging real-life experience is translated into dynamic knowledge (Korthagen, 2001, p. 43). Subsequently, a construction of the resolution towards this challenging real-life experience is made in the form of cognitive schemata and mental models that transcend the direct experience (its knowledge and skills) (Van Merrienboer & Paas, 2003, p. 5). Finally, what has been learnt is taken into the exploration of a new real-life experience and a new order of self-transcendence or consciousness (Csikszentmihalyi, 1996).
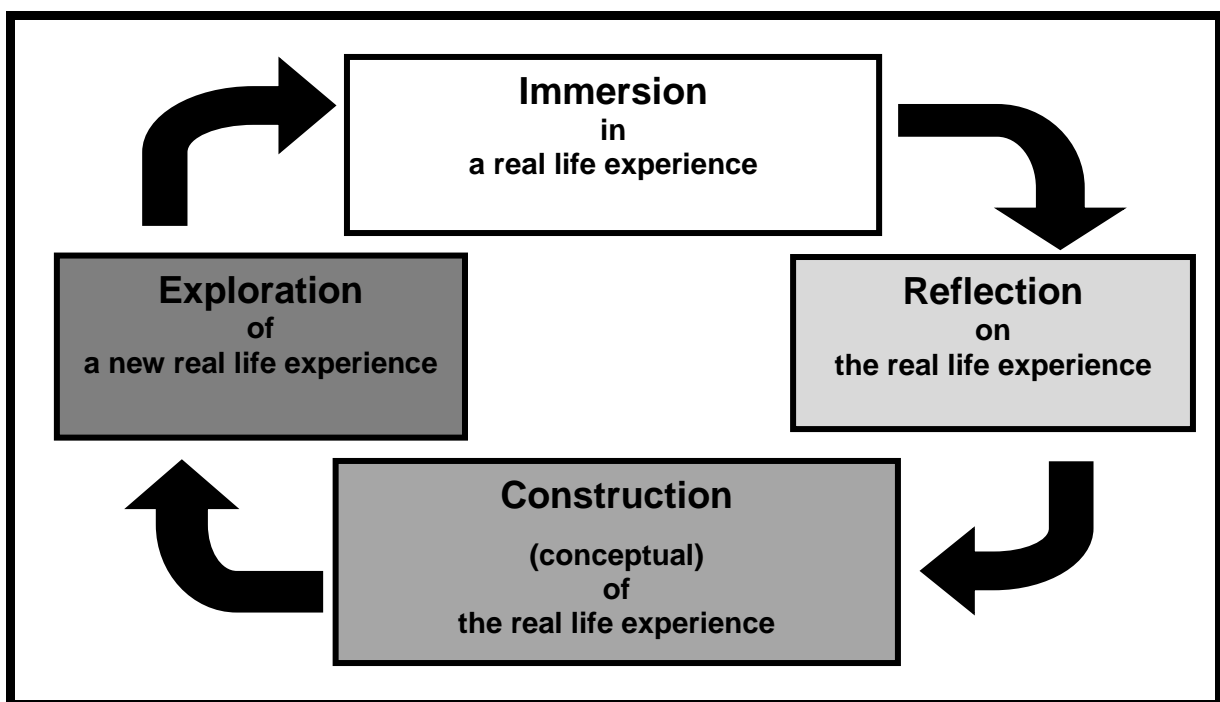
4. Figure 2.4: The cycle of authentic learning

(Source: Slabbert et al. 2009, p. 73)

Dispositions and qualities in the form of essential human virtues are acquired through this process and represent personal development of the highest order (Alexander & Potter, 2005, p.

108) and the ultimate transformation of the human being as the educational purpose (Barnett, 2007, pp. 101-103). This energises and enhances the foundational disposition of a will to learn (Barnett, 2007, p. 101), which compels the learner to explore a new, challenging real-life experience (Frankl, Man's Search for Meaning, 1984, p. 121).

While authentic learning has existed for decades, it has received considerable attention in recent years as technology, particularly 3D environments and cyber infrastructure, has lowered the barrier to implementation. Authentic learning builds on the concept of 'learning by doing' to create learning environments that advance beyond merely allowing learners to play a role. In the course of a real-life challenge, learners engage in the type of multidisciplinary problem-solving and critical thinking that researchers and experts use every day. Learners learn how to investigate problems that require more than textbook formulae or rationales to solve (Windham, 2007). From the work of Reeves, Herrington and Olivier (2002) and Lombardi (2007) and Harrington, Parker and Boase-Jelinek (2014) developed a ten-point definition for authentic learning can be constructed, which provides educators with a useful checklist that can be adapted to any subject matter domain. The checklist embraces the following:

- *Real-world relevance*: Authentic activities match the real-life tasks of professionals in practice as closely as possible. Learning rises to the level of authenticity when it asks learners to work actively with abstract concepts, facts, and formulae inside a realistic- and highly social context. In this regard, Newman, Marks and Gamoran (1995, p. 1) says that our learners should "become 'active learners', capable of solving complex problems and constructing meaning that is grounded in real-world experience";

- *Ill-defined problem*. Challenges cannot be solved easily by the application of an existing algorithm. Instead, authentic activities are relatively undefined and open to multiple interpretations, requiring learners to identify the tasks and subtasks needed to complete the major task of their own accord.

- *Sustained investigation*. Problems cannot be solved in a matter of minutes or even hours. Instead, authentic activities comprise complex tasks to be investigated by learners over a sustained period, requiring significant investment of time and intellectual resources.

- *Multiple sources and perspectives*. Learners are not given a list of resources. Authentic activities provide the opportunity for learners to examine the task from a variety of theoretical and practical perspectives using a variety of resources, requiring learners to distinguish between relevant and irrelevant information in the process.

- *Collaboration*. Success is not achievable by an individual learner working alone. Authentic activities make collaboration integral to the task, both within the course and in real life.
- *Reflection (metacognition)*. Authentic activities enable learners to make choices and reflect on their learning, both individually and as a team or community.
- *Interdisciplinary perspective*. Relevance is not confined to a single domain or subject matter specialisation. Instead, authentic activities have consequences that extend beyond a particular discipline, encouraging learners to adopt diverse roles and think in interdisciplinary terms.
- *Integrated assessment*. Assessment is not merely summative in authentic activities but is integrated seamlessly into the major task in a manner that reflects real-world evaluation processes.
- *Polished products*. Conclusions are not merely exercises or sub-steps in preparation for something else. Authentic activities culminate in the creation of a whole product, valuable in its own right.
- *Multiple interpretations and outcomes*. Rather than yielding a single correct answer obtained by the application of rules and procedures, authentic activities allow for diverse interpretations and competing solutions.

For educators who are considering using authentic learning in their own classrooms, practical advice is offered by Mims (2003, p. 3):

- "You must think like a coach.
  Authentic instruction calls you to a much different role than traditional teaching methods require. The learners are now in control of their own learning and it is important that you do not take that power away from them.
- Bring earplugs.
  Realise that your classroom environment will drastically change. Learners will be actively working, participating in discussions, hunting for information, and enjoying the entire process. Desks will have to be moved around and learners will need to have freedom to move about in the room. It will become important for you to develop the ability to distinguish between "energetic learning" and other energetic activities.
- Ease your way into it.
  Perhaps undertaking a two-week authentic experience in your initial effort is not a good idea for you or for your learners. All of you will need to become acclimated to this new process. I encourage the facilitator of learning to initially attempt one or two small authentic learning

events (real life challenges) in a school year and then develop the authentic learning over the years to come. By the end of the year, both the facilitator of learning and the learners themselves will be looking forward to starting the next real-life challenge.

- Get some help.

  There are quality examples and resources to help you design authentic instruction, both at a bookstore or library and on the Internet. Use their ideas and take advantage of any advice they offer. It might also be a good idea to have adult volunteers come into your classroom and initially assist you. The learners will have many questions and needs, not just related to the lesson, but also as they begin to adjust to this new process. An "extra set of hands" could be helpful in dealing with this.

- You are learning too.

  Think of your first attempt at implementing authentic instruction in your classroom as a learning experience for you".

Authentic learning portrays a number of fundamental characteristics as its constituents, which will be explored in the next paragraphs.

2.6.2 Metalearning

Metalearning is derived from the concept of metacognition of Flavell (1976). Achieving in the metalearning process involves learners engaging in a higher-order learning process of managing, controlling and taking responsibility for their own learning. The process entails the following metalearning strategies each with only its primary questions which the learner needs to answer through engaging with resolving the demanding real life challenge, which represents the first level of improving his or her learning quality:

a. *Planning one's own learning:*
- What is this all about?
- Do I know enough about this?
- What am I required to do?
- How do I see the task?
- How will I do it?
- How can I improve my plan?

b. executing one's own learning:

- What is my preconceived plan?

- Am I executing my preconceived plan?

- What is the next step to execute?

c. monitoring one's own learning:

- How does this new knowledge compare to what I previously knew or predicted?

- Do I understand what I am doing?

- Is this the best way of doing it?

- Have I completed this fully and carefully?

d. assessing one's own learning:

- How could I have done this even better?

- How can I use this knowledge in future?

Metalearning is designed to ensure that the individual learner will achieve the highest possible quality of learning (Van Merrienboer & Paas, 2003) and become an active, effective, independent, self-regulated, lifelong learner (Slabbert, de Kock, & Hattingh, 2009, pp. 108-111). Metalearning is identified by the learner continually asking him or herself particular metalearning questions during each of the metalearning strategies which they need to answer themselves through executing what is required in order to arrive at the answer. They need to do this efficiently enough to ensure that their entire learning process will have the highest possible quality of learning as a result. With this as the requirement of metalearning, learners are compelled to access the source of their authenticity to attain the essential intrapersonal human virtues, such as courage, responsibility, honesty, integrity, independence and resilience (Slabbert, de Kock, & Hattingh, 2009, pp. 91-94). Ezi, Ezenwafor, and Molokwu (2015) for instance, confirm the importance of metalearning in self-management and positive reinforcement and development of the self in such very practical aspects as the building trade and Meyer, Knight, Callaghan and Baldock (2015) do the same in much more sophisticated threshold concept learning.

The achievement of self-management through metalearning is a critical self-regulating mechanism (Kaufman, 2013) that allows each individual learner to become authentic. It is an inevitably tough and lonely journey that requires the individual learner to exert every single grain of power in order to excavate the deep rooted authentic but unfortunately mostly dormant

potential (De Quincey, 2005) encapsulated in essential intrapersonal human virtues (Slabbert, de Kock, & Hattingh, 2009, p. 92). But it is only when this intrapersonal relationship requirement has been met that the individual learner should and could efficiently and productively engage with others in a communal quest to pursue a higher level of authenticity through interpersonal mutual cooperation.

The ultimate purpose of metalearning is the attainment of the essential intra*personal human virtues.*

2.6.3 Cooperative learning

We are regarded as human beings because we grow, change and continually increase the depth of our social relationships in order to maximise and fully utilise our potential (Blackemore & Frith, 2005, p. 107). Vygotsky (1978, pp. 79-91) is recognised as one of the most prominent contributors to social constructivism, which states that social interaction plays a fundamental role in the process of learning – the construction of meaning. If we accept that the construction of meaning results in knowledge, then the explication of Jaworski (1999, p. 24) is significant. Jaworski (1999) is of the opinion that according to the theory on the sociology of knowledge, reality is constructed inter-subjectively and is socially negotiated between those who communicate and share perspectives and meanings of the world they live in (Maton, 2013). This theory gives credence to the acknowledgement of the socio-cultural and socio-emotional spheres of learning. The learner becomes a co-constructor of new knowledge.

This appropriate interaction between the learners in their mutual pursuance of their individual authenticity is, according to Palmer (1998, p. 104), achieved through the *community of truth*. He describes the function of the community of truth as follows:

> Individuals share their constructions with others to be tested and questioned by the community who may approve or disprove it in a communal effort to stretch each other to the limit. The subsequent conflict forces the individual to make new, higher quality knowledge constructions. This will happen only if we are willing to submit our assumptions, our observations, and our theories – indeed, ourselves – to its scrutiny. (Palmer, 1998, pp. 103-104).

Co-operative learning provides the context for the community of truth to operate. It is through co-operative learning that learners become active, effective, interdependent and collaborative. It is through co-operative learning that the essential interpersonal human qualities that determine the quality of their learning about life will be acquired. The quest is to find the most appropriate pedagogy that will provide the highest possible quality of learning in order to fulfil the educational aim. This aim would be to attain the essential interpersonal human virtues like humanisation, joy, empathy, magnanimity, and the like. According to Wessels (2010, p. 9), co-operative learning is very useful if the teacher must contend with large classes. Co-operative learning emphasises the use of resources to deepen understanding rather than the use of resources to compete (Killen (2013, p. 215) through the following features as characteristic of co-operative learning:

- *Positive interdependence*. Learners should operate as a cohesive group to succeed in achieving the learning goals.
- *Ongoing, direct interaction*. Learners must exchange ideas and decide on the best strategy to approach the topic.
- *Individual accountability*. Each learner must accept responsibility for a specific part of the task.
- *Appropriate interpersonal skills*. These skills involve listening and negotiating skills.
- *Reflection*. The learners must reflect and advise each other in order for learning to be on going.

Kaldi, Filippatou and Anthopoulou (2014, p. 621) suggest ideas on the effectiveness of co-operative work that are structured. Kaldi et al. (2014) are of the opinion that a theory of collaboration can be connected with Vygotsky's (1978) principles of interactive learning.

The characteristics of group work are:

- co-operation within the group since group members should reach common teaching goals;
- positive interdependence;
- sound interaction among the members of the specific group; and
- both collective and individual accountability (Kaldi et al., 2014, p. 621).

Biasutti (2015, p. 117) asserts that the aspect of creativity is essential when performing co-operative learning activities because interacting learners need to be assisted in engaging their

attention. Biasutti (2015) contends in her research on collaboration in ICT in music, that co-operation, identity and meta-cognition can be regarded as critical in supporting a community of interest.

Lippman (2015, p. 39) proposes that co-operative learning, especially with the use of technology, should be done in an environment with ample physical space because learners will discuss work in groups but will also need space to work independently. Initially, students work alone to achieve something utilisable, then exchange ideas, then work alone again and finally, consolidate together.

The ultimate purpose of co-operative learning is the attainment of the essential inter*personal human virtues.*

2.6.4 Lifelong learning

In view of the research by Frankl (1984, p. 121), there is little doubt that learning is, and should be, a lifelong process. In fact, the research of Smilkstein (2011, p. 76) in using the brain's natural learning process to construct 21st-century curricula, resulted in her choosing to give her publication the title: 'We're born to learn'. Jensen (2000, p. 122) concurs with the abovementioned stance. Leonard and Murphy (1995, p. xv) also agree and state: "Our destiny is to learn and keep on learning for the rest of our lives."

The preceding paragraphs expose the elements of the transformative pedagogy for a contemporary CAT curriculum in practice. Through exploration, I found a pedagogy that incorporates all these elements and many more as a comprehensive whole. It was important to explore this professional education practice in its entirety.

2.7 FACILITATING AUTHENTIC LEARNING

Returning to the ontological pillar, Barnett (2007, p. 102) indicates that the attainment of dispositions and qualities with its fundamental and stabilising durability "constitute the student's pedagogical being. It is they that have to be the focus of 'teaching'". Significantly placing 'teaching' in inverted comas indicates that, although the essential human qualities define learners' authentic being and should be the focus of our education, it cannot be taught. In fact, Oscar Wilde stated: "Education is an admirable thing, but it is well to remember from time to

time that nothing that is worth knowing can be taught" (Quoted in "Oscar Wilde", Brainy Quote, n.p.).   Although teaching may have many meanings, our dominating education practices certainly have a common teaching denominator.   We may not agree with how Kersson-Grieb (2006, p. 6) defines teaching, but we need to take heed of the detrimental possibilities if we indulge in education practices that are not conducive to its purpose:

> Teaching is an unnatural act, an incursion on another person's learning-in-progress. Each persuasive attempt to get students learning … comes with a built in demand that they stop thinking … the teach/tell/talk belief that defines 'learning' as 'students memorizing my understandings' instead of constructing their own … teaching is no doubt an imposition, a sustained redirection of other curious creatures' voracious cogitation".

Facilitating learning is equally fraught with differences in meaning.   A review of the literature indicates that it is taken to be anything on an elongated continuum, from requiring someone to imitate someone else, as occurs with much of the education of small children (e.g. brushing teeth), through all its variants to the opposite end of the continuum of individually and independently executing highly sophisticated research.

To clarify what is meant by facilitating learning, we can initially indicate what it is *not*.   It is certainly not teaching, but neither is it showing, telling, lecturing, demonstrating or employing any of the many other teaching strategies, methods, tools or techniques (Rooth, 2000, p. 35).   It is completely different from teaching in that it only provides the resources and structures for learners to discover, explore, experiment, construct and develop.   It is also qualitatively different from teaching in that the sole purpose of facilitating learning is to ensure the highest possible learning quality.

There are four realms of quality that need to be recognised.   The first realm is the level of quality of the learning process (skills) that is employed.   The second realm is the level of quality of the content (knowledge) that is acquired.   The third level is the level of quality of the product that will improve the quality of lives, and the fourth realm is the level of quality of human being (authenticity) attained.   These four realms are wholly integrated and interrelated in a very particular way: The real-life challenge with which the learners are to be confronted is set within its uncompromising supercomplexity beyond the current capability of the learners to resolve it. Their emotional realisation that their current capability (knowledge, skills, products and human

virtues) are insufficient, provides the energy necessary to penetrate and access the source of their full human potential. This is located in their authenticity when their *potential* human virtues are ignited into a higher level of *actual* human virtues, which is the source for generating the higher levels of knowledge, skills, products and the self.

With reference to the second philosophical perspective, there is no dispute that knowledge and skills as well as products and virtues must be acquired, but *how* they are acquired is in question. If it is quality that is pursued in education, then it must be understood that learners must have "qualities of personal insight and understanding" (Barnett, 2007, p. 149). This is possible only if the person has *constructed* the qualities because *personal insight and understanding* cannot be transmitted through the communicative process of teaching (Von Glasersfeld, 2008, p. 48). According to Barnett (2007, p. 164): "Learning becomes a complex matter. It is to have *'depth'* [quality] and is certainly not to be a mere acquisition".

The purpose of facilitating lifelong authentic learning is the concrete, active, *personal* construction of knowledge, skills, products and virtues of the highest possible quality. It is *not* mere acquisition, which would for all practical purposes result in facilitating lifelong, authentic learning being the direct opposite of teaching.

Finally, what distinguishes facilitating learning from teaching is that teaching in its general conception cannot be justified in education because its focus seems to be on the teaching dimension of education. Since the learning dimension is not explicitly the major object of educational discourse except within the context of assessment, there seems to be an assumption that teaching causes learning. Sternberg (2007, p. 144) admonishes this assumption: "The problem is that teachers think that if they 'teach', students learn". Therefore, since the possibility exists that a teaching event may not result in learning or the learning may lack in quality because or in spite of it, teaching is not justifiable in education. Conversely, facilitating lifelong, authentic learning is solely and exclusively designed for the single purpose of attaining the highest possible quality of learning in terms of knowledge, skills, products and the self.

There are various ways in which the quality of education can be indicated through different education paradigms (also referred to as models, modes or perspectives). According to Slabbert et al. (2009, pp. 136-138), traditional education may be characterised by three existing paradigms of education: the transmission, transaction and transformation paradigms. These three paradigms are closely related in that they are essentially content based, that is, the content forms the basis

for the required educational intervention. A fourth paradigm has been added, which takes learning quality not only to an extraordinary level but also to another dimension – that of pursuing authenticity. It is called the transcendental paradigm because it transcends the limitations and the confinements of the following:

a. The prescribed content-based curriculum
b. The acquisition of knowledge and skills and its application to the construction of meaning
c. Learning to know to learning to be
d. The classroom and school to real-life on all levels and in all domains
e. The self and all the ways of knowing

The major characteristics of each of the four paradigms are compared in Table 2.2.

3. Table 2.2: Four education paradigms

EDUCATION PARADIGM / EDUCATION COMPONENT	Transmission	Transaction	Transformation	Transcendental
Aim	To impart knowledge	To understand knowledge	To apply knowledge	To maximise human potential
Foundation	Content	Content	Content	Process (for content)
Education mode	Direct teaching	Interactive teaching	Project education	Facilitating learning
Focus	Learning to know (facts)	Learning to 'understand' (facts)	Learning to apply (facts/knowledge)	Learning to be (authentically and holistically human)
Educator action	Tell, illustrate, demonstrate, explain	Questioning, discussing	Give assignments, projects, guidance, help	Confront the learners with a real-life challenge they have to resolve themselves
Learner action required	Absorb, memorise, drill, practise	Answering questions, discussing	Exploration, discover, experimentation	Creatively constructing new meaning
Learning mode	Receptive	Interactive	Self-active	Self-directive and collaborative
Learner autonomy	None	Some	Much	Total
Level of learning	Shallow	Insight	Deep	Transcendental
Learning outcome	Cognitive	Social	Multiple	Holistic
Outcome	Core concept reproduction	Core concept understanding	Enriched curriculum	Authentic: Living real life wisely
Learning quality	Low	Medium	High	Maximum

(Source: Slabbert et al. 2009, p. 137)

This comparison between the four education paradigms clearly distinguishes that the mode of education is facilitating learning. Table 2.2 indicates that it is inherently a process that facilitates learning that is authentic in the way in which humans learn naturally. In addition, it is authentic in that it allows learners to pursue their authenticity. Facilitating learning ensures that the learning quality is at the maximum, that is, it is the educational intervention that compels learners to pursue their authenticity. For all practical purposes, facilitating learning is the practice of the philosophical perspective on education discussed above.

The overall purpose of facilitating learning is to achieve the aim of education as formulated by Slabbert (2015, p. 132).

> The aim of education is to design the most powerful learning environment possible that will compel learners to empower themselves to maximise (completely develop and fully utilise) their human potential (essential human virtues – ethical qualities of moral excellence) through facilitating (demanding the highest possible quality of) lifelong, authentic learning (resolving real-life challenges) for the purpose of creating a safe, sustainable and flourishing future for all.

Within the context of this aim of education, Heidegger (1962, p. 44) makes a very significant claim when he says: "The real teacher, in fact, lets nothing else be learned than – learning. His conduct, therefore, often produces the impression that we properly learn nothing from him". This is not only a befitting description of facilitating learning, but it is also a description of the 'real teacher' – more appropriately called a facilitator of learning (FOL).

According to Slabbert et al. (2009, p. 102), the professional practice of facilitating learning consists of a number of fundamental components that constitutes the professional practice of facilitating authentic learning. It is determined by three purposes of facilitating authentic learning, six corresponding functions of facilitating authentic learning in practice – which constitute the process (steps) in facilitating authentic learning - and the corresponding phases through which facilitating authentic learning is employed in practice. This is depicted in table 2.3.

4. Table 2.3: Facilitating learning in practice

FACILITATING LEARNING IN PRACTICE		
What is the major purpose?	**What are the required relationships to be established?**	**What is the facilitating learning function?**
Initiating Learning	Relationship for searching meaning	Learning Task Design (LTD)
		Learning Task Presentation (LTP)
Learning	Relationship for constructing meaning	Authentic Learning (AL)
Maintaining Learning	Relationship for enhancing meaning	Learning Task Execution (LTE): - Metalearning (ML) - Co-operative Learning (CL)
		Learning Task Feedback (LTF)
		Learning Task Consolidation (LTC)

(Source: Slabbert et al., 2009, p. 102)

2.7.1 Initiating learning – First purpose of facilitating learning

The first purpose of facilitating learning is initiating learning. The purpose of initiating learning is to precipitate learning. This is always the responsibility of the FOL, but learning might be initiated by, for example, an object or event or anyone within a professionally appropriate educational context and its required ethical imperatives.

Education always implies relationship. In relation to the philosophical perspective that Frankl (1984, p. 121) contributes to education, namely that "man's search for meaning is the primary motivation in his life", the purpose of initiating learning is to establish a relationship between the learner and the search for meaning. This refers to the relationship that the learner must establish with what is to be learnt. As has been indicated earlier, learning can be initiated by anything or anyone, but the FOL is ultimately responsible for this. In fulfilling this responsibility, the FOL needs to establish *what* is to be learnt in order to have the learners establish the corresponding relationship *how* with it. This is done through ensuring the most "powerful learning environment" possible (De Corte, Verschaffel, Entwistle, & Van Merrienboer, 2003), as required by the aim of education.

The most powerful learning environments are characterised by a situation which require complex learning, which is "a description of real-life or professional tasks because learning needs to be situated in problem solving in real-life, authentic contexts … [where] meaningful experiences enable the learner to learn the ways of knowing of the expert" (Van Merrienboer & Paas, 2003, p. 5). Since "real-life or professional tasks" need to initiate learning, they are aptly called learning tasks: "Learning tasks are concrete, authentic and meaningful real-life experiences that are provided to learners. (Van Merrienboer & Paas, 2003, p. 9). The learning task defines *what* that has to be learned. The learning task, therefore, is the pivotal point around which everything regarding facilitating authentic learning revolves.

Lombardi (2007) and Harrington, Parker and Boase-Jelinek (2014) provides the following characteristics of a learning task – the *what* has to be learned:

- an ill-defined demanding real-life challenge in its *holistic* uncompromising complexity with which learners were not confronted before in parts or as a whole;
- for which there is no known resolution – at least for the learners – and which cannot be resolved from a compilation of existing knowledge and information;
- the requisite knowledge and skills to resolve the challenge is not available;
- what to do next is uncertain - exactly as it would occur in everyday, real-life;
- its resolution should require the search for and acquisition of knowledge and skills (in particular critical thinking, reasoning and problem-solving ones) to understand the challenge and how it might be resolved;
- arriving at a resolution should require a sustained investigation over a substantial period of time;
- it should have more than one acceptable outcome;
- the end product(s) should be real – exactly as would the outcomes of real life challenges require; and
- it should be a challenge where the learner as a *whole* needs to be fully engaged and absorbed and in order to resolve the challenge.
- it should elicit the personal development of the highest order and the increasing transformation towards authenticity of each learner.
  (Lombardi, 2007, p. 3; Harrington, Parker, & Boase-Jelinek, 2014)

These characteristics of a learning task emphasises the fact that facilitating authentic learning constitutes *holistic* education on two accounts. If we conveniently fragment reality that is

inherently holistic in its uncompromising super complexity into smaller pieces of whatever kind or format and package each of them nicely in our educational presentation for easy consumption by the learner, we are, in fact, destroying meaning (Slattery, 1995, pp. xi-xii). If we, therefore, start our educational endeavour off with an already fragmented reality and then attempt to put the severed fragments back together again, failure is inevitable because we know that the whole is much more than the sum of its parts. Facilitating learning – within the context of a *learning task* - recognises that reality is already authentically whole. The challenging, uncompromising super complexity of the holistic learning task provides the required "*rigorous, authentic human experiences*" (Oakes, Lipton, Anderson, & Stillman, 2013, p. xv) that simultaneously – therefore, holistically – ignites the activation and fruition of the integrity of the four vital, inseparable constituents of our individual human nature – "body, mind, soul and spirit" (Dimitrov & Wilson, 2002, p. 43) and the subsequent "personal development of the highest order" (Alexander & Potter, 2005, p. 178).

2.7.1.1 Learning task design (LTD)

Amidst my becoming familiar with this structure of the professional education practice of facilitating authentic learning, I was introduced to the field of Learning Design (Dalziel, J; Conole, G; Willis, S; Walker, S; Bennet, S; Dobozy, E; Cameron, L; Badilescu-Buga, M, 2016). I was intrigued with its possible relationship with facilitating authentic learning in general, and more particularly with learning task design. However to make sense of this new field, I needed to consider it in the more traditional educational context with regards to a lesson. Within a very broad and generalised context, in traditional education, the teacher would consult the curriculum in order to determine what the next topic or content might be for which a lesson should be planned. Taking all the necessary aims into consideration the teacher can now make an eclectic selection from the many available teaching and learning philosophies, theories, strategies, methods and techniques and utilise them in the teaching of the lesson. In this way, the entire lesson can be securely planned and given with relatively predictable results.

I found the incredible intellectual and academic initiatives of some of the major scholars in the field of Learning Design, like Dalziel et.al (2016), Blessinger, Petrova, Stefani, Tegginmath, and Todhunter (2013), Beetham and Sharpe (2013), Conole and Alevizou, (2010) and their co-workers are astounding in pursuing the goal to "convey great teaching ideas among educators in order that learners may learn more effectively" (Dalziel, J; Conole, G; Willis, S; Walker, S; Bennet, S; Dobozy, E; Cameron, L; Badilescu-Buga, M, 2016, p. 28). The Learning Design

Conceptual Map (LD-CM) forms the basis for an ever increasing array of applications of educational philosophies, theories, methodologies, found in the works of among others Pahomov (2014), Mueller, Tippins and Stewart (2014), Gedik, Kiraz and Ozden (2013), Teräs and Herrington, (2014), Kats (2013), Masterman, and Manton (2011), Laurillard, Charlton, Craft, Dimakopoulos, Ljubojevic, Magoulas, Masterman, Pujadas, Whitley and Whittlestone, K. (2011), and many more.

While still being quite unfamiliar with the field of Learning Design, my scanning of some of the scholarly works in Learning Design prompted some questions and comments in view of my very limited exposure to and subsequently still inadequate understanding of the field and how it could contribute to improving my education practice through facilitating authentic learning:

- It seems as though most, if not nearly all of the questions that are considered during a Learning Design construction are questions and aspects that teachers need to consider for the compilation for an education intervention even in the absence of technology. It is true, though, that the considerations during a Learning Design construction may have become more detailed and prevalent but not necessarily, because technology is involved. A Learning Design Conceptual Map is, according to my ill-informed understanding therefore, very valuable for teachers because all the necessary considerations required in the LD-CM has already been made. What it effectively means is that they have an already designed framework with all the necessary information for how to utilise it and they only need to enter the variables regarding the teaching and learning activities planned for the particular lesson. Using Learning Design in this way may also be utilised, because of time constraints and to compensate for inadequately qualified teachers. However, one should be weary that since the teacher does not need to do any actual Learning *Design*, it does not amount to some kind of de-professionalisation of teachers.

  While Learning Design may be very valuable in traditional education, in authentic education, where teaching (in the traditional sense) is absent and only *facilitating* authentic learning in action, earning Design teaching and learning activities cannot be used for what they were intended. Reason being that in facilitating authentic learning, the learners need to resolve the demanding authentic real-life challenge themselves which means they also need to find the ways and means to do it themselves in the corresponding *authentic* learning context of the learning task. For instance, their own authentic exploration to resolve the challenge have to compel them to find the best possible way to do so with the result that they might find

(through prudent facilitating learning) the 'Problem Solving' Learning Design activity (I do not know if this is the correct terminology to use?) to resolve the challenge individually, but in order to additionally increase the quality of what they might produce as the resolution to the challenge they might find (again through prudent facilitating learning) the 'Co-operative Learning' Learning Design activity to do so.

- The consistent use of the words or phrase "teaching and learning *activities*" in the Learning Design discourse, indicates a fragmentation and/or de-contextualisation of education while the principle of resolving a demanding authentic real-life challenge in such or corresponding words and phrases are conspicuously absent. This is concerning especially regarding international research findings: "Research shows that training problem-solving skills out of context is not a solution" (PISA, 2012, p. 33). Unless learners, therefore, find these 'activities' themselves as a result of their own rigorous exploration to find the best possible resolution to the challenge, the quality of the learning is in serious jeopardy.

- What is another concern is that in the work of Beetham and Sharpe (2013), Skinner (2013) and Joo (2013) indicates that there is evidence that these scholars propagate a viewpoint that goes beyond a symbiotic relationship between pedagogy and technology. They "argue that the features of pedagogy change as technology develops" and go on to say that "we should continue to rethink the changing characteristics of pedagogy along with new technology-driven challenges". I am hesitant to accept this notion that technology theory dictates pedagogical considerations based upon an analysis of an argumentation conducted in an article as a case in point. Duke, Harper and Johnston (2013, p. 9) ends their article with title "Connectivism as a digital age learning theory" as follows:

> To conclude, there is always a certain amount of core knowledge that is required to be able to understand any information presented. Depending on the field of study, this core knowledge will vary. If a person with limited core knowledge accesses Internet information beyond his or her ability to understand, then that knowledge is useless. In other words, a structured study using the existing learning theories is required in order to acquire the core knowledge for a specific field. While the theory [of connectivism] … is important and valid, it is a tool to be used in the learning process for instruction or curriculum rather than a standalone learning theory.

The first sentence refers to the concept of any kind of 'prior' knowledge – whether it is 'core' or 'baseline' or a 'sequentially' imperative – for all of which the statement will be true. *Irrespective of the field of study*, when a person with limited core knowledge accesses Internet information beyond his or her ability to understand, the knowledge will (rather may) be useless – this is a cognitive principle. The assumption that *a structured study using the existing learning theories is required* in order to acquire the prior knowledge for *any* field, is simply inadequate. There are many more educationally efficient ways in which knowledge beyond someone's ability can be accessed besides a structured study – one of which is through authentic learning.

- Regarding connectivism as a digital age learning theory:

I assume that the word connectivism used in this article is derived from the term 'connectivity' in the world of information and communication technology. Suggesting that connectivism is a theory and more particularly a learning theory seems to be forcing a point. Since holism as a unifying theory, for instance, describes the interconnectedness and interdependences of everything – including that in the world of ICT – it does not seem that a 'new' theory is necessary just because it has some technological connection – pardon the pun.

- Conole and Fill (2005) postulates that there are five media forms:

Narrative media tell or show the learner something (e.g. text, image). Interactive media facilitate respond in a limited way to what the learner does (e.g. search engines, multiple choice tests, simple models). Communicative media facilitate exchanges between people (e.g. email, discussion forum). Adaptive media are changed by what the learner does (simulations, virtual worlds). Productive media allow the learner to produce something (e.g. word processor, spreadsheet)

Clinch (2005) elaborates on this description in the form of the following table:

5. Table 2.4 Learning experience, method/technologies and media forms

LEARNING EXPERIENCE	METHOD / TECHNOLOGIES	MEDIA FORMS
attending, apprehending	print, TV, video, DVD	narrative
investigating, exploring	library, CD, DVD, Web resources	interactive
discussing, debating	seminar, online conference	communicative
experimenting, practicing	laboratory, field trip, simulation	adaptive
articulating, expressing	essay, product, animation, model	productive

Although this table might not be exhaustive of its components, what is concerning about this information is that it is restricted and technology bound in a virtual reality. The 'field trip' as method/technology excites me if it is authentic in nature – pardon the pun again, but the rest of the information seems to obscure everything about rigorous, personalised authentic real-life experiences of the whole being – body, mind, soul, and spirit – while in continuous dynamic interaction with the environment. Moreover, while transforming the environment and being transformed by the environment, our authenticity is an inevitable reciprocal consequence of an authentic experience.

In reflection on the relationship between Learning Design and learning task design in the preceding paragraphs, I have to conclude that there is a vast difference between the two. Learning Design is practically exclusively about the *how* of teaching and the learning with little or no concern of the *what* of teaching and learning that should determine the how. Learning task design, in turn, is practically exclusively concerned about *what* needs to be learned while *how* it needs to be learned has already been determined. This aspect will be the object of exploration in the following paragraphs.

Learning task design (LTD) as the first function of facilitating learning is critical in ensuring that authentic learning will take place. At this point in time it is crucial to be reminded about what authentic learning is. It is ontological in its foundation (Barnett, 2007), an inherently human functioning in its conceptualisation (Von Glasersfeld, 2008; Kolb and Kolb, 2006) a natural physiological brain process (Zull, 2011) and a holistically authentic human phenomenon responsible for the highest possible quality of learning (Sternberg & Kaufman, 2011) and, subsequently, of pursuing one's authenticity towards the highest possible quality of being

human. A learning task, in turn, is a demanding authentic real-life challenge designed particularly for the sole purpose of achieving the above.

It must be emphasised that the hint of idealism throughout this entire study comes to a head in this paragraph of facilitating authentic learning and in particular regarding the learning task and what it is envisaged to achieve. This permeating *ideal* is aligned with the philosophical foundation of education that pursues the highest possible quality standard of what it means to be human. This is also indicated by Barnett (2013, p. 110) as the attainment of a "feasible utopia". Is this not our *vision* for education?

The learning task design is the process through which *what* that needs to be learned is determined. This *what* needs to be learned is contained − albeit obscured − in a demanding authentic real-life challenge the learners need to resolve themselves. Although designing the learning task is in itself it consists of a procedure through which it needs to be determined, its outcome is the demanding authentic real-life challenge that the learners will be confronted with.

At the same time, the learning task design also represents the first phase in employing facilitating authentic learning in practice.

The process of designing a learning task is presented in table 2.5.

6. **Table 2.5: Finding the real life challenge**

FINDING THE REAL-LIFE CHALLENGE

The following are guidelines to execute the professional task of finding the real life challenge:

(i) Answering fundamental learning questions

Finding the real-life challenge starts with answering the following questions:

a. Why do learners need to learn this curriculum content? (The answer to this question is not because it is in the curriculum but how does it have relevance in real-life).
b. What are the role, function and value of this curriculum content in the lives of the learners they are living right now?
c. Where/when in the lives of the learners they are living right now will they be required to do what you expect them to do?
d. What is the challenge (problem) you want the learners to solve (resolve)?

(ii) Consulting supportive resources

To answer the above fundamental learning questions, a continuous process of exploring, studying and consulting the following (re)sources (material) is crucial for the design of an effective real life challenge:

- *Real life*
- *Authoritative resources* (official documents, scientific textbooks used in universities, technikons, and colleges, scientific journals and electronic media and multimedia software on the challenge)
- *Popular resources* (journals and periodicals and electronic multimedia software on the topic which are not so scientifically inclined) which supply the context in a wider perspective;
- *General resources* (magazines, daily newspapers, radio, TV, films, and multimedia software as well as the internet)

- *Institutional resources* (prescribed textbooks for the learners and other electronic multimedia software).

By doing this, the facilitator of leaning is able to determine the scope, possibilities, limitations and implications of the problem or improvement as reflected in everyday life for which our learners are being prepared.

(iii) Considering what a real life challenge constitutes

The following characteristics define a real-life challenge:

- It is an unsettled, unsolved, challenging, exciting issue that needs to be resolved.
- It is an unanticipated event that disrupted the normal cause of matters.
- It is a situation that is unacceptable and needs to be corrected.
- It is something for which there is currently no ready-made solution – it is therefore original and new.
- It is not offered as an example of the relevance of prior learning or as an application of knowledge already learnt.
- It is encountered for the first time in the learning situation.
- It serves as a focus or stimulus for the use of creative problem-solving skills.
- It serves as a focus or stimulus for the search for and study of information or knowledge needed to understand the cause of the problem and what it entails.
- It serves as a focus or stimulus for the search for and study of information or knowledge needed to find out how the problem might be resolved.
- The required skills for resolving the challenge have not yet been acquired.
- The effect of a problem is that what one needs to do next is always uncertain.
- It claims the complete personal involvement of the learners because the learners themselves really experience the challenge in real time – right now!
- It is important and necessary to be resolved urgently through immediate action.
- It is something that will impact the enhancement of living their lives right now when they have solved the problem.
- It is something that needs to be resolved right now because the discomfort or excitement in experiencing it is too much to bear.

(iv) Adhering to the design criteria of a LT

The following is suggested to be the criteria for a real life challenge:
- It has to be a challenge in real-life context.
- It has to remove the boundary between the educational institution and reality.
- It has to be new, original and creative in nature.
- It has to be credible.
- It has to be a challenge for the learner.
- It has to claim complete personal involvement of the learner.
- It has to challenge learners to stretch themselves beyond what they believe their capacity is.
- It has to compel learners to learn spontaneously
- It has to launch learners into a peak experience of joy and self-fulfilment.

(v) Design the format of the LT

There are many life contexts or formats within which your learning tasks can be set which need to be selected

(vi) Design the authentic learning context

Creating the authentic learning context is of extreme importance. This may include:

a. visiting a real-life learning environment outside the school premises;
b. going to a real life learning environment inside the school premises;
c. transformation of the school premises into a powerful learning environment to a smaller or larger extent; and
d. secure organisation inside and outside the school premises with everyone involved.

(vii)Determine the end product outcomes of the learning

Determine the end product outcomes (at least one possibility) as would be expected from a learner who has executed the LT excellently.

- **The** <u>learning product</u> **or the** *answer to the problem or the resolved challenge* **as a product in at least one of the following forms:**
    - a <u>physical object</u> that has been produced
    - a <u>decision</u> that has been made and executed
    - a <u>process</u> that has been generated and executed
    - a <u>service</u> that has been provided
- This will represent the product of learning in terms of doing something creatively new

<div align="center">AND</div>

- *How the problem has been solved* – the process or procedure. This will represent the **<u>learning process</u>** through the competencies the learners obtained and employed.

<div align="center">AND</div>

- A construction of the *knowledge* acquired (in the form of a concept map or any other appropriate way aligning with the level of learning) and how everything is related regarding the solution to this problem. This will represent the knowledge or **<u>learning content</u>**, which implies that the learners are actually writing their own (but much more relevant) "textbooks".

<div align="center">AND</div>

- The learners should project the attainment of the selected essential human virtues by an observable change in their behaviour in whatever they do.

(viii)   Designing the learning task presentation

Formulating the real-life challenge is very important because it has to contain everything that will enable the learners to work individually from you. Firstly, it has to clearly set the framework within which the learning task needs to be executed. Secondly it has to indicate the challenge through particular adjectives that set the standard to which the learning task has to be completed like most, least, biggest, smallest, no, all, most cost-effective, shortest, longest, best possible accuracy, precision, thoroughness, fastest, slowest, etc.

(ix) Preparing the learning environment
Finally, everything needs to be done to prepare the learning environment to attract and welcome the learners to engage in the exciting learning environment.

(Source: Adapted from Slabbert et al., 2009: CD-Rom)

These guidelines determine the real-life challenge as the key in designing a learning task and reveal one of the requirements that characterises education as a profession. It is the professional obligation of the FOL to identify the most appropriate and demanding authentic real-life challenge within the context of a particular life domain (discipline/subject/field/area) and translates them into learning tasks with all the actions, options and requirements. This ensures that each real-life challenge is so enticing that it will generate an acute desire for learners to resolve it. As the learners engage with the learning task to execute it, resolving it improves the quality of their lives immediately, which makes the learning not only meaningful but valuable. The holism of encountering such a learning task also propels the learners to their personal transformation and towards the full potential of their authenticity as the result of the resolution becomes evident.

With the learning task designed, the *what* to be learned has been determined and the first phase in employing facilitating authentic learning in practice has been completed. What now needs to commence is the second phase of facilitating authentic learning in practice in the form of learning task operation. This means that *what* has been determined to be learned has to become a reality – the *learning* has to take place in practice. The emphasis is that the learning has to actually take place while it is facilitated by the FOL. This happens through the five functions of facilitating authentic learning following the first function and phase of learning task design. First of these functions in the phase of learning task operation – the how of authentic learning and facilitating it correspondingly – is learning task presentation.

2.7.1.2 Learning task presentation (LTP)

Learning task presentation (LTP) as the second function of facilitating is to present the designed learning task to the learners in the most appropriate way. It should compel the learners to establish a relationship with the FOL as a significant other, someone trustworthy who confronts them with a demanding authentic real-life challenge. This is the first time that learners will be exposed to required *rigorous, authentic learning experiences*. This compels learners to establish a relationship between the search for meaning and the challenge that needs to be learnt. At this crucial moment in the learners' educational lives, it is important to realise that even the best-designed learning task may fail when presented, which may cause the entire learning task operation to collapse. Within the parameters of the formulation of the learning task (indicated in the guidelines provided by Slabbert et al. (2009) in section 2.7.1.1), the learning task presentation should contribute to the conducive learning atmosphere and make the roles,

functions and organisation clear. The learning task presentation is a powerful and impactful verbal presentation of through a monologue by the FOL of no more than a few minutes setting the parameters in which the learning should take place (the learning task) in the shortest possible time so that the learners can start with resolving the challenge themselves (start learning) as soon as possible.

The presentation should be done with *clarity,* stating the challenge to be resolved within the parameters that represent the rigorous required quality criteria, explicating the vital *importance* of resolving it, emphasising the incumbent *urgency* of doing it now that compels and evokes immediate *action* from the learners in resolving the challenge and learning authentically immediately.

Learning task presentation is, therefore, not actually part of the learners' learning yet, but it is of crucial importance for initiating the learners' learning and achieving success in the actual authentic learning process during the learning task operation phase.

2.7.2 Learning – Second purpose of facilitating learning

Learning is the pivotal point of all education. The purpose of learning is for the learners to establish a relationship with what is to be learned in such a way that they are able to construct meaning. Meaning is constructed through authentic learning.

What is of vital importance at this point in time is that authentic learning is taking place and it is the FOL' responsibility to facilitate that learning.

2.7.2.1 Authentic learning – in facilitating learning

Authentic learning (AL) as the third function of facilitating learning was explored in section 2.6. Although authentic learning is strictly a function of the FOL, the FOL needs to be in full command about what authentic learning entails in order to facilitate it (during learning task design and presentation and in particular during learning task feedback.

2.7.3 Maintaining learning – Third purpose of facilitating learning

The purpose of maintaining learning is to establish a relationship between the learner and what is to be learned in a continuing effort of the learners to improve their learning quality. Learning can only be maintained and improved while it is ongoing. This occurs when the learners engage with the learning task through learning task execution in order to resolve it.

2.7.3.1 Learning task execution (LTE)

It is during learning task execution (LTE), the fourth function of facilitating learning, that authentic learning is instigated and executed by the learners. However, it is the way in which the learners will be involved with learning task execution that will determine their learning quality. Maintaining learning is achieved through the process of learning individually and alone through *metalearning* first (see section 2.6.2) in order to attain the fundamental *intrapersonal* human virtues *before* learning with others through *co-operative learning* (see section 2.6.3) in order to attain the essential *interpersonal* human virtues as the ultimate purpose of education.

2.7.3.2 Learning task feedback (LTF)

Learning task feedback (LTF) is the fifth function of facilitating learning. It consists of the feedback provided by the teacher of learning to the learner while the learner is executing the learning task. This function is generally accepted as one of the most vital and valuable functions in facilitating learning because its sole purpose is to provoke the learners with *rigorous, authentic learning experiences* because they do not currently have the ability to resolve the demanding authentic real-life challenge – this is not a problem, because it is a prerequisite for learning. Creating this uncomfortable uncertainty ignites the necessary curiosity that makes, what Beames, and Brown (2016) calls "adventurous learning" possible and why Brown, Roediger and McDaniel (2014, p. 4) says: "Trying to solve a problem *before being taught the solution* leads to better learning, even when errors are made in the attempt [original emphasis].

Vygotsky (1978) explains this as a Zone of Proximal Development (ZPD), which represents the zone between what the learner can do and what the learner cannot do – without the intervention of someone else, like a teacher. However, the conventional perception of 'bridging the gap of ZPD' through 'scaffolding' was never even mentioned by Vygotsky (Zimmerman & Schunk, 2014, pp. 45-75). However, bridging this gap should not be attempted by giving learners

exercises to practice or breaking a complex process into easier steps on the way to accomplish a task (which real life does not provide), neither is it asking 'leading questions' in order to 'help' the learner. Wessels (2010) shares the postulates of Vygotsky (1978) on the how this gap should be bridged. Cohen, Stern, Balaban and Gropper (2016, p. 52) explains that what is rather suggested by Vygotsky is that the adult or meaningful 'other' should "guide[s] the child's learning through focused questions and positive interactions" to ensure the continued enhancement in the quality of the learning.

The learning-task feedback actions and questions are also designed to constitute a hierarchical order, which means that if the first action or question succeeds in ensuring that the learner remains on task or re-engages with the learning task execution, then the learning task feedback is successful in that regard. If success is not achieved and the learner continues to disengage or interrupt the learning, the next action or set of questions are utilised by the teacher of learning. However, even if all proceeds smoothly and the learner remains engaged in the task, the teacher of learning may deliberately and purposefully intervene in the learner's learning by asking specific questions that compel the learner to reflect on the work (learning) that they are doing (Slabbert, et al., 2009). The following should be used as a guideline when facilitating learning:

- Give verbal or non-verbal recognition as emotional encouragement and support when the learner is progressing successfully.
- Ask for clarification when learners are on task in order to ensure that the best possible learning-task feedback action will ensue. Ask the learner: "What are you doing?" and "Why are you doing it?" in order to determine the next learning-task feedback action.
- Elicit metalearning actions through:
  o Requiring learners to answer their own questions;
  o Requesting reflection by asking learners content-void questions as well as questions that cannot be answered immediately with one word or a short answer. Examples for questions and statements that compel learners to improve the quality of their work (learning) are:
    - Show evidence that you have considered everything.
    - Convince me that this is the best way of doing this.
    - How many other ways can this be done?
    - How will you improve this?
    - How will you ensure that ..?
    - Explain your thinking behind what you are doing.

- What will happen if ..?
- What will you do next and why?
- When will you know that you have done enough?
- What does this mean?
- Etc.

- Require resourcefulness when learners are requested to find resources that may help them to find a resolution to the challenge.

- Demand resilience when learners are in difficulty and cannot find a way to deal with the problem;

- Advise auto-education when learners are referred to resources that they need to consult in order to find information, skills, methods, strategies or techniques to resolve a challenge.

- As a last resort, only if the learners have not been able to find a way to solve the problem and providing the information is secondary to the higher aim of the challenge, provide entertainment. Although this may appear to entail giving information or transmitting knowledge, it is the way in which the presentation of this entertainment causes emotional disequilibrium and provokes intentional focus demanding the quality of personal insight and understanding to be activated.

Having accomplished the highest possible quality of learning through learning task feedback evident in the personal transformation of the learner through the attainment of the essential human virtues, the establishment of the level of quality achieved an the way forward needs to be determined.

2.7.3.3 Learning task consolidation (LTC)

Learning task consolidation (LTC) as the sixth and last function of facilitating learning, bridges the time gap between one learning period and the next. Although the FOL facilitates the learning task consolidation process, the learners execute the actions to ensure the highest possible learning quality. Learning task consolidation ensures a continued focus on resolving the real-life challenge by *ascertaining the rate* of the learning progress, *assessing the quality* of learning and determining what the learners have learnt and *the best way forward*.
The main features of facilitating learning are depicted in Table 2.3.

These main features of facilitating learning in practice can also be represented in a comprehensive model for facilitating learning in Figure 2.5 below.
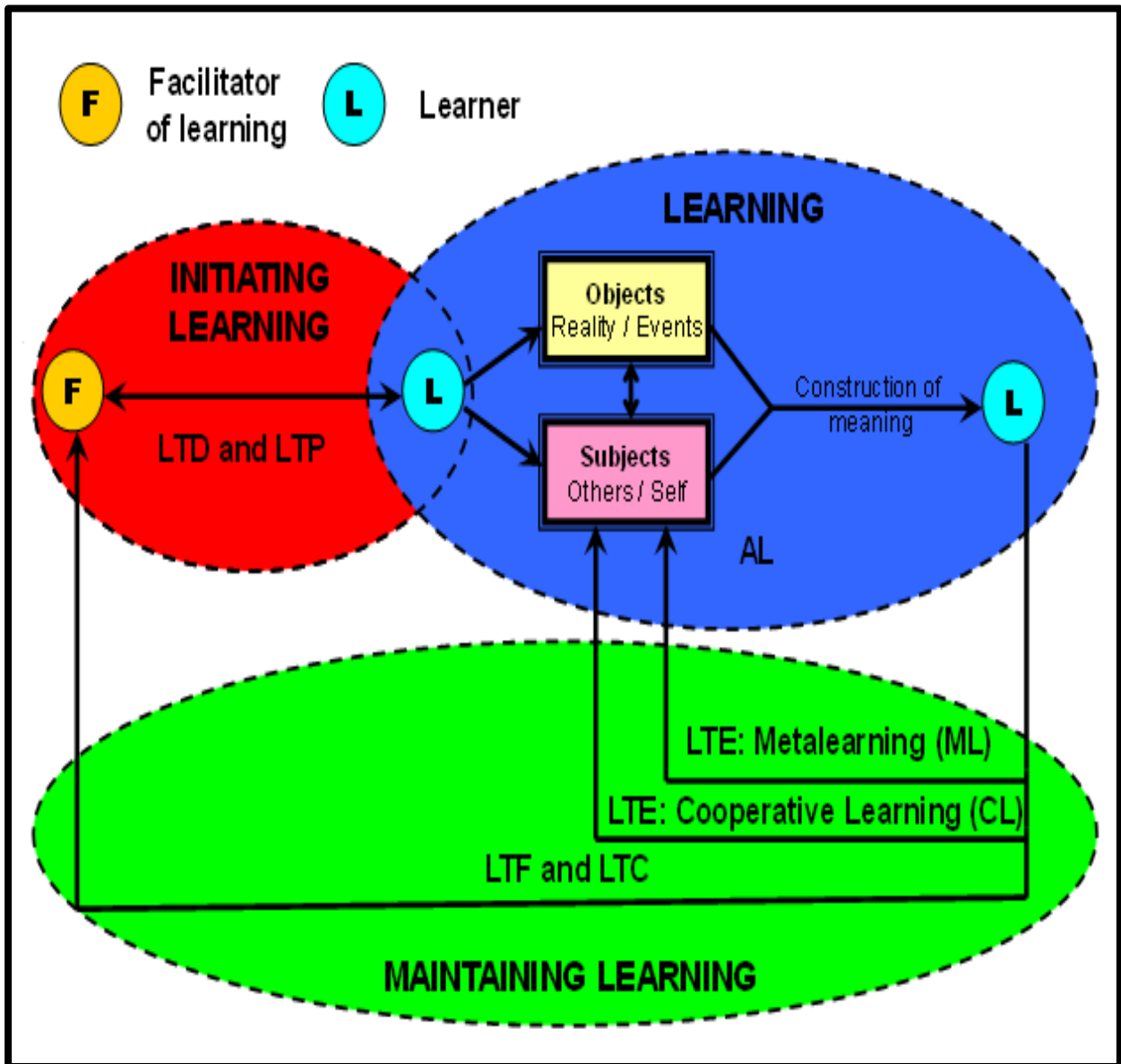
5. **Figure 2.5: A comprehensive model of and for facilitating learning:**

(Source: Slabbert et al., 2009, p. 118)

2.8   CONCLUSION

This literature review had several purposes. It answered the first question of the research challenge, namely: What are the current curriculum requirements and current dominating education practices in Computer Applications Technology education? It also served to explore the field in which this research was conducted. Finally, it revealed a simplistic, holistic, integrated construction of what could function as a theoretical framework for this study. This will be the foundation for the research design of this study.

CHAPTER 3

RESEARCH DESIGN

> *Planning is bringing the future into the present so that you can do something about it*
> *(Alan Lakein)*

3.1 INTRODUCTION

From the preceding chapters it is possible to determine the research design for this study. Chapter 1 has constituted the background, rationale and the research challenge. My own professional development forms the basis of my research challenge. I want to ensure that my education practice will fulfil the requirements of an authentic Computer Applications Technology education in practice.

3.2 AIMS OF THE STUDY

Since Computer Applications Technology emanates from and forms part of the broader knowledge domain of information and communication technology, its purpose is also to find solutions to real-life problems. Fortunately the purpose of providing solutions to real-life problems as indicated in the National Curriculum Statement (2011, p. 7), is to link the curriculum to its associated practice as it relates to authentic learning (Lombardi, 2007, p. 3).

The aim of this study closely relates to its challenge, namely to ensure that my education practice will fulfil the requirements of an authentic Computer Applications Technology education in practice.

Throughout this chapter, I will indicate all the aspects regarding the research design that was under consideration and where options were to be considered, which were preferred and/or finally chosen.

3.3 METHODOLOGICAL CONSIDERATIONS

The word methodology stems from the Greek words *meta* – along, *hodos* – the path, and logos – knowledge (Bezuidenhout, 2011, p. 42). This will be the focus of this paragraph.

3.3.1 Research premises: Delineating paradigmatic assumptions and perspectives

Cohen et al. (2001) assert that research is about achieving an understanding of the world, which is impacted by the way you view the world, what constitutes your view of an understanding of the world and what you deem to be the purpose of understanding. A paradigmatic perspective refers to a way of viewing the world and entails certain assumptions by the researcher when she/he chooses a particular perspective (or paradigm); in other words, the researcher in this particular study favoured specific systems of meaning and ways of interpreting reality (Maree & Van Der Westhuizen, 2009, p. 31).

Hitchcock and Hughes suggest the following lenses for examining research practice, which will then be explored (Maree, 2007, p. 31):

- Ontological assumptions;
- Epistemological assumptions; and
- Methodological preferences

3.3.1.1 Ontological assumptions

Ontology refers to a theory of being, which influences how we perceive ourselves in relation to our environment, including other people (Whitehead & McNiff, 2006). In this study, the ontological assumptions are foundational in its existentialist philosophical stance that emphasises the individual existence of the human being with freedom and choice. It underscores the view that humans define their own meaning in life. In close association with the existentialist philosophy of Sarte, Kierkegaard, Heidegger and others, Aristotle's philosophy of human purpose (Ergon) and the excellence (Aretê or virtue) with which that purpose is fulfilled substantiates its foundation and the view that these human qualities defines human authenticity completes this study's perspective. It is this philosophical perspective that is necessary to come to grips with what it means to be a learner and "what kinds of young people we are trying to turn

out" (Claxton G. , 2008) or, more precisely, "the kinds of human being that are appropriate, indeed, called for" in the twenty first century and beyond (Barnett, 2007, p. 3).

3.3.1.2 Epistemological assumptions

Burrel and Morgan in Cohen et al (2001) explain that knowledge can be viewed in various ways and the researcher applied the following epistemological assumptions in order to obtain a clear understanding of my research:

- It can be seen as real and objective (a positivist view), and transmittable in a tangible form, a view that might lead to adopting and observer role, using the methods of natural science to consider the use of quantitative methods;
- An interpretive, anti-positivist stance is one of a "softer, more subjective, spiritual of even transcendental kind", which might lead to a more subjective, participatory role for a researcher, often rejecting the standard methods of natural science;
- An interpretive paradigm is a view of social science, a lens through which you examine the practice of research (Cohen, Manion, & Morrison, 2001) from a (socio-) constructivist perspective. This study adopts the view that there are no fixed truths. Instead, reality (or a researcher's idiosyncratic view of what actually constitutes reality) and meaning are dependent on many factors, including time, space, the views of the person concerned, and language and symbols that researchers use to describe, explain and understand phenomena. Understanding language on various levels, the role of language in analysing discourses and negotiating meaning are regarded as crucially important factors if one is to really understand phenomena (Maree & Van Der Westhuizen, 2009, p. 32).

3.3.1.3 Methodological preferences

Paradigmatic assumptions and perspectives according to Cohen et al (2001) impact greatly on methodological choices and require a consideration of various research. They involve the following:

- A nomothetic approach is typified by procedures and methods aimed at discovering general laws; and
- An ideographic approach, with little (if any) emphasis on formulating general laws, focuses on the individual and the understanding of individual behaviour. This study concentrated on

the idiographic approach, as it focused on the individual, and not on formulating general laws.

3.3.1.4 Assumptions about human nature

According to Burrell and Morgan in Cohen et al (2001), researchers usually locate themselves on the following continuum:

- Humans respond mechanically to their environment (determinism);
- Humans initiate their own actions (voluntarism); and
- Humans find themselves at a point between the two extremes referred to above.

In practice, most social researchers locate themselves somewhere between the two extreme ends of this continuum (Maree & Van Der Westhuizen, 2009, p. 32). In order to ensure that my assumptions about human nature were as accurate as possible, I had to work between these two opposites by including individual as well as environmental influences.

3.3.2   Delineating a mode of inquiry

Before a mode of inquiry can be sufficiently provided the theoretical framework for this research needs to be identified. As could be recognised from the preceding chapters 1 and 2 and the preceding paragraphs of this chapter, the foundation of the theoretical framework is authenticity, two pillars on this foundation is authentic learning and the other one facilitating authentic learning. These two pillars lean towards each other to form an equally sided triangle. Inside the triangle is the 'I', the authentic self with purpose and virtue. This theoretical orientation provides the framework within which the mode of inquiry could be identified (See figure 3.1).
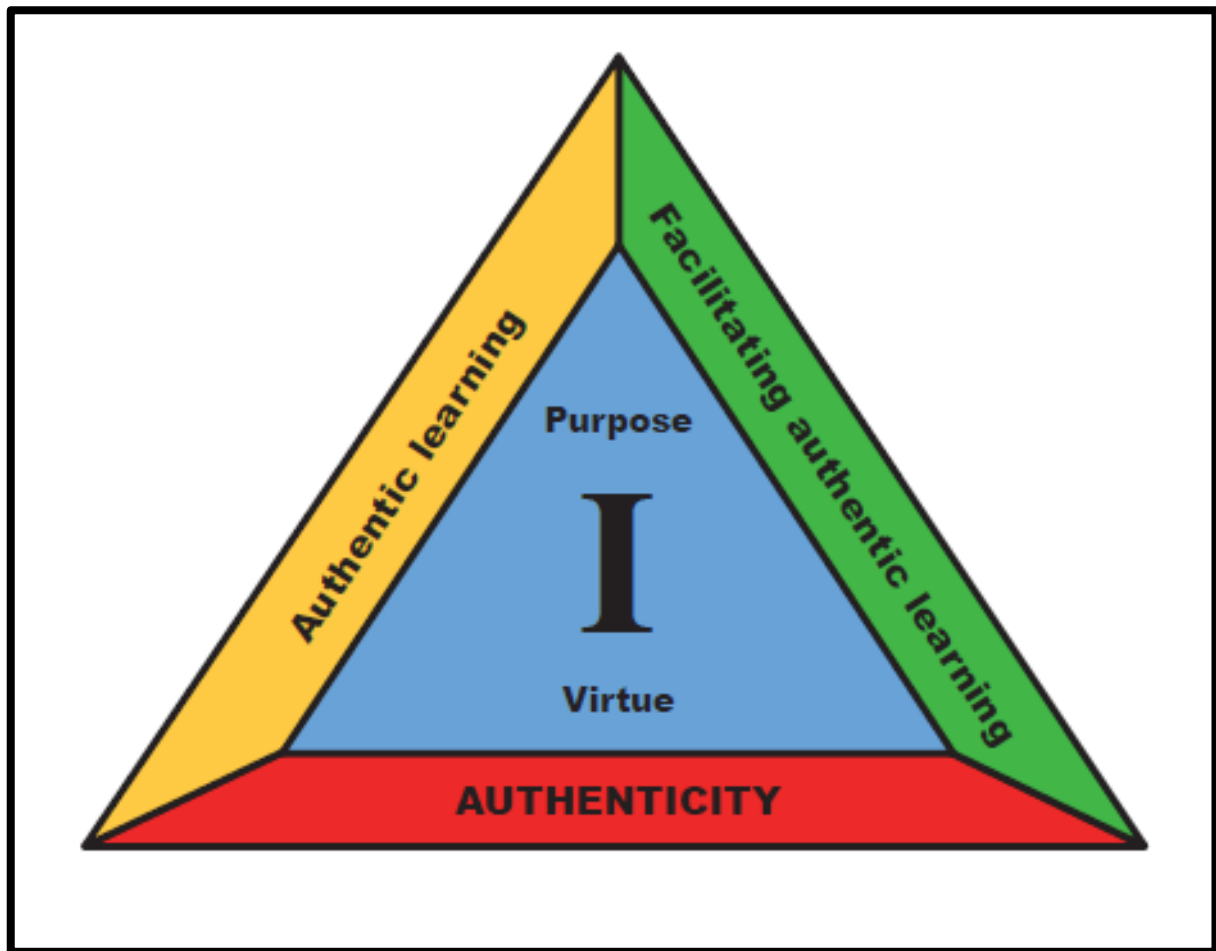
6. **Figure 3.1: A practical philosophy framework for education**

(Source: Slabbert, 2015)

According to McMillan and Schumacher (2006, p. 401) a mode of inquiry is a collection of research practices that are based on what has been said. The mode of inquiry informs the research design what happens to the subjects and which methods of data collection are employed (Maree & Van Der Westhuizen, 2009, p. 33). Researchers can adopt a qualitative, quantitative or multi-method mode of inquiry. According to Punch (2009, p. 12) the method or combination of methods chosen should be well described and should match the research questions to ensure that the research demonstrates internal validity (Punch, 2009, p. 13). Cohen et al (2001) emphasise that a research design "describes the procedures for conducting the study" and its purpose is to help find appropriate answers to the research questions (Cohen, Manion, & Morrison, 2001). The qualitative mode of inquiry seemed to be viable for the research study.

3.3.2.1 Research Design: Qualitative Research

The aim of research design according to Mouton and Marais (1988, p. 57) is to plan and structure a given research project in such a manner that the eventual validity of the research findings is

maximised (Mouton & Marais, 1988). The choice of research design is based on the researcher's assumptions, research skills and research practices, and influences the way in which he or she collects data (Maree, 2007, p. 64).

Although the terms qualitative and quantitative are commonly used, the exact meaning of these terms are not always understood. Some authors are likely to classify all research that does not contain statistics as qualitative. Mouton and Marais (1988, p. 79) however indicate that this is not necessarily true, and one does not have to use numbers to have a quantitative approach. Quantitative research may rather be described in general terms as the approach that is more highly formalised and more explicitly controlled. In contrast, qualitative research can be characterised as an approach in which the procedures are less strictly formalised, while the scope is likely to be more broadly defined. A more philosophical approach is followed and is therefore more commonly used in behavioural science (Mouton & Marais, 1988).

According to Creswell (Creswell, 2007, p. 37), qualitative research entails assumptions; a worldview and a theoretical perspective. McMillan and Schumacher (McMillan & Schumacher, 2006, pp. 321-324) identify nine key characteristics of qualitative research, and are of opinion that this is pertinent in any qualitative study, although not all have to be applied. A comprehensive description of these characteristics (McMillan & Schumacher, 2010, p. 321) will follow in the context of this particular study.

a. *Natural Setting*

Behaviour within the natural setting is studied without manipulation. In this regard, the setting is the Computer Application Technology (CAT) classroom where fieldwork was conducted.

b. *Context sensitivity*

This aspect focuses on the situational context in which actions and behaviours take place. "It is therefore important to observe the learners within the classroom and in addition to this apply a social dimension − the research takes place in real life situations, and aims to solve real life problems" (O'Brien, 2001).

c. Direct data collection

I wanted to be an active participant in the study with the purpose of improving my education practice. I was both the object of the research as well as the researcher. It allowed for obtaining pertinent information, because a considerable amount of time in direct interaction with my participants is spent in the classroom.

d. Rich narrative descriptions

This concept emphasises that no information is trivial, and that everything recorded contributed significantly to the understanding of the phenomenon (McMillan & Schumacher, 2010, p. 322). In the context of this particular study, a thorough literature study, observation, and semi-structured interviews were utilised.

e. Process orientation

In relation to qualitative research, this process seeks to find out how and why a phenomenon occurs. In the context of this particular study, the main question that the researcher took as primary focus is to investigate how she could ensure that her education practice would fulfil the requirements of a contemporary authentic Computer Applications Technology curriculum, and allow for conclusions that would explain the reasons for my results (McMillan & Schumacher, 2010, p. 323).

f. Inductive data analysis

The data were gathered first, and then analysed inductively to generate generalisations (McMillan & Schumacher, 2010, p. 323). When interpreting the data, the researcher searched for emerging patterns, associations, concepts and explanations with the ultimate aim to arrive at findings and draw conclusions. Each conclusion was based on substantiated findings from the variable data.

g. Participant perspectives

This qualitative approach helped the researcher to reconstruct the reality from the learners' positions regarding their learning process. The aim in this regard was to understand the situation from their point of view, and in their own voices (McMillan & Schumacher, 2010, p. 323).

h. Emergent designs

McMillan and Schumacher (2010, p. 323) argue that the qualitative researcher enters an investigation and connects with the participants without risking objectivity. In the context of this particular study, it was to investigate how I facilitated learners' learning to maximise it. However, as Bogdan and Biklen (2007, p. 54) suggest, I had a limited amount of knowledge about the phenomenon under investigation prior to starting with the study. Therefore, I learned more about the setting, the learners and other sources of information which I could use to make the necessary changes for greater understanding of the topic of interest as time went by (McMillan & Schumacher, 2010, p. 323).

i. Complex understanding and explanation

This notion emphasises I could ensure that my education practice would fulfil the requirements of a contemporary authentic Computer Applications Technology curriculum in practice. However, that required multiple perspectives, and it was not possible to account for all of the complexities in this situation (McMillan & Schumacher, 2010, p. 324).

The research study is a participatory, action research design. The main reason for choosing action research as my research design is because its primary focus is "on turning the people involved into researchers too - people learn best, and more willingly apply what they have learned, when they do it themselves. It also has a social dimension – the research takes place in real-life situations, and aims to solve real-life problems" (O'Brien, 2001).

3.3.2.2 Action Research

a.   Definition of Action Research

Kurt Lewin is generally considered the "father" of action research. Lewin, then a professor at *Massachusetts Institute of Technology*, first coined the term "action research" in about 1944, and it appears in his 1946 paper "Action Research and Minority Problems" (Lewin, 1946, pp. 34-46). In the above-mentioned paper, Lewin describes action research as a comparative research method, involving the conditions and effects of various kinds of social actions and research. These culminate in social action that implements a method of spiralling, as steps occur in the form of a spiral and each step consists of a circle of planning, specific actions, and fact-finding pertaining to the result of the action (Lewin, 1946, pp. 34-46).

Action research is "learning by doing" – a group of people identify a problem, do something to resolve it, see how successful their efforts were, and if not satisfied, try again (O'Brien, 2001). While this is the essence of the approach, there are other attributes of action research that differentiates it from common problem-solving activities that we all engage in every day.

A more succinct definition is from Thomas et al. (1986) in O'Brien (2001) when they state: "Action research...aims to contribute both to the practical concerns of people in an immediate problematic situation and to further the goals of social science simultaneously. Thus, there is a dual commitment in action research to study a system and concurrently to collaborate with members of the system in changing it in what is together regarded as a desirable direction. Accomplishing this twin goal requires the active collaboration of researcher and client, and thus it stresses the importance of co-learning as a primary aspect of the research process."

b.   Characteristics of action research

Denscombe (2003) emphasises the following as the characteristics of action research. Action research is:

- practical;
- a method that focuses on change;
- a cyclical process;
- a method that involves participation; and
- an interactive form of knowledge development.

c.   *Types of action research*

- **Technical action research**

    According to Denscombe (2003) this type of research has specific characteristics. They focus on the following aspects:

    o   It aims to improve the effectiveness of practice; and

    o   Practitioners are greatly dependent on the researcher as teacher.

- **Practical action research**

    According to Denscombe (2003) this research can be described as:

    o   Studying local practices;

    o   Involving individual or team-based inquiry;

    o   Focusing on self-development;

    o   Implementing a plan of action;

    o   Leading to practitioner as researcher;

    o   Proposing effectiveness and aims at practitioner's understanding of professional development; and

    o   Focusing on the researcher role as it encourages practical deliberation and self-reflection of practitioners.

- **Emancipatory action research**

    According to Denscombe (2003) it is a method that:

    o   aims for effectiveness, understanding and improvement;

    o   aims at transformation and change within the existing boundaries and conditions; and

    o   focuses on changing the system itself.

- **Participatory action research**

    According to Cresswell (2005), participatory action research can be described as:

    o   Studying social issues that constrain individual lives;

    o   A type of "equal" collaboration as research participants are involved as an integral part of the design;

    o   A life-enhancing experience, that changes results within the emancipated researcher.

    This study used participatory action research as the research approach.

d.   The research process or cycle

What separates action research from general professional practices, consulting, or daily problem-solving is the emphasis on scientific study, which is to say the researcher studies the problem systematically and ensures the intervention is informed by theoretical considerations. Much of the researcher's time is spent on refining the methodological tools to suit the exigencies of the situation, and on collecting, analysing, and presenting data on an ongoing, cyclical basis (O'Brien, 2001). According to Strydom (2005) and Wadsworth (2005) in Maree (2007, p. 133), action research has a number of phases which are important to consider in large-scale research. Within this relatively small-scale research, the research process or cycle consists, generally speaking, of the following steps or phases:

- **Plan:** Determine which particular aspect (problem you have experienced) of your facilitating learning practice you want to improve. Formulate this into a research question in context; review literature; refine original question and formulate sub-questions; set out the plan of intervention; determine how you will collect data;
- **Act:** Execute your plan or implement the intervention;
- **Observe:** Collect data while you are executing your plan. The way in which your data is collected should also represent a proper classification thereof. You may have to, and in some cases it may be necessary, to have someone else collect your data for you. Classify your data appropriately;
- **Reflect:** Critical assessment – only from data that has been collected: Reflection or critical assessment is always in relation to something. Normally it would be an assessment of what actually happened in relation to what was intended. It is, therefore, an assessment of how well intended outcomes (aims) were achieved.
- **Review**: Review your original plan according to the result of your reflection indicated by the data you collected and adapt your plan to improve your performance. Adjust, change, and adapt the original plan.
  - o   State the relevant intended aim or outcome clearly;
  - o   recall and describe what actually happened;
  - o   interpret what happened;
  - o   supply suggestions why it may have happened;
  - o   indicate whether that which happened was good or bad;
  - o   what was learnt from what happened;
  - o   how could that which happened be rectified and/or improved;

e. ***Strengths of action research***

The following strengths of action research are identified by Denscombe (2003) and Mouton (1988):

- It addresses practical problems in a positive way, which results feeds back into practice;
- Practitioners benefit directly form self-development and the development of research capacity, whereas the organisation benefit from the continuous cycle of development and change on site;
- It displays a high construct validity, low refusal rates and ownership of findings;
- The attachment and involvement of the researcher contribute to the representation, generation and depth of data;
- There are the possibility of obtaining rich contextual data by reporting on participants' own perspectives and points of view with regard to experienced challenges and opportunities;
- Participants can be facilitated to plan ways of addressing challenges and putting their plans into action;
- Participatory activities often require limited and inexpensive resources; in addition, action research activities are generally relatively cost-effective in terms of time, as extensive information might be constructed and obtained from a relatively short session with participants;
- Activities often centre around concrete and interesting actions which are fun to perform, encouraging the enthusiasm and contribution of participants;
- Activities also focus on the participants life, thereby directly addressing their interest; and
- The relationship between participant and researchers might be enhanced when participants enjoy the research activities.

f. ***Challenges of Action Research***

The researcher might be faced with the following challenges when using action research as a research design as mentioned by Maree (2007, p. 135):

- Earning the trust of participants in order for them to take ownership of the process and allowing researchers insight into their perceptions and experiences;

- Addressing the challenge of being different, by acknowledging and respecting the differences between the participants and themselves and continuously striving to decrease power differences;

- Applying action research implies the potential challenge of ignoring certain social relationships within the selected group of participants, by implication excluding certain voices which are not heard;

- Assessing the quality of the outcomes of the process, facilitating sustainable change and determining whether or not success will generate future success; and

- Applying the findings of the research to the selected community as it can seldom be generalised to other communities.

3.3.3   Research Methods

3.3.3.1 Research Sites

The research study was conducted at an anonymous secondary English medium, government secondary school located in Gauteng. It has over a thousand Grade 8-12 learners from various cultural- and ethnic groups. The school consists of a diverse staff, which includes 76 members from various cultures, races, religions, and gender. I explained the purpose for conducting this study openly to all the participants at the school before they took part; specifically to the Grade 11 and Grade 12 Computer Applications Technology learners who are the focus of the study.

3.3.3.2 Describing the sample

Maree (2007, p. 79) defines sampling as the process used to select a portion of the population for the research study. Punch (2009, p. 162) states that in qualitative research one would use deliberate sampling – 'purposive sampling', which means doing sampling in a deliberate way with some purpose or focus in mind. He continuous by saying that qualitative research is generally based on non-probability and purposive sampling rather than probability or random sampling approaches (Punch, 2009, p. 163).

Purposive sampling simply means that participants are selected because of some defining characteristic that makes them the holders of the data needed for the research study (Maree, 2007, p. 79). Decisions are not restricted to the selected participants but also involve the settings, incidents, events and activities to be included for data collection (Maree, 2007, p. 79).

Patton (1990) has identified 16 sampling strategies, but I will be exploring the three most commonly used. They are:

- **Stratified purposive sampling:**   This sampling method means selecting participants according to preselected criteria relevant to a particular research question. The sample size may or may not be fixed prior to data collection, and very often depends on the resources and time available to the researcher. Purposive sampling is most successful when data review and analysis are done in conjunction with data collection (Maree, 2007, p. 79);

- **Criterion sampling:** This sampling method implies that you decide at the design stage of a study the number of participants to be included as well as the typical characteristics of these participants. The criteria chosen should assist in selecting those participants most likely to possess the experience, or know about, or have insights into the research topic. The researcher will then go into the community and find people who fit these criteria, until he or she has met the required number or has saturated the data (Maree, 2007, pp. 79-80);

- **Snowball sampling (Chain referral sampling):** This is a method whereby participants with whom contact has already been made are used to penetrate their social networks to refer the researcher to other participants who could potentially take part in or contribute to the study. Snowball sampling is often used to find the "hidden populations" (groups that is not easily accessible to researchers through other sampling strategies (Maree, 2007, p. 80).

In the research study I made use of stratified purposive sampling as the purpose of this sampling method is to "capture major variations rather than to identify a common core" (Patton, 1990, p. 174).

As previously mentioned, I did my research at an identified secondary, English medium, government school located in Gauteng, where the focus of my research initially started on the Grade 11 Computer Applications Technology learners. My research continued into the following year, with the same group of learners, now in my Grade 12 Computer Applications Technology class. Both years the population size consisted of 25 learners in my classroom, from where I selected 10 learners for the sample size where these learners were of both sexes, male and female, and various racial groups, which included members of all four main population groupings: white, black, coloured and indian learners. According to Patton (1990) when the researcher has the same fixed resources and limited time, a researcher could study a specific set

of experiences for a more open range of experiences for a smaller number of people (seeking depth) as in-depth information from a small number of people can be very valuable (Patton, 1990). A qualitative inquiry sample only seems small in comparison with the sample size needed for representativeness when the purpose is generalizing from a sample to the population of which it is a part. There were 25 learners in my CAT class to be evaluated. It would be necessary to sample 20 of those learners (80%) to make a generalization at the 95% confidence level, which I did over a two-year period by interviewing 10 learners each year.

3.3.3.3 Data Collection Techniques

I made use of the following techniques for data collection:

a. *Literature study*

Hart (2001) defines an academic literature review as: "The selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence, written from a particular standpoint to fulfil certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed".

The researcher conducted the literature study as widely as possible within the context of the research focus. Books, academic journals, articles in periodicals, conference proceedings and the internet were used to ensure that the pedagogical interventions would fulfil the requirements of a contemporary authentic Computer Applications Technology curriculum.

b. *Observation*

Observation is the systematic process of recording the behavioural patterns of participants, objects and occurrences without necessarily questioning or communicating with them (Maree, 2007, p. 84). It is used to enable the researcher to gain a deeper insight and understanding of the phenomena being observed.

According to Maree, there are four types of observation (2007, p. 85):

- Complete observer;

- Observer as participant;
- Participant as observer; and
- Complete participant.

I made use of the participant as observer method when I conducted my research, as this method is typical of action research projects, as the researcher participates in the research process, and works in collaboration with the participants as part of the situation to design and develop intervention strategies (Maree, 2007, p. 85). I was a participant in the Grade 11 and Grade 12 Computer Applications Technology classes where I intervened in the dynamics of the situation and even tried to change it. I immersed myself in the class to gain insider perspective (emic perspective) of that setting (Maree, 2007, p. 85).

My data collection instruments during observations were field notes while I was busy with participating fully as researcher and object of the research during my education practice which was always challenging because I found myself completely absorbed in the practice of my education. I also started by keeping a reflective journal in which I made substantial entries as much as possible. I did the same with some ad hoc conversations, discussions and meetings that I had with learners and teachers that might have a contribution to make towards adding value to this research.

c. *Interview*

The interview is the most prominent data collection tool in qualitative research. It is a very good way of accessing people's perceptions, meanings, and definitions of situations and constructions of reality. It is also one of the most powerful ways we have of understanding others (Punch, 2009, p. 146).

There can be distinguished between three various types of interviews which will be described by means of a continuum model (Punch, 2009, p. 148)

Structured interviews	Focused or semi-structured interviews	Unstructured interviews
←		→
Standardised interviews	In-depth interviews	In-depth interviews
Survey interviews	Survey interviews	Clinical interviews
Clinical history taking	Group interviews	Group interviews
		Oral or life history interviews
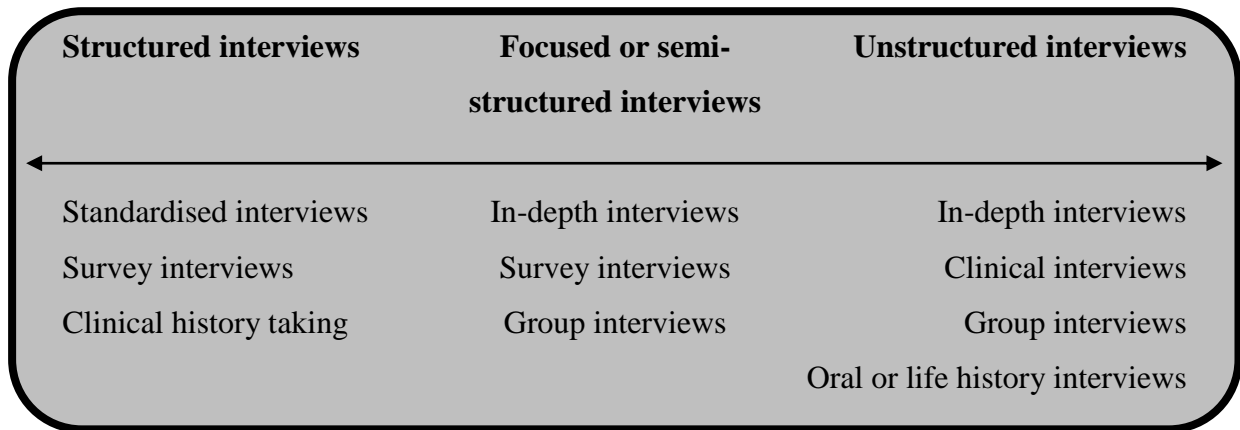
7. **Figure 3.2: Types of interviews**

At the left-hand end of the continuum, interview are tightly structured and standardised. Here, interview questions are planned and standardised in advance, preceded categories are used for responses, and the interviews do no attempt to go to any great depth. On the right-hand end, by contrast, interviews are unstructured and open-ended. Interview questions are not pre-planned and standardised, but instead there are general questions to get the interview going and to keep it moving. Specific follow-up questions will then emerge as the interview unfolds, and the wording of those questions will depend upon the direction of the interview (Punch, 2009, p. 150).

I conducted semi-structures interviews with my CAT teacher and learner participants. The interviews were open, allowing new ideas to be brought up during the interview, because of what the interviewees said. This corresponds well with the purpose of the study as it "corroborates data emerging from other data sources". I set the pace and defines the line of enquiry through a set of predetermined questions (Nieuwenhuis, 2007, p. 87). Furthermore, this study was personal, which is synonymous with the semi-structured interview. (De Vos, Strydom, Fouche, & Delport, 2011, p. 351).

3.3.4   Data analysis strategies

Qualitative data analysis according to Maree (2007, p. 257) tends to be an on-going and iterative process, implying that data collection, processing, analysing and reporting are intertwined, and not merely a number of successive steps. The researcher may often find it necessary to go back to the participants consulted in the research (Maree, 2007, p. 257). Maree (2007, p. 257) further states that when analysing qualitative data, your goal is to summarise what you have seen or

heard in terms of common words, phrases, themes or patterns that would aid your understanding and interpretation of which is emerging. This requires creativity, discipline and a systematic approach.

According to Maree (2007, p. 37) data analysis can be deductive or inductive. For the purpose of this study an inductive approach for analysing the data was followed, which is more likely to help me identify multiple realities potentially present in the data. When interpreting the data, I was searching for emerging patterns, associations, concepts and explanations with the ultimate aim to come to findings and draw conclusions. Each conclusion was based on substantiated findings from my verifiable data and was only applicable to my participants in the context of my research.

Regarding my semi-structured interviews, after its transcription, I contemplated the open, axial and selective coding and what I found to be most advantageous to the contribution of this study is a variation on selective coding. The procedure for this variation of selective coding entails the identification of themes regarding each question and through a simple process of counting the number of associate responses and to eventually select only the one or, if necessary and appropriate (for instance if there are too much variation between the responses that would not be sufficiently represented by only one response), another response that will sufficiently represent the theme.

Regarding my observations (field notes and reflective journal as data collection instruments), I found the following to contribute best to the value of this research. I became so quickly fully immersed in every moment that I participated in my new vocation as a facilitator of learning and its associated actions and/or responsibilities that I found it difficult to regularly and consistently dot down sufficient field notes during *ad hoc* observations, discussions, and meetings with CAT learners and teachers from various schools and during my own CAT education practice. Keeping a reflective journal was a little more successful, but, the abundance of data of at least ten periods per week per class quickly became overwhelming to such an extent that particularities were assimilated in an integrated whole of my life experiences.

I am the center of this participatory action research I have chosen to engage in because:
"I am the subject and the object of the research.
I take the responsibility for my own actions.
I own my claims and judgments.

I am the author of my own research accounts." (McNiff, Lomax, & Whitehead, 2003, p. 20).

I fit into the action because I have initiated the action and have invited others to participate in the action while I regard every participant as an equal participant in respect of their contribution to the action. I have a responsibility to improve my own education practice in this action, but at the same time that action, inevitably has an influence – even possible an impact – on the lives of others that cannot be other than the improvement of the quality of their lives (McNiff, Lomax, & Whitehead, 2003, pp. 20-21).

When I am, therefore, living my life experience as intensely and responsibly as the ethical imperative requires, I may be performing that experience as an interpretive auto ethnography, which is a reflective narrative expression of my life experience (Denzin, 2014, p. 7). Although there may be other intermittent sections, the largest part of my empirical research (participatory action research) in chapter 3 is such a reflective narrative of my life experience at that time.

3.3.5   Quality assurance: data verification

The essence of the research techniques, centre around the reliability and relevance of the data and their analysis.   To indicate the trustworthiness of this study Guba's Model of Trustworthiness of Qualitative Research (Guba, 1981, p. 81) was used, because it is well developed conceptually and has been used by qualitative researchers for a number of years.

The following four aspects of trustworthiness form the basis of Guba's Model (Guba, 1981, p. 83) and are considered the traditional criteria for judging research:

- Truth value (credibility);
- Applicability (transferability);
- Consistency (dependability); and
- Neutrality (confirmability).

3.3.5.1 Credibility

Truth-value determines whether the researcher has established confidence in the credibility of the findings of the study. Factors taken into consideration are the confidence of the researcher regarding the truth of findings based on the research design, participants (informants), and context. The issue is how well the internal validity of the study had been managed and how valid were the instruments used as a measure of the phenomenon under study. Truth-value is

usually obtained from the discovery of human experience as they are perceived and lived by the participants (informants) and is termed credibility (Lincoln & Guba, 1985, p. 319).

This prolonged engagement with the participants (informants) allowed me to identify recurring patterns, themes, and values to control the perspectives and draw up the findings and conclusions.

3.3.5.2 Transferability

Applicability is usually seen as an important factor of validity and refers to the degree to which findings can be applied to other contexts and settings within groups, which includes the ability to generalise from the findings to larger populations. In qualitative studies, generalisation is often not possible because every research situation consists of a particular researcher in a particular interaction with particular participants (informants). Lincoln and Guba (1985, p. 324) suggest that a more appropriate perspective would be transferability as the criterion against which the applicability of qualitative data are assessed. Research meets this criterion when findings fit into contexts outside the study situation that are determined by the degree of similarity between two contexts. I do not necessarily have to transfer the findings to other settings, but the data are sufficiently descriptive so that it is possible for another person to make a comparison, if needs be (Lincoln & Guba, 1985).

3.3.5.3 Dependability

According to Morse (1994, p. 226) consistency determines whether the findings would be consistent if the inquiry were repeated with the same subjects in a similar context. Variability can be expected in qualitative research because the instruments assessed are the researcher and the participants (informants), both of whom vary greatly within the research project. Seeing that qualitative research emphasises the uniqueness of the human situation it is variation rather than agreement that is sought Morse (1994, p. 227). Because variability can be expected in qualitative research, consistency is defined in terms of dependability. Dependability implies tractable variability, meaning variability that can be ascribed to identify sources. Variability should therefore be explained in terms of the informant, the researcher, or the context. Qualitative research further looks at the range of experience rather than just at the average of experience so that it is important to include a typical or non-normative situation in the findings.

The key to qualitative research is to learn from the participants (informants) rather than to control them.

3.3.5.4 Confirmability

Neutrality refers to the degree to which findings are a function solely of the participants (informants) and conditions of the research and not of other biases, motivations, and perspectives. In quantitative research one tries to be as objective as possible, with a good scientific distance between the researcher and the subjects. In qualitative research, however, the value of findings increases when the distance between the researcher and the participants (informants) is decreased. Lincoln and Guba (1985, p. 82) shift the emphasis of neutrality in qualitative research from the researcher to the data. Neutrality of the data becomes the important factor and not neutrality of the researcher. Lincoln and Guba (1985, p. 319) suggest that confirmability is therefore the criterion of neutrality, which is achieved when truth-value and applicability of data are established.

The criteria used to measure trustworthiness in this study were therefore credibility, transferability, dependability and confirmability. They are briefly elucidated next:

- Credibility: Findings were tested from where the data were drawn and with the persons who are familiar with the phenomenon being studied;
- Transferability: It was established if findings fitted into similar context outside the study situation;
- Dependability: Variability is explained either in terms of the participants (informants), myself or the context; and
- Confirmability: Truth value and applicability of the data were established.

Merriam (1998) in addition to the above criteria classifies six strategies to ensure internal validity in qualitative research. They are:

- Crystallisation;
- Member checks;
- Long-term observation;
- Peer examination;
- Collaborative research; and

- Researcher bias.

For the proposed study, I intended to use crystallisation, peer examination, collaborative research and clearing researcher bias, which will be explored in the next paragraphs.

3.3.5.5 Crystallisation

According to Merriam (1998), crystallisation can be seen as the process where several investigators, sources and methods should be used to compare the findings with one another. In this study, I compared the literature study, observations and interviews to validate the data and enhance the trustworthiness.

3.3.5.6 Peer examination

Merriam (1998) describes peer examination as seeking feedback from colleagues and co-workers. I discussed the information found in the research with my other participant teachers who also teach Computer Applications Technology under ethical conditions in order to ensure the reliability of the data.

3.3.5.7 Collaborative research

The researcher involved the participants in the research, as recommended by Merriam (1998). Discussing the outcomes of the data with the participants under ethical conditions and incorporating their ideas and opinions into the research added to the validity of the data.

3.3.5.8 Researcher bias

The preceding paragraphs declare my assumptions, views and theoretical orientation and clear my researcher bias. (Maree, 2007, p. 38).

3.4   POSSIBLE CONTRIBUTIONS OF THE STUDY

In the sample proposal, the strategic outcome could have been to create an authentic Computer Applications Technology curriculum. This did not, however mean, I wanted to create new activities for the subject or rewrite a textbook. I wanted to investigate real-life problems in the

class environment, exploring the possibilities of computers and the benefits it may hold for society. My focus was on how learners should be taught, but more importantly, what should be taught to them in order to make a positive impact on society and develop a passion towards lifelong learning.

3.5   THE ROLE OF THE RESEARCHER

McMillan and Schumacher state that the researcher as field worker must choose a research role, which will be appropriate for the purpose of the study. Roles may vary in terms of the way in which a field worker's presence will affect the social system or the subject or respondents being studied (McMillan & Schumacher, 2010). They continue by saying that qualitative researchers become "immersed" in the situation and the phenomena studied. Research roles vary from the more traditional neutral stance to active participation, depending on the research approach followed (McMillan & Schumacher, 2010).

In this study I:

- created a comprehensive literature study;
- was a participant that acted as an observer;
- compiled and managed all the observations;
- prepared, structured and conducted interviews (Maree, 2007, p. 41);
- analysed and crystallised the data (Maree, 2007, p. 41); and
- combined all the information into a sensible research report.

3.6   ETHICAL CONSIDERATIONS

Any research, which involves other people in some way, has ethical implications. Even though action research is focused merely on the social world of the classroom, the open, fluid nature of the research process makes it important to produce a protocol that will apply to any situation that may arise. The object of the protocol is to ensure individual rights are not infringed and to promote fairness in the interpretation of data.

Action research is carried out in real life circumstances, and involves close and open communication among the people involved (O'Brien, 2001). Winter (1996) in O'Brien (2001)

list a number of principles that the researcher paid close attention to when conducting the research:

- I made sure that the relevant persons, committees and authorities had been consulted, and that the principles guiding the work were accepted in advance by all;
- All participants were allowed to influence the work; and the wishes of those who decided not to participate in the research, were respected;
- The development of the work remained visible and open for suggestions from others;
- Permission was obtained before making observations or examining documents produced for other purposes;
- Descriptions of others' work and points of view were negotiated with those concerned before being published; and
- I accepted responsibility for maintaining confidentiality.

Several more points might be added to this (O'Brien, 2001):

- Decisions made about the direction of the research and the probable outcomes were collective;
- I was explicit about the nature of the research process from the beginning, including all personal biases and interests;
- There was equal access to information generated by the process for all participants.

3.7   DELIMITERS OF THE STUDY

Delimiters refer to ways in which the researcher specifies boundaries in my research (Maree, 2007, pp. 38-39). Proposed delimiters of the study were based on the general framework as provided by Patton, Swanson and Holton (Maree & Van Der Westhuizen, 2009, pp. 38-39).

7. **Table 3.1: Proposed delimiters of the research**

DELIMITERS OF THE RESEARCH	
Potentially limiting issue	**Delimiter**
Naturalistic enquiry	Only Grade 11 and Grade 12 Computer Applications Technology learners from an anonymous High School were used in this study that took place over a period of two years with my focus on the grade 11 learners in my first year of study and the grade 12 learners the following year.
Inductive analysis	Only one person (the researcher) performed data collection and analysis
Holistic perspective	Since human subjects were involved in the research, the "Hawthorne effect" was considered. It might have influenced class dynamics, environmental influences and learning dynamics
Qualitative data	Detailed descriptions were made possible by means of qualitative data collection methods; however, an individual performed this task
Personal contact and insight	Findings were criticised in terms of the Hawthorne effect and personal bias
Dynamic systems	There were no changes in the classes being investigated, due to no newcomers or any learners leaving the course
Unique case orientation and context sensitivity	The context was focused only on self-directed learning. Environmental influences and differences that could affect behaviour might not be known
Empathetic neutrality	Observation was not strange to individuals and/or classes and did not influence behaviour
Design flexibility	Structural research requirements might have influenced the nature of the flexibility associated with this study

The above list of proposed delimiters was used as a checklist of possible shortcomings and weaknesses. It also served as a measurement of validity in the research.

3.8   POSSIBLE LIMITATIONS AND CHALLENGES OF THE STUDY

The following are possible limitations of the study:

- The digital world:
  The possibilities of what the digital world has to offer are endless. In order to explore these possibilities and incorporating them into real-life problems in the classroom was and will remain extremely challenging.
- Cultural differences:
  Observations and interviews were planned carefully in order to identify problems relating to cultural differences.

3.9   CONCLUSION

This chapter exposed the research design for this research in that it explicates all aspects that were considered and the eventual choices that have been made where options were possible. It is according to this research design that the following chapter with its empirical research will be conducted.

CHAPTER 4

EMPIRICAL RESEARCH

> *The real teacher, in fact, lets nothing else be learned than – learning. His conduct, therefore, often produces the impression that we properly learn nothing from him.*
> *(Heidegger, 1962)*

4.1 INTRODUCTION

Since my own professional development is of primary concern to me – as it would be for all education stakeholders – I wanted to ensure that this research project would have a longitudinal impact on such development by improving my education practice. For this reason, I chose participatory action research as my approach to this project. I believe that this approach will allow me to advance my position in this field and to enhance my education practice.

4.2 PARTICIPATORY ACTION RESEARCH

Two defining characteristics of authentic learning guided my action research. First was the resolution of real-life challenges that present themselves in holistic complexity; second was significant investment over time of participatory action research in an investigation to produce the best possible resolution (Lombardi, 2007, p. 3). This implied that the nature of my educational intervention would be comprehensive and would be completed only after a relatively lengthy period. In order to comply with these time constraints, I had to confine this project to two major comprehensive research cycles (plan, act, observe, reflect, review). The completion of each cycle would extend over a number of learning periods. A learning period in this sense is a scheduled period of time in a school timetable allocated to each class in a particular subject per day, during which teachers and learners are in direct face-to-face contact and engaged in reciprocal interaction. This means that each of the two major action research cycles in this study consisted of several sub-cycles that were executed during each of the learning periods. Each of the major comprehensive cycles was completed in a period of approximately eight weeks, comprising ten learning periods per week, in which the curriculum content indicated for that period was covered. Figure 4.1 depicts the execution of my action research cycles.
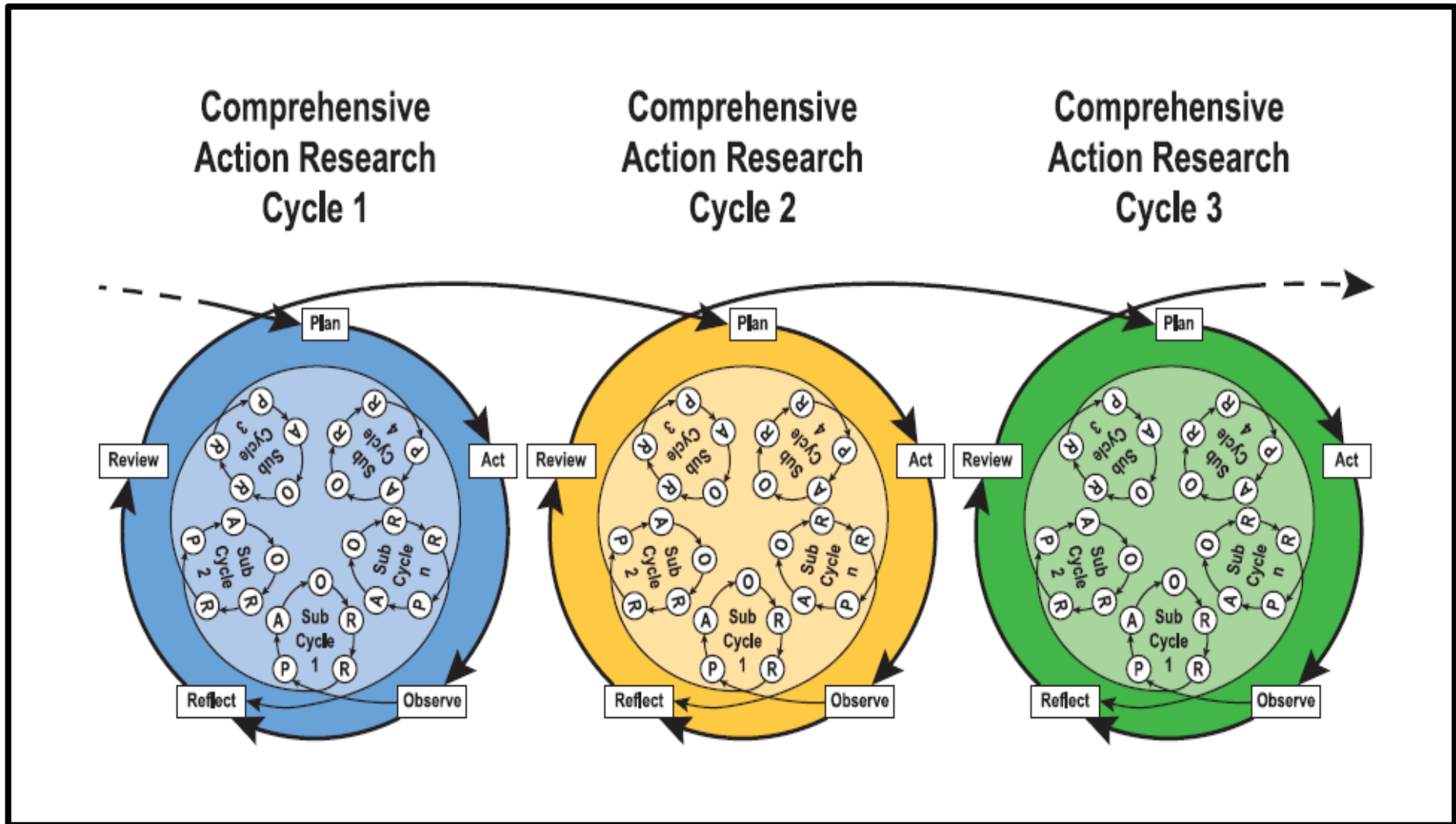
8. **Figure 4.1: My Action Research Cycles**

Each action research cycle consisted of the following action research steps:

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THE ACTION RESEARCH STEPS IN EACH ACTION RESEARCH CYCLE

- **Plan:** This step is informed by the review process, the last step in the cycle. It identifies the aspect of my education practice I wish to improve on or innovate and is, in essence, the planning of the education practice, of which the outcome represents the intended improvement or innovation. This will be represented by the nature and structure of my intended practice before I step into the classroom and face my learners.

- **Act:** This is the execution of the plan in its initial phase, when I meet my learners face-to-face and introduce my intended learning activity to them.

- **Observe:** This is the enactment of my intended education practice to its conclusion, while I simultaneously collect and record data in several ways. These are indicated in the research design.

- **Reflect:** This stage is a reflection on the recorded data in the form of my data analysis.

- **Review:** Identifying what educational practice is necessary to ensure the improvement of my education practice in the next action research cycle.

</div>

4.2.1 Cycle 1: Investigating the initial education practice

The improvement of my education practice is of crucial importance to me and I had to keep the requirements and challenges confronting me in my own professional development in mind. The current CAPS curriculum document was always my point of departure and was used as my teaching framework, as I am required to operate within this as a teacher. For this purpose, I include the practical requirements for grade 11 and grade 12 learners obtained from the CAPS document as well as a work schedule I use in my classroom, adjusted from the original given worksheets that reflects my classroom practice within this framework.

4.2.1.1 Plan: Designing my "Pre-authentic" learning lesson

Regarding my initial education practice, the CAPS curriculum is provided to each teacher in the form of the National Curriculum Statement Grades R–12, which has replaced Subject

Statements, Learning Programme Guidelines and Subject Assessment Guidelines with the following:

a) Curriculum and Assessment Policy statements (CAPS) for all approved subjects listed in this document
b) National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R–12
c) National Protocol for Assessment Grades R–12.

Under this policy, a general overview of the subject (Computer Applications Technology (CAT), in this case) is provided, as well as a suggested time each teacher should spend on each aspect of the curriculum, and the required resources. An overview of topics to be covered per term and the suggested annual teaching plan are also provided for each Grade. Lastly, this policy includes the formal and informal assessment types and programmes to be followed. As stipulated in the National Curriculum Statement (NCS) Curriculum and Assessment Policy Statement (CAPS), the department of education requires from the Computer Application Technology educators to cover the following outlined work with Grade 10 – 12 learners (mentioned in the table below). (Department of Basic Education, 2011, pp. 30-38).

8. Table 4.1: CAT scope for Grade 10 – 12

	WORD PROCESSING		
	GRADE 10	**GRADE 11**	**GRADE 12**
TERM 1	- What it is used for? - First looks: Workspace features such as ribbon, tab, menus - File management in word processor: Open new and existing documents, close, save, save as, print - Select data using keyboard and/or mouse - Text: entering, editing and deleting text - Basic punctuation - one space after all punctuation, including periods - Formatting - Font type, style, size, colour, highlight, effects - Paragraph: spacing, alignment, borders, shading, indents (simple) - Using existing quick styles in gallery (simple) - Editing: cut, copy, paste, find, replace - Reviewing: proofing: spelling and grammar - Autocorrect and basic word processing typography such as quotes, dashes, emphasis - Page layout: page set-up: margins, orientation, size, page border - Document layout: page numbers, page breaks, symbols - View options – print layout, preview - Insert and manipulate illustrations and text - Pictures, clip art, word art, shapes, charts, smart art, text box	- File management - Printing (including options such as range of pages, odd or even, number of copies, print quality, pages per sheet), send to (e-mail, Internet fax, pdf), convert, properties - Input data from different file formats, e.g. text files, csv, rtf, tables - Editing: Paste special, find and replace (extend to more options) - Page layout: Themes - Document layout - Section breaks and sections - Headers and footers (including date, path and filename) - Page numbers: Different first page, odd, even, starting from a specific number - Cover page - Paragraph: - Customise bullets and numbering - Outline numbering/multi-level lists - Customise spacing - Templates: Agenda, memo, basic resume/CV - Import/export data and online and offline help	- Bookmarks - Reviewing and tracking changes - Line breaks (pagination issues such as widow/orphan control) - Import data collected via electronic forms
TERM 2	- Paragraphs (basic) - Bullets and numbering (basic), Indents (hanging), Tabs - Document and page layout - Customising margins, Headers and Footers - Tables - Insert, Table tools, Table design, Table properties, Design: Table styles, borders and shading, Layout: Rows and columns, header rows, Cells: size, distribution, merging and splitting, Text alignment and direction, Table: split, auto fit, gridlines, Working with data: sorting, convert to text and working with formulas - View options - Work with more than one document/window, zoom - Document views: Draft, full screen reading	- Styles - Quick style gallery (reinforce) - Style set - Change/edit a style - Create a new style	- Mail Merge - different data sources, e.g. e-mail list - File management: Prepare, publish
TERM 3	- Reviewing - Comments - Protecting document - Document layout - Page setup - Columns, Hyphenation - Watermark, Page colour - Integration – Hyperlinks	- Mailings - Mail Merge - Reference - Table of contents - Footnotes - Captions - Citations and Bibliography	- Documents using style focusing on aspects such as: - Page layout that includes advanced word processing techniques - Techniques of integration with other software including linking objects
TERM 4	- Templates: Letter, Fax, Report - Accessing off-line help including FAQs (frequently asked questions) - Integration techniques - Solve problems using word processor - Troubleshoot basic word processing problems	- Electronic forms - Mail Merge - Envelopes and labels - Integration with other packages	

	SPREADSHEET		
	GRADE 10	**GRADE 11**	**GRADE 12**

TERM 1		Reinforce content, concepts and skills from Grade 10
		• Absolute cell referencing
		• Auto fill options
		• Using spreadsheet functions such as round, small, large, countif, counta, countblank, sumif, power and rand
		• Rounding off numbers and the difference between rounding and formatting
		• Conditional formatting
		• Interpreting error indicators such as:
		  o circular reference
		  o #NULL!
			• Reinforce content, concepts and skills
			• More complex functions such as
			  o Nested IF
			  o Vertical lookup, including error indicator #N/A
			  o Variations of known functions, e.g. rounding up and rounding down
			• Basic date and time calculations

TERM 2	• Overview of the basic skills and core concepts of spreadsheets
	• First looks: Workspace
	  o Rows, columns, cells, sheets, workbook
	• Cell reference
	  o The importance of using cell references rather than constant values in cells and formulas
	• Cell ranges
	• Data types such as General, Number, Currency, Date and Time
	• Values and contents
	• Format cells: data type, borders, shading, alignment, wrapping, merge, alignment, text direction, merge, split, auto fill
	• Formatting rows, columns and sheets
	  o Size (width and height), insert, delete, hide, unhide, borders, styles
	• Reinforce generic/common concepts such as formatting and editing, page layout, illustrations, search, proofing as in word processor
	• File options: open, save, save as, new, print
	• Basic calculations using basic operators including +, -, *, / , order of precedence and the use of brackets
	• Error indicators:
	  o ######, #NAME!, #DIV/0!, #REF!#VALUE!, #NUM!
		• Simple IF function
		• Use of relational operators (> < <= >= <>) in simple IF functions
		• Charts/graphs: Create, format and edit
		  o Meaningful titles and labels
		  o Gridlines
		  o Legends
		  o Options appropriate to the graph type chosen
		• Integration techniques
			• Reinforce and consolidate content, concepts and skills
			• Text functions such as:
			  o left, right, mid, concatenate, len, value and find

TERM 3	• Formulae vs. functions
	• Know and use basic functions such as:
	  o sum, average, count, min, max, today, rand, mode, mean, countif and use of relational operators (><<= >= <> =)
	• 'Round' numbers using cell formatting
	• Sorting
	• Work with sheets
	  o rename
	  o headers and footers
	  o printing
	• Introduction to graphs
		• Import/export data
		• Help files
		• Work with sheets:
		  o Move, copy, headings, protect, gridlines, freeze panes, etc.
		• Use different print options such as print area
		• Integration techniques within package e.g. linking cells and formulas between sheets
			• Consolidate and reinforce content, concepts and skills
			• Identify appropriate functions to suit scenario and solve problem:
			  o Date and time, maths, statistical, text, logical, lookup and reference
			• Use more advanced combinations of functions and formulas
			• Edit, format and change charts including
			  o Changing the scale on the axes
			  o Minimum and maximum values
			  o Re-labelling axes, etc.
			  o Creating stacked bar and column graphs using a graphic, etc.
			• Appropriate graph for a given scenario

TERM 4	• Graphs
	  o Pie, Line, Column/Bar
	  o Purpose of each / when to use
	  o Create, format, edit
	  o Interpretation of information presented in a graph
	• Basic integration techniques
	• Solve problems using spreadsheets
	Troubleshoot basic spreadsheet problems
		• Consolidate and reinforce content, concepts and skills
		• Templates, e.g. basic invoice and receipt, home/personal budget, basic time sheet
		• Plan and design own documents for specific scenarios and inquiries
		• Integration with other packages
		• Problem solving using spreadsheets
		• Troubleshooting spreadsheets	

	GRADE 10	GRADE 11	GRADE 12
DATABASE			
TERM 1		- First looks: - Objects: Table, form, query, report - Tables: Records and fields, field names - Basic field properties: size/length, default value, decimal places, required - Data types - Text, number, date and time, currency, auto number, Yes/No and Memo - Database structure - Primary key - Create tables and forms - Enter data (records) - Add and delete records, fields - Formatting and editing - Sorting - Basic data validation techniques - Use filters - Work with different views, e.g. design and table view	- Reinforce content, concepts and skills from Grade 11 - Design reports - grouped - Group headers and footers - Calculations in groups such as sum, average, counting, maximum, minimum - Add fields with calculations in queries, reports - Data validation techniques - Queries using and, or, not, wildcards(*), IS Null operator
TERM 2		- Design database tables - Choosing appropriate data types - Text, number, date and time, currency, auto number, Yes/No, Memo, OLE object, hyperlink and Lookup - Reinforce and extend the use of field properties: size/length, default value, decimal places, required, input mask, validation rule, validation text and alignment - Queries: - Design basic queries using and, or, not and sorting options - Selecting which fields to display in a query	- Reinforce and consolidate content, concepts and skills - Design a database for a specific scenario
TERM 3		- Reports: - Design basic reports using a wizard - Basic calculations at end of report such as: sum, avg, count, min and max - Page headers and footers (design view) - Report headers and footers - Import/export data	- Consolidate and reinforce content, concepts and skills - Create a database for a given scenarios
TERM 4		- Formatting techniques to fields, records, tables, forms, queries and reports - Integration with other packages - Design a database table for a specific scenario, including forms, queries and reports - Problem solving using databases - Troubleshooting databases	

	HTML/WEB DESIGN		
	GRADE 10	**GRADE 11**	**GRADE 12**
TERM 1			
TERM 2		• Reinforce the concepts of 　o　Websites, web pages, hyperlinks and URLs • What is HTML? • What is an HTML editor? • HTML syntax – Basic HTML tags: Opening tag and closing tag	• Reinforce content, concepts and skills as well as good website/page design • HTML tables 　o　Syntax: Table tags 　o　Attributes: border, cell padding • Develop a web page for a specific scenario

Table within Grade 11, Term 2:

	Opening tag	**Closing tag**
Basic document tags	<html> <head> <title> <body>	</html> </head> </title> </body>
Heading elements	<h1> : <h6>	</h1> : </h6>
Text elements	<p> <hr />	</p>
Text formatting	 <i>	 </i>

	GRADE 10	**GRADE 11**	**GRADE 12**
TERM 3		• Good website/page design – consider • Use of colour (basic) • HTML links 　o　Link syntax: This is a link 　o　Attributes: target and name • HTML images 　o　Syntax: 　o　Attributes: source and alternate text • HTML lists 　o　Numbered list: ; Bulleted list: • List items:	• Reinforce content, concepts and skills as well as good website/page design
TERM 4			

	PRESENTATIONS		
	GRADE 10	**GRADE 11**	**GRADE 12**
TERM 1			
TERM 2			

TERM 3	• Overview of the basic skills and core concepts
	• Uses
	• First looks: Slides, designs, layouts
	• Formatting
	  ○ Font type, style, size, colour, highlight, alignment
	  ○ Paragraph: spacing, alignment, bullets, indentation
	• Editing: Cut, copy, paste, find, replace
	• Text: entering, editing and deleting text
	• Reviewing: Proofing: spelling and grammar
	• Page layout
	  ○ Page set-up: margins, orientation, size
	• Slides: Insert, delete, numbers, headers & footers
	• View options – normal, slide sorter, notes, slide show
	• Insert illustrations, tables
	• Custom Animations (basic)
	• Basic integration techniques
	• Start slide show		

TERM 4			

	SYSTEM TECHNOLOGIES		
	GRADE 10	**GRADE 11**	**GRADE 12**

TERM 1	**Explain what a computer is:**
	• Overview of a general model of a computer in relation to the information processing cycle: input, processing, output, storage
	• as well as communication
	• Overview of the different types of computers:
	  o Multi-purpose devices such as Desktop / Laptop / Netbook / Tablet / Server / Smart phones / Media players
	  o Dedicated devices such as ATMs and electronic appliances (embedded computers)
	• Overview and concepts of the main components of a computer system:
	  o Hardware and software
	  o Devices: Input, output, storage and communication
	• ICTs used in everyday life
	  o Define and explain the term Information and Communication Technology (ICT)
	  o Overview of a general model of an ICT system: Convey data, manipulate data, store data
	  o Example of an ICT system in a familiar context such as a point of sales system, cell phone.
	• Concepts of data and information
	  o Explain the difference between data and information and the importance of each
	  o Give examples of uses of data and information within a familiar organisation such as the school
	• **Startup – switch on the computer, log on, access**
	  programs.
	  o Desktop: First looks, icons and shortcuts
	  o Introduce the desktop:
	    - My documents
	    - Recycle bin
	    - Start button
	    - Task bar, etc.
	    - My computer
	    - File manager e.g. Windows Explorer
	  o Basic accessories
	Describe file organisation
	• Basic concepts and introduction to file organisation: drives, folders, files
	  o Examples of different types of files
	    File extensions (association) – common/generic extensions such as archived/compressed, forms of text files, Web pages
	  o applications such as word processor, spreadsheet, database, presentations
	  o graphics, movie, sound, animation
	  o Adobe Acrobat
	• File specification: Drive: Path/Filename/File extension
	• Files: File naming, conventions, file properties – types
	  o File manager e.g. My Computer / Hierarchy
	  o Organise, copy, rename, delete, restore, move, view, sort files and folders
	• Introduce file organisation with use of typing tutor when busy with keyboarding skills
	• Reinforce file organisation when dealing with word processing, spreadsheets and presentations.
		Information processing cycle: Input, output, processing, storage and communication
		• Types of computers and typical features
		  o Dedicated devices such as ATMs and electronic appliances
		  o Mobile computers and devices such as smart phones
		  o Client/server
		• Categorise computers
		  o Portable (mobile)/non-portable
		  o Processing power
		  o Usage
		• The role of ICTs in the workplace
			• Types of computer systems for different uses:
			  o Personal, SOHO, mobile and power users
			• Role and use of data, information, knowledge, conclusion/decision as part of information management
			• Reasons for using computers:
			  o saving paper, time, labour
			  o communication costs
			  o efficiency
			  o accuracy
			  o reliability
			  o effect on time and distance
			  o global communication including social networks and web tools such as blogs, wikis, etc.
			• Convergence - What is it?

CHAPTER 4: EMPIRICAL RESEARCH

	SYSTEM TECHNOLOGIES		
	GRADE 10	**GRADE 11**	**GRADE 12**

TERM 2	• Creating shortcuts
	• Taking screenshots
	• Adding new peripheral such a printer – USB and Plug-and-Play (PnP)
	• Changing the default printer
	• Basic printing and printer queue management – personal computer
	• Compressing/decompressing files and folders
		• Primary storage (memory) vs secondary storage
		  o Online storage
		  o What is it?
		  o Advantages/disadvantages
		    - Suitable storage media for backup
		    - How to write CDs, DVDs
		    - Interpret adverts
		    - Basic troubleshooting
		• **Processing**
		  o Understand the role of basic components of the system unit
		    - Motherboard - houses components
		    - CPU - processing
		    - RAM - holds data and instructions during processing/execution
		    - ROM - stores start-up instructions
		• Overview and basic concepts of start-up process	

TERM 3		• Basic system requirements
		  o Hard disk space, CPU, RAM
		  o What does it mean?
		  o How does it link with software?
		• Software installation
		  o Portable storage medium
		  o Internet download
		• Management of files:
		  o File types
		  o Properties
		  o File attributes such as read-only and hidden
		  o Import and export
		  o Search
		• System utilities can be done in an integrated manner when hardware and other concepts are taught, e.g.
		  o Install and uninstall when software and hardware is taught
		  o Backup and archive when data protection is taught
		  o Disk scanner, defrag and compression when hard drive capacity is taught
		  o Spyware, adware and firewall when we teach viruses and system security
			• Role of the operating system:
			  o Starting the computer
			  o Provide user interface
			  o Manage programs
			    - Concept of single user vs multiple users including examples
			    - Concept of multitasking including examples
			• Concept of Task Manager (Windows)
			• Management of files: File types, properties, file attributes such as read-only and hidden as well as metadata such as the author and title properties of documents, import, export, search and conversion
			• Operating system utilities (what is it? why is it needed?):
			• File management
			• Schedule/update
			• Coordinate tasks - Concept of spooling when printing
			• Compress/decompress files and folders
			• Security features such as access control, control of spyware, adware and firewall
			• Backup
			• Anti-virus software
			• General troubleshooting using utility software
			  o e.g. defragmentation
			• Factors that influence performance such as:
			  o RAM
			  o Type of processor, processor speed
			  o Number of applications running and caching
			  o Hard disk space/fragmentation
			• Influence of malware - Basic concepts/non-technical

TERM 4			

HARDWARE		
GRADE 10	**GRADE 11**	**GRADE 12**

• What is hardware?
• Overview of basic concepts relating of hardware
  o Identify hardware components
  o Identify ports and connectors such as network ports, USB and FireWire
• Input:
• What is input?
• Types of input:
• Data – unprocessed text, numbers, images, video, audio
• Instructions – programs, commands, user response
• What is an input device?
• Generic/common input devices: Keyboard – external (desktop), built-in (laptop) and mouse (optical, wireless)
• Output:
• What is output? Types of output: text, graphics, audio, video
  o Hard copy vs. soft copy
  o What is an output device?
• Generic/common output devices: LCD Monitors (size, quality) and Printers (inkjet and laser: speed, quality, cost)
• Storage:
• What is storage?
• What is a storage device? What is storage media?
• Examples of generic/common storage devices and media: hard disks (fixed and portable), USB flash drive
• Measuring capacity (KB, MB, GB and TB) of storage media
• Volatility, capacity of storage media
	• Input
	  o What is it? / Purpose / When to use
	  o Advantages, disadvantages and limitations
	  o Scanners and digital cameras
	• What determines the quality of digital cameras and scanning? Basic concepts
	  o Biometric input
	  o Input via PDAs, smart phones, tablet PCs, data collection devices
	  o Terminals (POS), ATMs
	  o Touch screens
	  o Alternative input devices such as virtual keyboards, optical keyboards
	  o Wireless technology
	• Output
	  o What is it? Purpose / When to use
	  o Advantages, disadvantages and limitations
	    - Interactive whiteboards
	    - Display devices
	• What determines the quality of monitors and printers? Basic concepts
	• Wireless technology
	• What software/other equipment is required, e.g. device drivers, OCR?
	• Input and output devices for physically challenged users
		• Input, output, processing, storage and communication as part of the information processing cycle
		• Consolidate and reinforce hardware and software regarding uses, advantages and limitations of common/generic input, output, storage and communication devices
		• Integration of input modes to enhance productivity/efficiency
		• Making buying decisions:
		  o What to buy? / Why? / Fit for purpose
		  o Keyboard and mouse:
		  o Ergonomic considerations
		  o Wireless vs cables
		• Digital cameras, web cams, scanners, monitors: uses, advantages and limitations
		  o Resolution and image quality
		  o Software to use with these such as OCR
		• Voice recognition - uses, advantages and limitations
		• Printers
		  o Which printer is best for task? Why?
		  o Budget, speed, colour, cost per page, graphics capability, photo printing, paper type and size, system compatibility, future needs, wireless capability, mobility, fit for purpose
		  o Resolution, economic and environmental considerations
		• Storage:
		  o Capacity, volatility, durability, backup, fit for purpose
		• Processing
		  o Making informed decisions regarding the basic components of the system unit e.g. buying a system that will be suitable for running particular software (system requirements) regarding processor and RAM
		  o Interpret specifications regarding CPU and RAM (basic)
		• Productivity, efficiency, accuracy, accessibility issues
		• Risks associated with input devices such as key logging software
		• Suggest input, output, storage, communication devices as well as CPU and RAM including specifying basic specifications in terms of processor, memory and storage for:
		  o home user
		  o SOHO user
		  o mobile user
		  o power user
		  o disabled user
		• Fix ordinary problems such as:
		  o sticky mouse
		  o scanning
		  o disk errors, e.g. defragging
		  o resolution
		  o non-responding programs
		  o printing problems
		  o checking amount of used or free space on storage medium
		• New technology
		  o their uses and merit

TERM 1

CHAPTER 4: EMPIRICAL RESEARCH

	HARDWARE		
	GRADE 10	**GRADE 11**	**GRADE 12**

TERM 2	Extend hardware concepts
	• **Input** (Basic concepts, features and uses)
	  o Pointing devices
	    - Touch pad, trackball, pointing stick, touch screen, pen input, joystick
	  o Digital camera
	  o Scanning and reading devices
	    - Flatbed, handheld, sheet feed scanners
	    - Radio-frequency identification (RFID), magnetic stripe, magnetic ink character recognition (MICR), optical mark recognition (OMR), bar-coding
	    - Optical character recognition (OCR)
	  o Video input – video camera, webcam
	  o Audio input: Microphone, voice recognition
	  o Biometric input e.g. fingerprint scanners
	• **Output** (Basic concepts, features and uses)
	  o Audio output: What is an audio output device?
	    - Headsets and speakers
	  o Other output
	    - Fax/Fax Modem, Multifunction devices, Data/DLP projector
	• **Storage media and devices** (Basic concepts, features and uses)
	  o CDs, DVDs, Blu-Ray
	  o Memory cards
	• **Processing**
	  o Overview of the basic concepts and introduction of the system unit:
	    - Motherboard, CPU, Memory (RAM, ROM)
	    - Measuring speed in GHz		

TERM 3			
TERM 4			

	SOFTWARE		
	GRADE 10	**GRADE 11**	**GRADE 12**

TERM 1	Overview of the basic concepts and introduction to software:
	• What is software? Identify software components
	• Concept of a graphical user interface (GUI)
	• Identifying and using typical components of a GUI such as icons, toolbars, menu usage and navigation, radio buttons, checkboxes, dialog, list and combo boxes
	• Minimising, restoring, resizing, moving and closing windows
	• System software vs. application software
	• Basic accessories such as calculator, paint, snipping tool
	• Application Software – Overview of basic concepts and introduction
	• What is application software?
	• Common/generic examples such as Office suites, financial applications, designing, gaming/entertainment
	• System Software – Overview of basic concepts and introduction
	• What is system software?
	• Operating System – basic function / purpose, typical features of GUI
	• Examples of operating systems
	• Administering security (PC/Laptop) – log on, user name, password (concept of authentication)
			• Software that enhances accessibility, efficiency, productivity such as:
			  o Voice recognition software
			  o Typing tutor/keyboarding skills
			  o Note-taking software
			• Uses of common applications such as:
			  o Applications dealt with practically (word processing, spreadsheet, database, presentation)
			  o Reference software
			  o E-mail software
			  o Document management software such as PDF file formats
			  o Web browsers
			• Web-based applications vs installed applications
			  o Advantages, disadvantages, examples and what they offer
			• Interpret system requirements and compare to system properties such as hard disk space, memory, and processor
			• Common software problems and upgrades such as:
			  o Obtaining and installing software improvements (patches), updates
			  o Read-only files, etc.
			• Risks of using flawed software
			• Which software to use where and when and by whom

TERM 2	**Extend software concepts**
	• Stand-alone vs. integrated software
	• Freeware, shareware, proprietary software
	• Open source software – definition and benefits, disadvantages
	• Licensing and licensing agreements including end-user, site license agreements, creative commons
	• System software
	  o Drivers: What is a driver?
	  o Utility programs: What is it?/Purpose
	Examples of generic/common utility programs such as backup		

TERM 3		• The role of application software
		• Function/purpose/role of different types: Multimedia and communication software
		• Compatibility issues
		• Versions, patches and service packs
		• Updating software
		• Online/web applications, e.g. Google docs
		• Software for physically challenged users
		• Explore web applications: Blogs
		  o Uses
		  o Advantages and disadvantages
		• Good practices	

TERM 4			

	SOCIAL IMPLICATIONS		
	GRADE 10	**GRADE 11**	**GRADE 12**

TERM 1	• Social issues applicable to the above content: Ergonomics, green computing (recycling, e-waste), health (posture), authentication (user id, passwords)
	• Economic reasons for using computers: Saving paper, labour, communication costs, efficiency, accuracy, reliability
		• Options available for enhancing accessibility such as speech recognition, screen readers and magnifiers, on-screen keyboards, screen, mouse and keyboard settings
		• Hardware theft and protection
		• Power settings/saving and protection against power failure
		• Factors influencing health and health risks
		• Value of CAT - career options and further study
			• Social issues applicable to the above content:
			  o environmental issues
			  o user-centered design in software applications such as:
			    - website
			    - database form
			    - presentations

TERM 2	• Social issues applicable to the above content: ethical use of computers, care of PC system, storage devices
	• Software piracy, licensing, intellectual property
		• Social issues applicable to the above content:
		  o Unauthorised access
		  o Ethical use of networks
		    - Acceptable use policies of schools
		  o Network safety and security issues
		  o Privacy issues
		    - spyware
		    - adware
		    - role of databases
		    - respect privacy and products of others
			• Social issues applicable to the above content:
			  o Computer crimes in relation to hardware, software, information, identity, bandwidth theft, theft of time and services
			  o Internet-related fraud scams/ Internet attacks
			  o Taking over PCs, e.g. bots, zombies
			  o Right to access vs right to privacy/Misuse of personal information
			• Security issues such as malware, spyware, adware, pop-ups, key logging and safe guards such as firewalls
			• Avoiding security threats and safeguards against criminals and viruses
			• The impact of technology on the global community:

TERM 3	• Social issues applicable to the above content:
	• Recognise and acknowledge the ownership of electronic material
	• Appropriate communication etiquette
	• Email threats, issues and remedies – Viruses, Trojans, Worms, hoaxes, spam, phishing, email spoofing and pharming
	• Safe email and Internet use – dangers and tips to ensure safe use
		• Social issues applicable to the above content:
		  o Computer and human error and the effects thereof such as accuracy and validity - data input
		  o Data types used, e.g. databases POLICY STATEMENT (CAPS)
		  o Verification and validation of data, e.g. database
		  o Software bugs
		  o Hardware failure
		• How ICTs impact on the workplace and employment practices
		• Mobile offices, virtual office, decentralisation of labour, office automation
			• Social issues applicable to the above content:
			  o Impact and use of social networking sites and technologies such as:
			    - MySpace, Facebook, Twitter, Virtual communities such as Second Life
			• The impact of technology on the global community
			  o Tele-commuting/tele-working, Computer fraud
			• How technology can benefit or harm society
			• Use information sources from around the world
			• Information overload

TERM 4	• Impact on society
	  o Identify how ICTs influence one's life and life styles
	• Impact on home office, education
	• Computer criminals – types and what they do/how they operate
		• Social issues applicable to the above content
		• Social engineering tricks - what is it?
		• Information accuracy - why is it important?
		• Data protection such as backup
		• Computer misuse
		• Protecting oneself when online
		  o Online harassment, Stalking and bullying
		  o Malware and security software
		  o E-commerce and e-banking (e.g. https)
		• Why anti-virus and anti-spyware programs need to be updated and how they function	

	NETWORKS & NETWORK TECHNOLOGY		
	GRADE 10	**GRADE 11**	**GRADE 12**
TERM 1			
TERM 2	• Overview of the basic concepts and introduction to networks: • What is a network? • Aims and objectives of networks • Advantages such as facilitating communications and sharing hardware, software, data and information; and electronic funds transfer (EFT) • Disadvantages such as security and privacy issues • Internet as an example of a network	• Local area networks (LAN and WLAN) o Definitions and where and why they are used? o Definition, purpose, role, uses o Advantages, disadvantages and limitations • Basic components of a network - Overview and concepts o Workstations and servers o Network interface card (NIC) o Network devices for connection o Communication medium o Network software • Connection o Wired vs wireless o Data transmission speed • Intranet - Definition and uses • Basic network security such as passwords, usernames and access rights	• Wide area networks (WAN) o Definition, purpose and role • Internet as an example of a WAN • Internet services (uses/purpose, advantages, disadvantages, limitations, examples): o Real-time messaging - instant messaging and chat o Voice over Internet Protocol (VoIP) o File Transfer Protocol (FTP) o File sharing o Concept of grid computing and cloud computing • Government Internet services and information such as tax return, TV license payment and election information • Make buying and informed decisions regarding Internet connection and access o Modem/router, types of connections, e.g. ADSL, wireless technologies, including their advantages, disadvantages and limitations o ISP, Internet services o Consideration of access points, coverage (wireless) o Data transmission speed - measured in kilobits per second(kbps) and megabits per second (mbps) o CAP, bundle • Concept of broadband and bandwidth • Downloading/uploading
TERM 3	• Overview and basic concepts: • Personal area network (PAN) / Home area network (HAN) o What is it?/ What is it used for? / What does it offer? o Advantages, disadvantages, limitations o What is needed to create a PAN/HAN? • Network device: Modem, Router, Switch • Communication channel/media • Obtaining Internet access: o Identify hardware and software needed for connecting to the Internet using a PC • ISP – Definition and purpose		
TERM 4			

	GRADE 10	GRADE 11	GRADE 12
INTERNET & WWW			
TERM 1			

TERM 2		• Usability of web pages/websites - basic areas
		  ○ Explore web pages/websites and evaluate aspects such as:
		  ○ Readability, navigation, consistency, layout, typography - link to word processing documents and forms	

TERM 3	• Internet
	  ○ What is the Internet?
	  ○ Internet addresses
	• Overview of the World Wide Web (WWW)
	  ○ Describe the WWW
	  ○ Web address/uniform resource locater (URL)
	  ○ Web page, Web site, hyperlink
	  ○ Types of Web sites, their purpose/what they offer and examples
	    - Portal, news, informational, business, Weblog (blog), Wiki, online social network, educational, entertainment, advocacy, Web application, content aggregator, personal
	• Browsers
	  ○ What is it?/Purpose/Tabbed browsing
	• Search engines
	  ○ What is it?/Purpose/Common/generic examples
	• Basic browsing and searching techniques
	  ○ Keywords/key phrases/Search engine operators
	• Concept of downloading and uploading
	• What is e-communication?
	• What is a communication device?
	• E-communication using a PC
	• Overview of applications to facilitate e-communications: e-mail, Web browser, instant messaging, text, picture and video messaging, mailing list, Web log
	  ○ What is it?/What does it offer?/Purpose
	• Email as a form of e-communication
	  ○ Taxonomy of e-mail addresses /ISP vs. web-based e-mail
	  ○ E-mail software features such as Cc and Bcc fields, attachments and address books
	• Fax/Computer fax, Fax to E-mail
	• Netiquette/Basic use of the Internet and e-mail/Hyperlinks
	• Apply netiquette rules such as spelling check, messages, being courteous and concise, not gossiping, reducing the size of attachments and not typing in capital letters
	• Basic e-mailing
	  ○ compose messages /send and receive, forward, reply to, reply to all
	  ○ Attachments
		• Types of digital communications: Voice over Internet Protocol (VoIP), FTP, video conferencing, chat rooms, RSS aggregator
		  ○ Advantages and disadvantages
		  ○ Good practices
		• Overview of online services such as banking, shopping, booking/reservations
		• Uses of computer communications: social websites
		  ○ Advantages and disadvantages
		  ○ Good practices
		  ○ Examples
		• Limitations of fixed Internet access
		• Overview of portable and mobile Internet access (basic concepts - What is it? Where is it used? Examples)
		  ○ Wi-Fi Hotspots, WiMAX, Bluetooth
		  ○ Portable and mobile - 3G
		  ○ Cellular data service
		  ○ Cell phone as a modem
		  ○ Browser and e-mail software
		• Website accessibility
			• Types of digital communications such as video conferencing:
			  ○ Advantages and disadvantages
			  ○ Good practices
			• Typical features of web browsers such as:
			  ○ Bookmarks
			  ○ History and favourites
			  ○ Home page settings
			  ○ Pop-up blocker
			  ○ Blocking websites
			  ○ Caching
			  ○ Browser plug-ins - What are they? Why are they needed? Examples
			• Uses of computer communications such as:
			  ○ RSS feeds
			  ○ Blogs/vlogs
			  ○ Podcast/vodcast
			  ○ Wikis
			  ○ GPS
			  ○ Social networks
			• Digital communications:
			  - Strengths and weaknesses
			  - Advantages, disadvantages and limitations
			  - Good practices
			• Communication devices: Smart phones and other personal mobile devices
			• New trends and technologies

TERM 4		• Managing e-mail:
		  ○ Organise using e-mail folders
		  ○ Sort by, flag, prioritise
		  ○ Distribution lists, message rules
		• Register a web-based e-mail address	

		INFORMATION MANAGEMENT & PAT		
		GRADE 10	**GRADE 11**	**GRADE 12**
TERM 1				• Reinforce content, concepts and skills from Grade 10 and Grade 11 • Setting questionnaires • Gather information and data • Discuss the writing of professional/formal reports • Discuss the use of spreadsheet and database in professional reports

TERM 2		• Data vs. information
		• Understand the problem/task
		  o Problem solving steps
		  o Role of questions and questioning to determine information needs
		• Information sources and data gathering tools
		  o Electronic reference works, e.g. Encarta, Internet
		  o Printed media, e.g. books
		  o Surveys/Questionnaires and People, e.g. interviews
			• Reinforce content, concepts and skills from Grade 10
			  o Task definition, data and information gathering
			  o Quality control of information:
			  o Evaluate questions (types/levels/variety)
			  o Questions that can be answered explicitly by facts, e.g. questions starting with words such as What? When? Where? Who? How many? etc.
			  o Questions that will help you to examine, explore, query, e.g. questions starting with Why? How? etc.
			  o Questions that will help you to adjust alter or predict, e.g. questions starting with If? What if? etc.
			  o Questions that will help you to make a judgment, critique, review or find meaning of some sort, e.g. questions starting
			  o with Would it be better if? What recommendation? How can I determine? What would be the best way? etc.
			• Evaluate information
			  o Authority (who created it?), Accuracy (are the facts substantiated?), Currency (is it up-to-date/still relevant?), Objectivity (any bias?), Coverage (how well does it cover the topic?)
			• Evaluate websites: Criteria
			  o Affiliation (e.g. who supports the Web site?), Audience (e.g. level at which it is written/who is it intended for?), Authority (e.g. who is the author and what are his/her credentials?), Content (e.g. organisation of content and working links), Currency (e.g. is the information on the Web page up-to-date?), Design (e.g. is it easy to navigate and visually pleasing? How quickly does it download?)
			• Objectivity (e.g. does it reflect any preconceptions?)
				• Practical Assessment Task
				  o Reinforce Information Management skills
				  o Use information and data gathered: Processing and analysing

TERM 3		• Information vs. knowledge • Find and access information and data o Role of surveys and questionnaires • Sifting information • Process of keeping only gathered information that meets the criteria/will solve the problem	• Role of spreadsheet and database to process and manipulate data to provide information • Reinforce content, concepts and skills through application packages and PAT	• Practical Assessment Task • Reinforce Information Management skills • Use information and data gathered: Processing and analysing

TERM 4		• Knowledge vs. insight/decision making
		• Manipulating information
		  o Extract core meaning
		  o Summarise using own words
		• Data handling using spreadsheet
		  o Data questions: How many? What is most popular? What is least common? How many more than? What is the average?
		• Processing data
		• Presentation of information:
		  o Graphs, tables, techniques and tools in word processor
		  o Report writing – elements of a report: introduction, body, conclusion, bibliography/references, copyright/plagiarism issues
		  o Summarising information/report using presentation software
			• Reinforce content, concepts and skills in finalising PAT
			• Finalise PAT	

CHAPTER 4: EMPIRICAL RESEARCH

In addition to the policies, each district is allocated a facilitator who provides teachers with additional resources. These resources are provided in electronic format on a compact disc (CD) approximately four times a year, with the main purpose of assisting the teacher in the classroom. Materials include completed weekly lesson plans and PowerPoint presentations of the entire year's syllabus that teachers may use to explain content to learners, as well as various exemplar tests and exams. These may be used during the year for revision purposes, or for activities that contribute to the learners' school-based assessment (SBA). All work schedules, planning documents, documentation required by the HOD, including recording mark sheets, file dividers with policies and guidelines are also provided on the CD. Below is an example of the content of a CD received from the district facilitator in my specific district in Gauteng (Figure 4.2).
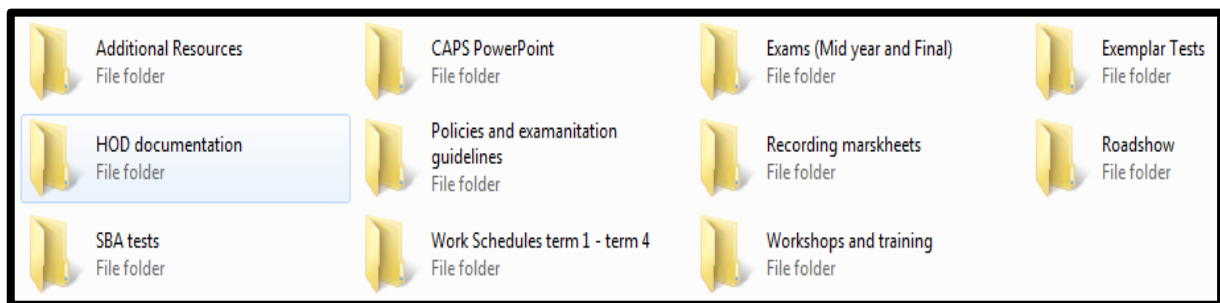
9. Figure 4.2: Example of CD content

(Source: Screenshot taken from CD provided by District Facilitator)

In addition to this CD, the CAT textbooks consist of a package of material to be used in teaching the subject. Apart from this textbook, additional material is provided in a teacher guide with an accompanying digital versatile disc (DVD). This DVD includes planning documents and PowerPoint presentations covering each chapter of the textbook, which teachers can use to explain both theoretical and practical content in the textbook. The textbook is aligned with the exact requirements of the CAPS document. All activities and data with which to complete them are given to the learners and the solutions to these activities are made available to the teachers. Step-by-step video clips demonstrating most of these activities are also included, either to assist the teacher, or to be used to demonstrate the activity to the learners.

The time allocated per week to each subject in the FET phase, as stipulated by the CAPS document, amounts to about four hours per week, or eight hours in a ten-day cycle. I teach my CAT learners eleven times in a ten-day cycle, with each lesson approximately fifty minutes in duration. The work schedule is done yearly, termly, and daily and gives the teacher an indication of which topics, themes, and content the learners must complete throughout the year. More

specifically, it indicates how must time should be spend on that content, by giving the teacher an estimated start and finish time for all the weekly content. It indicates to the teacher which activities must be done during that time and the assessment plan is furthermore included at the bottom of the work schedule. In other words, everything a learner needs to know and will do in class on the relevant theme is indicated on this work schedule. Segments of the grade 11 work schedule are included in table 4.2 below to serve as a visual example:

GRADE 11						
TERM 1						
Theme and Chapter	Content		Activity number and page		Time Allocated	Planned Date	Date Completed
Solution Development: Spreadsheets Chapter 5: Unit 1 Formatting, formulas and functions Learner Book: Computers part of your life Pages 152-163 (Study Opportunities)	• Reinforce Grade 10 work • Absolute cell referencing • Auto fill options • Round, small, large, countif, counta, countblank, sumif, power and rand functions • Rounding • Conditional formatting • Error indicators		Activity 1 - Revise your spreadsheet skills Activity 2 – Use absolute cell referencing Activity 3 – Use auto fill Activity 4 – Use Large and small functions Activity 5 – Use countif and sumif functions Activity 6 – Use round, power, rand functions Activity 7 – Apply conditional formatting Activity 8 – Revise spreadsheet skills		12 hours	3 March – 14 March	
ASSESSMENT						
Practical Test (60 marks)	**Word Processing** Modules 3.1 – 3.4		**Spreadsheets** Modules 4.1 – 4.2		1 hour		
Theory Test (60 marks)	**Systems Technologies** Modules 1.1 – 1.2				1 hour		
TERM 2						
Solution Development: Spreadsheets Chapter 5: Unit 2 If functions, charts and integration Learner Book: Computers part of your life Pages 164-169 (Study Opportunities)	• Simple IF function • Relational operators in simple IF functions • Charts • Integration techniques		Activity 9 – Use the IF function Activity 10 – Use the IF function with operators Activity 11 – Solve problems in charts Activity 12 – Select data for charts		4 hours	5 May – 9 May	
ASSESSMENT						
Practical Test (60 marks)	**Word Processing** Modules 3.1 – 3.5	**Spreadsheets** Modules 4.1 – 4.3	**Database** Modules 5.1 – 5.4		1 hour		
Examination: Practical	Textbook: Modules 3.1 – 3.5 Modules 4.1 – 4.3 Modules 5.1 – 5.4 Modules 6.1				3 hours		
Examination: Theory	Textbook Modules 1.1 – 1.3 Module 2.1 – 2.2 Module 7.1 Theory of Modules 3.1 – 3.5 Theory of Modules 4.1 – 4.3 Theory of Modules 5.1 – 5.4 Theory of Module 6.1				2 hours		

CHAPTER 4: EMPIRICAL RESEARCH

TERM 3						
Solution development: Spreadsheets Chapter 5: Unit 3 Working with and share Spreadsheets Learner Book: Computers part of your life Pages 170-179 (Study Opportunities)	• Import/export data • Help files • Work with sheets • Print options • Integration techniques within package		Activity 13 – Import a database table into a spreadsheet Activity 14 – Use the spreadsheet Help option Activity 15 – Work with Spreadsheets Activity 16 – Link Spreadsheets		4 hours	22 Aug – 29 Aug
ASSESSMENT						
Practical Test (60 marks)	**Database** Modules 5.1 –5.5	**Spreadsheet** Module 4.1 – 4.4	**Word Processing** Module 3.1 – 3.7	**Web design** Module 6.1 – 6.2	1 hour	
Theory Test (60 marks)	**Systems Technologies** Modules 1.1 – 1.5		**Network and Internet Technologies** Modules 2.1 – 2.3		1 hour	
TERM 4						
Solution development: Spreadsheets Chapter 5: Unit 4 Solving problems with spreadsheets Learner Book: Computers part of your life Pages 180-184 (Study Opportunities)	• Consolidate and reinforce content, concepts and skills • Templates • Plan and design own documents • Integration with other packages • Problem solving using spreadsheets • Troubleshooting spreadsheets		Activity 17 – Test your spreadsheet skills Activity 18 – Use installed templates Activity 19 – Link charts to a Word documents Activity 20 – Import a text file into a spreadsheet Activity 21 – Use a spreadsheets to solve problems		4 hours	27 Oct – 31 Oct
ASSESSMENT						
Examination: Practical	Textbook Modules 3.1 – 3.7 Modules 4.1 – 4.4 Modules 5.1 – 5.5 Modules 6.1 – 6.2 Modules 7.1 – 7.3 Module 8.1 Practical e-mail (Module 2.4)		3 hours			
Examination: Theory	Textbook Modules 1.1 – 1.6 Module 2.1 – 2.4 Module 7.1 – 7.3 Module 8.2 Theory of Section 3, 4, 5, 6		3 hours			

9. Table 4.2: Segment from the Grade 11 work schedule

In addition to the work schedules, weekly lesson plans are also provided by the Department of Education: Gauteng Province. 136 weekly lesson plans are created for grade 10 learners, 143 lesson plans for grade 11 and 112 lesson plans are created for grade 12 learners. Table 4.3 is an example of one of the grade 11 lesson plans teachers receive from the department of Education, and also what I used in my classroom prior to discovering the advantages of authentic learning. A detailed PowerPoint presentation is attached to every lesson plan, and data files with other additional resources are also available (South African Department of Education, 2015).

CURRICULUM AND ASSESSMENT POLICY STATEMENT

LESSON PREPARATION

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

GRADE	11	SUBJECT	CAT	WEEK	7	TOPIC	Spreadsheet	LESSON	6

LESSON SUMMARY FOR:		
Spreadsheet		
Functions: COUNTIF		
DATE STARTED		**DATE COMPLETED**	
LESSON OBJECTIVES	*At the end of this lesson the learner must be able to:*	

At the end of this lesson the learner must be able to:
- *Use COUNT, COUNTA and COUNTBLANK*
- *Know how to use the COUNTIF function*

TEACHER ACTIVITIES	LEARNER ACTIVITIES	TIMING	RESOURCES NEEDED

• **Methodology**
  • Revision of the COUNT function.
  • Learn how and when to use the COUNTA, COUNTBLANK AND COUNTIF function.
• **Introduction**
  • Revise the functions COUNT, COUNTA and COUNTBLANK
	Explore the different options available in Excel
	Complete the activity
	CountIfActivity.docx
	Media.xlsx
		Introduction
		± 5 min
		
		Investigation
		± 25 min
			Computer
			CountifExample.xlsx
			PowerPoint presentation
			Activities:
			CountIfActivity.docx
			Media.xlsx

COUNT	Counts how many numbers are in the list of arguments
COUNTA	Counts how many values are in the list of arguments
COUNTBLANK	Counts the number of blank cells within a range
COUNTIF	Counts the number of cells within a range that meet the given criteria
COUNTIFS	Counts the number of cells within a range that meet multiple criteria

- Ask the learners if they think it will ever be necessary to count only some items in a range.

- **Main Body (Lesson presentation)**
  - Introduce **COUNTA**
    =COUNTA(range)

Activities available in text books:
Computers part of your life
p. 229 Activity 3
Via Afrika
p. 158 Activity 5
Focus
p. 81 Activity9

Activity
±20 min

Discussion of results
±10 min

Activity solutions
Media_Solution.xlsx

Content in text books
Computers part of your life
p. 228
Via Afrika
p. 157
Focus
p. 79, 80

	A	B
1	Sales	
2		
3	19	
4	TRUE	
5		
6	**Formula**	**Description (Result)**
7	=COUNTA(A1:A5)	Counts the number of nonblank cells in the list in A (3)
8	=COUNTA(A1:A2, A5)	Counts the number of nonblank cells in the top two, and bottom cell in the list (1)

- Introduce **COUNTBLANK**
  Counts empty cells in a specified range of cells.
  - **Syntax**
  - COUNTBLANK(range)
  - The COUNTBLANK function syntax has the following <u>arguments</u>:
  - **Range**   Required. The range from which you want to count the blank cells.
  - **Remark**
  - Cells with formulas that return "" (empty text) are also counted. Cells with zero values are not counted.

	A	B
1	**Data**	**Data**
2		
3	6	=IF(B4<30,"",B4)
4		27
5	4	34
6	**Formula**	**Description (Result)**
7	=COUNTBLANK(A2:B5)	Counts empty cells in the range above. The formula returns empty text. (4)

- Introduce the **COUNTIF** function:
  =COUNTIF(range, criteria)

The **COUNTIF** function syntax has the following arguments:

- **Range:**
  One or more cells to count, including numbers or names, arrays, or references that contain numbers. Blank and text values are ignored.
- **Criteria:**
  A number, expression, cell reference, or text string that defines which cells will be counted. For example, criteria can be expressed as 32, ">32", B4, "apples", or "32".

	A	B	C
1	Data	Data	
2	apples	32	
3	oranges	54	
4	peaches	75	
5	apples	86	
6	**Formula**	**Description**	**Result**
7	=COUNTIF(A2:A5,"apples")	Number of cells with apples in cells A2 through A5.	2
8	=COUNTIF(A2:A5,A4)	Number of cells with peaches in cells A2 through A5.	1
9	=COUNTIF(A2:A5,A3)+COUNTIF(A2:A5,A2)	Number of cells with oranges and apples in cells A2 through A5.	3
10	=COUNTIF(B2:B5,">55")	Number of cells with a value greater than 55 in cells B2 through B5.	2
11	=COUNTIF(B2:B5,"<>"&B3)	Number of cells with a value not equal to 75 in cells B2 through B5.	3
12	=COUNTIF(B2:B5,">=32")-COUNTIF(B2:B5,">85")	Number of cells with a value greater than or equal to 32 and less than or equal to 85 in cells B2 through B5.	3

NOTE

- You can use the wildcard characters — the question mark (**?**) and the asterisk (*****) — in criteria.
  A question mark matches any single character, and an asterisk matches any sequence of characters.
  If you want to find an actual question mark or asterisk, type a tilde (**~**) before the character.
- Criteria are case insensitive; for example, the string "apples" and the string "APPLES" will match the same cells.

	A	B	C
1	Data	Data	
2	apples	Yes	
3			
4	oranges	NO	
5	peaches	No	
6			
7	apples	yes	
8	Formula	Description	Result
9	=COUNTIF(A2:A7,"*es")	Number of cells ending with the letters "es" in cells A2 through A7.	4
10	=COUNTIF(A2:A7,"?????es")	Number of cells ending with the letters "les" and having exactly 7 letters in cells A2 through A7.	2
11	=COUNTIF(A2:A7,"*")	Number of cells containing any text in cells A2 through A7.	4
12	=COUNTIF(A2:A7,"<>"&"*")	Number of cells not containing text in cells A2 through A7.	2
13	=COUNTIF(B2:B7,"No") / ROWS(B2:B7)	The average number of No votes (including blank cells) in cells B2 through B7.	0.333333333333333
14	=COUNTIF(B2:B7,"Yes") / (ROWS(B2:B7) -COUNTIF(B2:B7, "<>"&"*"))	The average number of Yes votes (excluding blank cells) in cells B2 through B7.	0.5

- **Challenge**
  Explore additional functions
    - COUNTIFS
    - DCOUNT

- **Conclusion**
    - Complete the activity saved in CoutIfActivity.
    - Discuss the solution of the activity.

Name of Teacher: _____   HOD: _____

Sign:_____   Sign: _____

Date: _____   Date: _____

10: Table 4.3: My initial CAT education practice (Lesson Plan received from Department of Education, Gauteng Province)

My appointment as a teacher of CAT reflects my keen interest in the subject as well in teaching. These two aspects stood me in good stead; despite the prescriptive nature of the CAT curriculum and its associated documents, I found it relatively easy to prepare a lesson in CAT. In the work schedule(s) I drew up in preparation for my teaching, I realised that CAT is essentially a process of following steps to create different kinds of "documents" electronically, according to the instructions and certain requirements and limitations of the electronic operations of the program in which they are located. One then uses these "documents" to accommodate data in various ways and formats for particular purposes. I found it relatively easy to plan a lesson because this requires effective showing, telling and explaining the step-by-step operations of the program and its requirements or limitations. Since I had also been appointed as Head of Department: CAT, I took this as an indication that my teaching and my management skills in the subject area were highly regarded, and that my expertise in this discipline was recognised. I thus felt confident when preparing lessons in CAT.

4.2.1.2 Act: Presenting my own education practice

This brings me to the "learner activities" section, which indicates the systematic process I followed during the course of the lesson. This section is also indicated on the lesson plan; in other words, I did not create or plan this myself – I followed the outlined lesson provided.

It may be unconventional, but I thought it appropriate to use this step in my first action research cycle also, in order to address the second part of my first research question, discussed in paragraph 2.2.2: What are the dominant education practices in CAT education?

My own education practice
I start this research by revealing my own CAT education practice during one of my initial education practice:

a. Learners entered the classroom.
b. Learners stood behind their chairs and we said good morning. They sat down at their desks.
c. Learners took out their tablets and switched them on to access their e-books.
d. I completed the attendance register.
e. I discussed prior knowledge covered the day before and in the previous week.
f. I used "additional resources", a folder provided on the CD and in the textbook, to explain the content of the work that formed the topic of the day. In other words, I did not have to find

resources myself in order to explain this content to the learners – it had been done for me. I discussed the context of this specific document, and then instructed the learners to complete the activity, as indicated in the lesson plan above, under "learner activities". These activities are in the textbook and learners complete them, using data files that has been loaded onto their desktop computers.

g. I informed the learners that we would be discussing 'Countif' in Excel.

h. I gave them the module and page numbers for the activities that would be following.

i. I discussed how one would go about doing Countif (as can be seen in the lesson plan above).

j. I gave no further explanations, but instructed learners to complete the next activities. I moved around the classroom and where learners were having difficulty with the activity I assisted them by showing them the answers.

k. I discussed the solutions to the activity the learners just completed. These solutions had also been provided to me on the CD version of the textbook; in order for me to discuss them with the learners, I displayed the answer sheet/solutions to the problem on the smart board. Learners went back to their activities and corrected any mistakes they had made.

l. I revised the formula briefly. After I had marked the previous activity, learners completed the next activity of that chapter from the textbook. This served as revision of the content that had been discussed. This allowed the learners to determine whether they had understood the content. I stepped in and assisted learners who had difficulties by showing them what to do or by completing parts of the activity for them.

m. This process (f–l) was repeated until all activities on a particular topic had been completed.

n. When the bell rang, learners switched off their computers and put their tablets away.

o. We said goodbye and they left the classroom quietly.

4.2.1.3 Observe

Besides this revelation of my own CAT education practice, it was also important to me to observe my colleagues practices. I wanted to determine whether their education practice was similar to mine and also whether their responses to these questions would have been the same as mine, if I have been asked the same questions before I was introduced to authentic learning and facilitating it. I have conducted semi-structured interviews with them by asking them a few questions regarding CAT education in general and their corresponding education practices. What is represented in Table 4.4 below is the response that best represents the view of both, or, where the responses are bulleted, the first bullet are responses from colleague 1 and the second bullet from colleague 2.

11. Table 4.4: Two Semi-structured interviews with my CAT colleagues

What would you say is the nature and structure of CAT as a subject?

Teaching the learners about Microsoft Office, the software program, and HTML and then preparing them for the workforce in this field, so that when they apply for a job they are ready to work on the computer in Office – basically teaching them a skill.

How do you think CAT prepares learners for their future?

One of the big advantages of taking CAT is that you can prepare the learners for the outside world because it is practical. It is work related – what you teach them is what they will apply in the office one day. With CAT, you can start at the bottom and do a secretarial job or do data capturing or work at a super market – it is a skill that they learn.

How do you go about teaching CAT in your classroom?

- *I believe in strict discipline, because that prepares learners for the outside world. So when they come in, I*
  - *ask them to stand behind their computers;*
  - *greet them;*
  - *they log into their computers;*
  - *I (as the educator) start the work;*
  - *I believe you should interact with learners, because it is a practical subject. You should tell them what to do; and*
  - *at the end of the lesson I stand, dismiss them, and they leave. I do this so that they understand that in a working environment there is also a structure that one needs to follow. You cannot just do what you like as you like and when you like.*
- *During a CAT lesson, I*
  - *take the register while the learners are logging in;*
  - *I usually have my PowerPoint on, so when they look at the board, they have a clear understanding of what we are going to do;*
  - *all the activities will be written down on the white board, so that as soon as they come in, they can start;*
  - *I will give a short introduction of what I want to explain*
  - *I do one example with them; and*
  - *I set them to work."*

Which teaching and learning methods do you use in your CAT classroom?

- *One of the wonderful things about teaching CAT is that the learners are so in to technology; so we can say to them go on the Internet or go on your cell phones and Google, so they get to know about new technology and apply that.*

- *I like to draw a big idea first so that they can see what you must achieve at the end and how everything fits in the end. Then we start bit by bit. I also like to remind them the next day of little things they did the previous day. This is just to recap the most important things and then they have to repeat these to me.*

How do you explain new concepts to learners?

- *I do it with them practically. I show them how to do it, and then let them do it. Then they can see what they have achieved. They love HTML (web page), because they can see the end product and what they have done. With excel formulas I first let them write the formula down by hand and make them understand what they are going to do and then go to the computer and type it in. If they don't understand the formula, they cannot do the formula on the computer.*

- *I like them to understand. I like to draw a picture. HTML for example I would like to draw pictures of the codes – big codes and small codes, and how they fit together. This will then make sense to them. For everything, there must be a sign – a picture. They must put in colour, because seeing it visually will make it more understandable.*

What are the major advantageous of CAT in CAPS as opposed to NCS?

- *CAPS have broadened the scope. They have brought in formulas that are more complicated. They have brought in HTML – how to create a website. I think they have brought in the more up-to-date technology. They are actually lifting the standard of CAT, which will help the learners once they go and work in the field.*

- *I feel HTML is wonderful to have because it puts kids in a different mind frame, especially after school when you start with other programmes and learn other languages.*

What are the major disadvantageous of CAT in CAPS as opposed to NCS?

- *"I would not say CAPS has a lot of disadvantages, because what CAPS has done is that they cater for your not average [low performance] child. They can still pass the subject and they can still go and work with the knowledge that they have got."*

> - *"Learners want to do more tricky things like HTML. They get excited about Access and HTML, and I love the excitement."*
>
> **If you were required to compile a new curriculum for CAT what will you do?**
> - *I don't think I will change anything. The learners enjoy the practical much more than the theory because it is a practical subject, but I do understand that they need the theory to understand what they are doing. So no, I would not change anything. I like Word, Excel, and Access, and I like the fact that you do have web page. Then the Grade 10 learners have PowerPoint. I think it is a good overall overview of the whole Microsoft Office.*
> - *Maybe do a creative programme – Photoshop for example. This will bring excitement back to the subject, because you can do invitations, design, or even do a technique where you create a basic logo.*

It is important to note that these are responses that would probably not have been unlike mine if I have been asked the same questions before I was introduced to authentic learning and facilitating it. Besides my colleagues' responses to these questions, I was curious to observe their CAT education in practice.

In a very general sense, there was a correlation between their rendition of their education practices and what I had observed. Of course, with the exception of very specific details, there was also an obvious relationship between their practices and mine:

- There were no outstanding value-added differences that I could observe. What was a clear common denominator between all our practices was a technical tell, show and do pattern in which learners effectively imitated what had been told, shown and done by the teacher, as well as using other technological resources that had been provided to the teacher and the learners.
- There was very little significant interaction except in the form of a learner asking a question and the teacher telling or showing the learner what to do, or doing it for the learner. It was rather alarming to observe that, while PowerPoint and video clips were being displayed on the smart board, the learners were playing games on their tablets. While the teachers were teaching (showing and doing activities), learners were browsing through web pages and social network sites that bore no relation to the particular topic that was being discussed.

During the many meetings with colleagues at formal and informal forums with teachers and with Heads of Department, as well as the many compulsory training sessions, my general perception about the prevailing CAT education practices was that they did not differ essentially from one teacher to the next. Although there may, of course, have been exceptions to the rule, it seemed very likely, given the prescribed resources, the LTSM, exemplar training sessions, time constraints, and many other obstacles, that most current education practices would confirm my assumptions. It appeared likely that current CAT educational practices are characterised as follows: very little significant interaction except in the form of learners asking questions and teachers telling or showing them what to do, or doing it for learners.

With these results from my empirical study, I arrived at an answer to the second part of my first research question.

However, it was also important to gauge the learners' perceptions about their CAT education. I have conducted semi-structured interviews with ten of my Grade 11 CAT learners to find out what their experiences were regarding my teaching. What is represented in table 4.5 below is the one or more responses that best represents the various responses of the learners on the questions asked.

12. Table 4.5: Semi-structured interviews with Grade 11 learners about my initial CAT education practice

> **What do you like most about Computer Applications Technology?**
>
> The overall responses were very similar. There as a general consensus represented by the following response:
>
> *Working on the computers, because we learn how to create programmes and how to work on the different applications.*
>
> The following response stood out amongst the others:
>
> *It is mind blowing how a computer, at just one click of a button, can do all the work that a human being cannot do alone. This made me see the whole aspect of everything that is given to us and what we are able to do with computers. Most careers in the world require a person with a technological ability. I am learning skills that I can apply in the real life.*
>
> **What do you like least about Computer Applications Technology?**
>
> Some learners complained that they found the theory work too long or that they have time constraints in regards with completing their work. Others find certain application programmes difficult to grasp, but one learner made a very important statement by saying:

I am sometimes lost and I don't know what is going on. This happens a lot because I lose focus easily.

What is your biggest challenge in Computer Applications Technology?"

The learners' responses were very similar to the previous question in regards with time management and difficulty they might experience with certain application programs and theoretical aspects. However, the following statement by a learner was an eye opener to me when he said:

The biggest challenge in Computer Applications Technology is that there are no challenges in the subject.

How well do you think the current Computer Applications Technology curriculum is preparing you for the challenges of the real life outside there regarding ICT?

They responded by saying the world was changing and moving very fast and that in the modern world it was all about technology. They said that if you did not know anything about technology you would be stuck, as computers were everywhere and in every single job you would be required to have computer skills.

What would you propose to improve the education of Computer Applications Technology?"

Initially learners were very reluctant to respond to this question. They would say:

I think our class is very nice; there is no noise and we all work together; you are also awesome, Mam.

But I wanted to discover the truth and I requested that from them. Then the following responses were shared:

- *Sometimes the activities are just being repeated and it becomes boring.*
- *Some activities have repetition – we do the same thing over and over again, so it becomes tedious.*
- *I want an example of a real-life situation because that gives you more knowledge and that really prepares you for the future.*
- *The activities we do in class – can we do them in real life challenges? For example Excel. We do accounting in Excel, so in the Accounting class we can use the accounting techniques that we learn in CAT for a real life challenge.*

> - *I think it would be better if you have to go and find the answers, like do research and find what the functions are instead of it being spoon fed to you. The textbook does help a lot but I think it would be better if you go out and find the answers yourself. You will remember them better, because you took your own time and used your energy to do it.*

4.2.1.4 Reflect

The results of my observation in the preceding phase of my action research were quite disturbing. Even though much may be said of the many aspects that have been revealed by the results, the following encapsulating reflective comments may suffice to inform the iterative review step in this cycle of my action research:

a. An exceptionally well structured curriculum and, in particular, the provision of a comprehensive and detailed set of everything necessary to enact the curriculum (work schedules, lesson plans, and LTSM's: the textbook complete with accompanying CD with PowerPoint presentations – *explaining* the application and how it works, and video clips – *showing* the learners exactly how use the application, complete with answers), has created in me an illusionary complacency that, if I comply with what I am required (perceived to be prescribed) to do, my CAT education practice will be successful. In view of my findings in the previous observation step, this might be a general condition amongst CAT teachers.

b. This false complacency has been exposed by the learners' concern about my education practice that ranges between two irreconcilable extremes.   On the one hand:
"I am sometimes lost and I don't know what is going on. This happens a lot because I lose focus easily."
And on the other hand:
"The biggest challenge in Computer Applications Technology is that there are no challenges in the subject."
This unveils a serious challenge regarding the way in which that CAT curriculum is (required to be) enacted.

c. It seems as though the learners have a good perception of the inescapable prominence and importance of technology and ICT's and real-life and its virtually incomprehensible advances, but yet, in class, I could not witness a corresponding work ethic and determination to acquire and improve their required computer skills.

My contribution to this situation is undeniable. Most of my lessons appeared to go smoothly; but this was not always the case. The most frequent challenges I encountered during teaching a lesson were:

a. I did not fully understand the content myself.

As all content was provided to me and activities and PowerPoint presentations were created beforehand, I did not find it necessary to put in much effort to prepare lessons in advance. I entered the classroom each morning, read through the themes and topics that were to be discussed with the learners that day and followed the given steps. The biggest challenge I faced here lay not in assisting learners with the activities in their textbook, as generally I did not find this difficult; problems occurred when learners asked me something that was not in the textbook, or that was not related to a particular activity. Because I had not prepared the learning content myself, I was often unable to answer such questions. I remember an occasion in 2012 when a learner asked me to explain a function in Microsoft Access, and I simply did not know how to do it. Another learner in the class stood up, went to the front of the class and offered to explain the chapter to the class. I was unprepared and felt very embarrassed as the lesson I had taught that day had clearly been unsatisfactory. A learner stepped in to teach my lesson as I did not fully understand the content myself.

b. Many activities had to be completed.

Because I followed the prescribed planning documents and work schedules, in turn I expected learners to complete all the activities indicated in these documents. On a Monday morning, I would write all the activities on the blackboard and learners were expected to complete them by the Friday. This was often an unrealistic demand: there were simply too many activities to complete in the time allowed. As this was stipulated in the documentation, however, this is what I expected from my learners. While they were meant to be copying down the list of activities, learners would often ask despairingly: "Do we have to do *all* these, ma'am? Why?"

c. Activities became repetitive from one year to the next.

Over the years, learners would often ask me why they had to do the same type of textbook activities over and over again. Activities included similar questions from one year to the next and learners indicated that they were growing bored. In all honesty, I too became bored,

teaching the same activities year after year. I felt myself losing my enthusiasm for my subject; something that was very unfortunate for the learners facing me in the classroom each day.

d. When learners had difficulty with activities, I was not able to assist all of them.

On average, a CAT class comprises 25 to 30 learners. It was impossible for me to assist every learner with questions about activities they were completing in class. There were simply too many learners with too many questions. Sometimes I spent so much time with one learner that I could not assist any others who had raised their hands during the lesson. As a result, some learners began to fall behind in their work as each lesson required the completion of a new set of activities.

e. I did not have enough time to mark completed activities.

I very seldom marked any of the practical activities with the learners. There were simply too many activities and too little time in the syllabus to fit in any discussion. If a learner had difficulties with a particular section, I would be unaware of this until he or she had written the first cycle test in Term 1. Only then, would I address the problem in extra classes; for some learners, this was too late.

I have to note here that I believed that I was a good teacher. I was never absent, and I followed every instruction in the stipulated documents, which to me meant that I was prepared for my classes. I was also very popular with the district facilitator. My files were neat and contained all the correct documentation. I covered the syllabus as stipulated by the CAPS document to the best of my ability and, in general, learners seemed to enjoy the subject. Academically, learners achieved average marks and most passed my subject. I was satisfied with what I had achieved in each lesson and had no particular reason to take any action after a lesson, unless I had not finished what I had intended to do, or learners had had a particular difficulty with something during the lesson. In such cases, I would make a mental note to pay attention to the issue at the beginning of the next lesson.

4.2.1.5 Review

I have to be honest and confess that I cannot recall that I ever consciously took the consequences of a previous lesson into consideration for the following one, unless, as indicated in the previous

paragraph, I had to complete a lesson in the next period or when learners had particular difficulties in a lesson. In such cases, I would revise those aspects which had caused difficulties to ensure a smooth transition to the next lesson. Such revision was done very briefly, however, as the time constraints had always to be taken into consideration.

I usually prepared for my next lesson in the same way as I had prepared for the ones before; each was simply another lesson following the one before it.

Even though my complacency 'prevented' me from contemplating my education practice through a critical reflective assessment, and neither was I aware of the learners actual challenges, I had a knowing sense that all is not well with my CAT education practice. Fortunately, I was introduced to the concept of authentic learning within the education practice of facilitating learning in my early years as a post-graduate student and I was immediately attracted to its associated aims. I realised that this was what I had felt was missing from my own professional development. Enrolling for a master's degree presented the ideal opportunity to make facilitating learning the professional educational practice that I wished to adopt. I set about doing this by means of a proposed evidence-based research project.

However, during a post-graduate workshop on the foundations of facilitating learning I had to confront what adopting this new paradigm in education would mean; this proved no easy task. I was used to teaching in the accepted sense of the word. I would explain the necessary content for a particular lesson; this would be followed by the learners completing activities taken from their textbooks, with assistance from me where I could, as previously discussed. Now I learnt that this new paradigm in education, called authentic learning, meant that I should have avoided using these activities in the classroom entirely. Instead, I should have been making use of real-life challenges that had real world relevance.

In addition, I had to accept the fact that the tasks (not activities) should be challenging and that learners should identify for themselves the tasks and subtasks required to successfully complete the major task at hand. As if this was not enough, I discovered that learners should not be able to solve these real-life challenges in a matter of minutes, hours or, when appropriate, even weeks. Challenging authentic learning tasks required a sustained effort. I barely had time to finish the syllabus in the time available as it was; how was I to deal with this requirement? I found it very hard to make sense of this.

We discussed the use of the textbook I was using in the classroom. If I was "not allowed to make use of activities from this book anymore", what was the point of having a textbook at all? I had to learn that authentic learning demands that learners examine a task from a variety of perspectives, using a variety of resources; it requires learners to distinguish relevant from irrelevant information in the process. Learners should learn to make wise choices and to reflect on their learning, both individually and as a team or community. Such authentic activities have consequences that extend beyond a particular discipline, encouraging learners to adopt diverse roles and to think in interdisciplinary terms. Rather than yielding a single correct answer obtained by the application of rules and procedures, authentic activities allow for diverse interpretations and competing solutions. This annoyed me; I felt that having the textbook was pointless, as I could no longer make use of its activities.

What really bewildered me was the notion that I should abandon the teaching of my learners; instead, I should facilitate their learning. In other words, I should no longer assist my learners as I had before, but they should, in a sense, discover the learning themselves. This caused me to wonder a) was there a difference between teaching and facilitating learning? If so, b) how could learners discover learning without being taught the content first or at least engaging in some form of discussion and explanation of the content?

Finally, I also had to accept that this was not simply about solving a problem. Rather, it was about the human virtues that learners needed to develop once they had faced and overcome a real-life challenge. But what are human virtues? I felt confused and frustrated. How dare anybody question my expertise and the way I taught my learners? I was a good teacher, wasn't I?

4.2.2 Cycle 2: Engaging in my first facilitating learning practice

After my intensive study and engagement with aspects of the professional practice of facilitating learning, I realised that I needed the courage to venture into the unknown. My purpose was to experience this facilitating learning in its holistic complexity for the first time, even though there might be weaknesses and deficiencies in my execution. If things were to go wrong, I would have my experience and expertise as a CAT teacher to fall back on. But I was determined to make a success of my intentions.

4.2.2.1 Plan: Designing my first learning task (Careers)

As has been indicated above, the requirements for learning task design and its subsequent procedure are daunting but necessary if the aims of education are to be achieved. Since facilitating learning required that tasks were authentic real-life challenges, I spent a long time thinking about how I would eventually implement this in my education practice.

The first challenge in learning task design I had to face was the prescribed CAT curriculum. The next section of the curriculum I was to teach was content heavy (knowledge and skills), especially in the sense that it integrated several application programs. The difficulty lay in enabling learners to master the prescribed content within the context of this new facilitating learning paradigm and along with that complete the Practical Assessment Task (PAT) given to the learners once a year.

The Practical Assessment Task is "an individual research project that assesses the learner's procedural skills and individual interaction with data and information as well as the way in which he or she processes, manipulates and presents the information. The information will finally be presented in a number of documents. These must be presented in the four application programs studied. The CAT PAT focuses on Information Management and the use of ICTs and application software. It covers the following:

- Identifying, finding and accessing information/data;
- Using, manipulating and processing information and data gathered; and
- Presentation of solutions/findings/recommendations" (South African Department of Basic Education, 2011).

The topic of the PAT is provided to schools each year and evidence of the process must be provided in a series of draft documents, which in turn counts 25% of the total promotion/certification mark for the subject. It is important to note however, that PAT provides an opportunity for the learners to demonstrate the skills they *have already acquired* in the subject in terms of their

- Research and information management skills
- Ability to use software applications and technologies to produce quality outputs

When I received the PAT topic for the grade 11 learners: 'Careers' I immediately knew this was a relevant topic that I could use for my learning task design. The difference would be instead of using the PAT as a revision document where already acquired information will be reinforced, I would use it as a learning task design where learners discover knew content themselves. For the purpose of this study, I would therefor from this point forward refer to "my learning task design", but it must be noted that all credit for the topic must be given to the South African Department of Education.

None the less, since my learners were in Grade 11, making a career choice would certainly be one of the most important decisions they would soon have to make and I realised that a learning task centred on the real-life challenge of choosing a career would be valuable exercise for a number of reasons:

a. Firstly, the undeniable importance of making a decision that would have a significant effect on their lives in the years to come.

b. Secondly, since most if not all my learners had shown an interest in pursuing a career in the field of ICT, any real-life challenge should require them to engage with technology in the way that mirrored the real-life situation of employment.

c. However, I had to keep in mind that the rapid advancement of self-sustainable technologies was increasingly diminishing career opportunities in technology, while careers in the service sector were increasingly in demand (Colvin, 2015). For this reason I decided to expand the real-life challenge of career choice to include any alternative non-technology career.

d. Arguably the most important feature of a career, and one that is rarely considered when choices are made, is its spiritual (SQ) dimension and its association with our unique human potential.

e. Closely associated with (d) above, is the notion that a career should be a vocation that reflects who we really are, what we are capable of and our ultimate purpose.

f. Finally, a vocation is attuned to a further aspect of spirituality (SQ) because, although its purpose is to provide for the livelihood of the self and one's immediate dependents, ultimately its purpose is serving humanity and the world we are living in for the common good.

All these aspects are part of the four inseparable holistic human constituents (physical intelligence - PQ, mental intelligence - IQ, emotional intelligence - EQ and spiritual intelligence – SQ). The SQ is the source of our human potential in the form of essential human virtues and

attaining them, are the ultimate aim of education. I must admit that I would not have taken these aspects of being human into account had it not been for the fact that I was forced to implement them in the professional practice of facilitating learning. It is for this reason that, perhaps rather ambitiously, I indicated in the learning task design that learners should attain all the fundamental human virtues. The interconnectedness of everything in education, as in life, was a life-changing discovery.   These considerations elevated this real-life challenge, allowing it to fulfil its requirements for all learners because it was highly personal, holistic, current, and had an impact on the family and society as a whole. I was still not satisfied with the real-life context, however. I was aware that the Life Orientation curriculum included a theme on careers and this led me to collaborate with the Life Orientation department in the hosting of a 'Career Day' for the Grade 11 learners. In this way, I was able to provide an appropriate real-life context for my learning task.

As you will see, learning task design as it has been presented here is a major endeavour. It differs vastly from the lesson plans that are provided in the official CAT curriculum materials and the recommended accompanying LTSM's. It is a demanding challenge and a professional task, which leaves no room for an unsubstantiated decisions for its inclusion in such a learning task design. All components included in the learning task design have one purpose only and that is to produce the three end product outcomes. Learning task design begins with the end in mind, and that is what is real-life challenge that the learners need to resolve which is indicated as the learning product or the resolved (solved) real-life challenge (problem). The second end product outcome is the best and most appropriate process that the learners need to follow in order to solve the problem which is the end product of the learning content – presented exactly what will be expected of the learners to execute. The third end product that the learners need to produce is what they have learned (or rather had no option to learn) during (or for being able to acquire for) the execution of the learning task, namely the learning content. There should be no doubt that the kind of professionalism that is required for learning task design leaves no possibility that I should not be an expert in my subject (subject content knowledge - SCK (which I was not initially) as well as facilitating learning (pedagogical content knowledge – PCK).

Table 4.6 reflects my first learning task design created after receiving the grade 11 PAT document (South African Department of Basic Education, 2013).

13. Table 4.6: My first learning task design: Careers

PHASE AND GRADE	Further Education and Training (FET) Grade 11
SUBJECT	Computer Applications Technology (CAT)
CURRICULUM CONTENT (Copied from the official Curriculum or Syllabus documents (South African Department of Basic Education, 2011, pp. 12-17)	• *Solution Development* is the actions and processes involved in developing a computer-based solution by utilising appropriate tools such as application packages to solve a variety of problems represented by real life scenarios. For Computer Applications Technology these applications are end-user applications which include word-processing, spreadsheet, database and presentation applications; • *Systems technologies* refer to the physical and non-physical components of a computer system. The components of the system are independent units, which are designed to perform a particular function. These components which include hardware, peripherals and software components are connected as a unit to perform the basic functions of a computing system, which include input, processing, output, storage, communication and transfer of data in an electronic format; • *Network technologies* include various network technologies to facilitate the management and dissemination of digital data from one point to another. Network technologies also refer to the electronic systems used for electronic data interchange used to facilitate information dissemination between various individuals or groups at a single point or dispersed locations; • *Internet technologies* include the WWW and all interrelated processes in the digital presentation of multimedia data on a web page. Internet technologies are defined as a set of related and interconnected technologies which enable the establishment of global networks, for various purposes such as collaboration, electronic data interchange, electronic commerce, electronic communication and social networking; • *Information management* refers to the techniques and technologies involved in the collection, storage, processing of data into information that leads to knowledge and decision making. It includes the use of

		appropriate communication and presentation tools to communicate new knowledge and recommendations;
		• *Social implications* refer to issues relating to the digital age and bridging the digital divide and include issues that lead to the responsible use of ICTs. This section of the CAT curriculum should consider the impact the use of computer technology has on everyday life.
TIME TO EXECUTE LT	3 months (1 month for preparation; 2 months for completion of 2 phases)	
TOPICS FOR GR.11 (Copied from the official Curriculum or Syllabus documents)	**APPLICATION TO BE COVERED WITHIN THE TOPIC FOR THIS LTD**	**CONTENT TO BE COVERED WITHIN THE TOPIC FOR THIS LTD (shaded below)**
Solution Development

(South African Department of Basic Education, 2011, p. 12) | Word Processing *(Content covered. Revision from Grade 10)* | • File management
• Customising
• Styles
• Reviewing tools and proofing functions
• Sections
• Reference functions
• Advanced document layout
• Troubleshooting |
| | Word Processing *(New sections of application program to be learned by learners* | • Electronic forms
• Integration techniques |
| | Spreadsheets | • Advanced formatting |

		• Advanced formulas and functions
		• Error indicators
		• Graphs/charts
	(Content covered. Revision from Grade 10)	• Manipulate worksheets
		• Import/export data
		• Integration techniques
		• Troubleshooting

	Databases
	(New application program to be learned by learners)
		• Basic skills and basic knowledge in working with
		   o Tables: Records, fields and data types
		   o Record manipulation
		   o Basic field properties
		   o Formatting and editing
		   o Forms
		   o Basic data validation
		   o Basic queries
		   o Simple reports
		   o Calculations
		   o Integration techniques

Systems Technologies (South African Department of Basic Education, 2011, p. 13)	Introduction to Concepts of Computing *(Content covered. Revision from Grade 10)*	• Information processing cycle • Role of ICTs

	Hardware (Systems Unit) *(Content covered. Revision from Grade 10)*	• Input, output, storage and processing • Mobile technology • Portable devices • Alternative I/O and storage devices
	Software *(Content covered. Revision from Grade 10)*	• Software updates, versions and compatibility • Application software • System software • Web applications • System requirements • Help files
	Computer Management *(Content covered. Revision from Grade 10)*	• File management • System properties • Basic trouble-shooting
Network Technologies (South African Department of Basic Education, 2011, p. 14)	Networks *(Content covered. Revision from Grade 10)*	• Types of network: LAN and WLAN • Basic components of network • Connection • Intranet • Introduction to network security concepts
Internet Technologies (South African Department of Basic Education, 2011, p. 15)	Internet and WWW	• Overview of online services • Features of browsers • Web page and websites • Website usability issues

		• Limitations of fixed Internet access • Portable and mobile Internet access
	Electronic Communications *(Content covered.* *First term Grade 11)*	• Types of digital communications • Uses of computer communications • Managing e-mail
Information Management (South African Department of Basic Education, 2011, p. 16)	Find and Access Data and Information	• Task definition in different contexts - understanding the problem/task • Questions and questioning • Utilising main question • Formulating other questions • Quality control of questions • Identifying appropriate sources • Information and data gathering • Adding questions to questionnaire • Using one other source • Quality control of information
	Process Data and Information	• Extracting appropriate information • Utilising appropriate tools and techniques to process data/organise and manipulate information • Processing data • Adding data questions • Data handling - the role of the spreadsheet and the database

		• Analysing data and information
	Present Solution	• Utilising appropriate software tools to communicate findings
		• Reporting
		• Interpreting knowledge and understanding
		• Cohesive and logical organisation and flow of content and recommendations/conclusions
		• Communicating, using supporting texts and graphics
		• Copyright and plagiarism issues
		• Appropriate referencing
Social Implications (South African Department of Basic Education, 2011, p. 17)	Impact on Society *(Content covered. First term Grade 11)*	• Enhancing accessibility
		• Computer and human error
		• Impact of ICTs in the workplace and employment practices
		• Social engineering tricks
		• Online safety and protection issues
	Legal and Ethical and Security Issues	• Hardware theft and vandalism
		• Ethical use of networks
		• Unauthorised access
		• Network safety and security
		• Privacy issues
		• Information accuracy
		• Data protection
		• Computer misuse

		• Currency of protective software
	Health and Ergonomic Issues *(Second term Grade 11)*	• Factors that influence health • Health risks
	Environmental Issues *(Content covered. Second term Grade 11)*	• Power settings and savings

The Facilitator of Learning has to ask and answer the following fundamental learning questions regarding the CAT curriculum content (knowledge and skills) that the learners need to learn in order to eventually arrive at the real life challenge that the learners needed to be confronted with:
REAL-LIFE CHALLENGE
Why do learners need to learn this curriculum content?

- The curriculum content covered in this learning task design is very extensive. The foundations of some of the above topics have been discussed in Grade 10 and the beginning of Grade 11. Revising and building onto this foundation with a fresh approach is necessary to understand the new applications fully. Learners need to work on three different application programs: Microsoft Word (foundation in Grade 10 established), Microsoft Excel (foundation in Grade 10 established) and Microsoft Access. The real-life challenge should challenge learners on all three applications; however, *only Microsoft Access and 'Electronic Forms' in Microsoft Word are considered "new content".*

- Learners need to learn Microsoft Word as this section of the curriculum allows users to type (create), save and print documents. It is a powerful tool that allows them to create from a simple letter, to a research paper to professional book length manuscripts. Their finished work can be simple text or include special formatting, illustrations, tables, columns and more. This application program can and will be used in everyday life – from creating typed tasks for school to creating documents in their professional working environment.

- Microsoft Excel is another application programme that needs to be learned by learners due to its calculation and graphic features. Excel has

a reputation for use in accounting departments, and while its math functions are vital for bookkeeping, the programme's spreadsheet and charts help out with everything from building a budget to analysing scientific records. Learners need to know this content of the curriculum as Excel makes organisation and sorting of data simple. This data can also be visualised automatically as a chart or a graph. Excel's functions (calculations) automate math formulas, simplifying data tracking.

- Microsoft Access must be learned as it is a database creation programme that allows for anyone to easily maintain and edit a database. It is suitable for anything from small projects to large businesses, and is a very visual programme. This makes it great for performing data entry, as you don't need to work with tables (Microsoft Word) or spreadsheets (Microsoft Excel). There are several ways in which the learners can format, interact, and filter the data in Access, which includes tables, forms, queries and reports.
- Microsoft Word, Microsoft Excel and Microsoft Access are part of an office suite, which means these programmes "talk" to one another. Learners can import and export necessary data from the one document to the other and integrate these packages as they see fit.

What are the role, function and value of this curriculum content in the lives of learners they are living right now?
The use of technology is considered an integral part of our learner's daily lives. Not only is the school making use of tablets (e-learning), but all the learners' projects must be in typed format on the computer and presented in PowerPoint (a presentation application program on the computer). Adding the database programme will not only add and broaden their current knowledge, but create a foundation of any profession they might pursue after school. All three these programmes are of utmost importance if they should decide to pursue a career in Computer science; although the use of computers in any professional field is inevitable.
Where/when in the lives of the learners right now will they be required to do what they are expected to do?
Every day the learners face challenges on the computer – not only in class, but when they go home and work on their laptop/desktop computer. They are even put in a position where they have to assist family members at home with certain aspects, as they "should know everything on the computer". They firstly find it extremely challenging to master all the facets every application has to offer, and it is secondly very challenging to see how these specific application programmes usually fit into the broader society.

What is the challenge (problem) you want learners to solve (resolve)?			
The real life challenge that the learners should be confronted with should compel them to construct (discover, find, acquire, and use) all the CAT curriculum content (knowledge and skills) indicated in this learning task design in order to resolve the real life challenge. Since obtaining everything necessary to engage in an in-depth interrogation of oneself in order to compile a comprehensive personal profile of oneself and to explore career (or rather vocation) possibilities and opportunities that will align with one's personal profile to ensure that one would be able to make the best possible career (vocation) choice seemed to be a challenge that will demand such a learning endeavour.			
FUNDAMENTAL HUMAN VIRTUES TO BE ATTAINED FOR AND DURING THE EXECUTION OF THIS LT			
Intrapersonal		Interpersonal	
Self-confidence	X	Humanisation	X
Motivation	X	Communication	X
Initiative	X	Dealing with feelings	X
Effort	X	Commitment	X
Perseverance	X	Awareness	
Responsibility	X	Enthusiasm	X
Independence	X	Accuracy	
Joyfulness		Resourcefulness	
Honesty	X		
Identity			
Passion			
Imaginative and creativity			

LEARNING TASK PRESENTATION
After attending a career day with exhibitions and receiving a lot of information, brochures and corporate gifts, the learners will enter my class and view two video clips regarding careers in the world of technology before they will be presented with the following challenge:
Verbal Presentation

Choosing a career needs careful consideration and planning. Not only do you have to take into account what your interests are, which careers will suit your personality and abilities, but you also need to consider the demands of the job, the qualifications requirements as well as the costs of tertiary education for a particular career, etc.
 	
Your parents/guardians want you to investigate:
 	
• a computer-related career (which is later referred to as career 1) and
 	
• a career (which can be a career outside the field of computer-related aspects and is later referred to as career 2) that may interest you.
 	
They also want you to do thorough research regarding your investigation so that they can help you plan your future. You must also share information, such as the knowledge and insight you gain trough your investigation.
 	
The focus question that your parents/guardians want you to answer:
 	
What do I need to know or do to become a [career 1] or a [career 2]?
 	
The investigation should, as a minimum, include the following for each career:
 	
• A description of the career: What does it involve?
 	
• Educational requirements, e.g.
    ○ Qualifications needed
    ○ Minimum requirements to obtain these qualifications, e.g. subjects, NSC results, AP (admission points) score
    ○ Where to obtain qualifications (University/College/Other Institution/ Workplace)
    ○ Years of study/Occupational training/In-job training, etc.

- Skills required

- How CAT feeds into that career/will support that career

- Suitable personality traits

- Cost implications, e.g.

   o Cost per year, e.g. class fees, accommodation fees, textbooks/resources, pocket money, other costs, e.g. clothes, living costs

   o Income, e.g. salary while completing apprenticeship

- Bursaries available, financial aid available, discounts, e.g. for leadership or distinctions

- Job opportunities

- Any other interesting facts about the job, e.g. employment opportunities, starting salary, potential salary range, working hours, self-employment opportunities, etc.

As part of the investigation you will need some self-assessment (i.e. gathering information about yourself) to determine or confirm your interests, personality traits, skills and ability and match these with the careers of your choice. As part of my self-assessment you will need to create a questionnaire that you will hand to people that know you well such as your friends, relatives and educators, to get a sense of what they think your strengths and weaknesses are or whether they think these careers will suit you. Alternatively I could create any other suitable questionnaire that will provide the data and information you need.

(South African Department of Basic Education, 2013)

Written presentation

Choosing a career needs careful consideration and planning. Not only do you I have to take into account what the learner's interests are, which careers will suit their personalities and abilities, but he/she also needs to consider the demands of the jobs, the qualifications needed as well as the costs of tertiary education for a particular career.

The parents/guardians want the learners to investigate

- one computer-related career (which is later referred to as career 1)

• another career (which need not be computer-related and is later referred to as career 2) that may interest you.
The focus question that your parents/guardians want you to answer:
What do I need to know or do to become a [career 1] or a [career 2]?
(South African Department of Basic Education, 2013)

LEARNING TASK ASSESSMENT
I used the criterion-reference tool received in conjunction with the Practical Assessment Task in order to do the assessment (South African Department of Basic Education, 2013). *(Refer to the "Assessment" folder in the "Learning Task 1 Package" folder.)*

AUTHENTIC LEARNING CONTEXT
Organisation of learning space
The learners will be working in my computer lab at their individual workstations. *(Refer to the "Learning Space" in the "Learner Task 1 Package" folder.)*
Roles, functions and organisation of participants
Since choosing a career is of the utmost importance to all the grade 11 learners, it needs careful consideration and planning. Not only do they need to take into account what their interests are, which careers will suit their personality and abilities, but they also need to consider the demands of the job, the qualifications needed as well as the costs of tertiary education for a particular career. They should therefore solve this real-life problem by investigating careers and ultimately determining what career they want to pursue. I should facilitate the entire learning process of the learners in resolving the challenge.
Material and equipment
A workable computer for each learner in the classroom. To complete the tasks, they will need: • An office suite with the following software

- o   Word processing software, Spreadsheet software, Database software
- Internet access to
  - o   Find data and information
  - o   Administer electronic questionnaires, e.g. use e-mail to send questionnaires to respondents and receive completed questionnaires from respondents
- Access to other sources such as printed media (e.g. magazines, newspapers, brochures, textbooks.)
- Textbook used in the classroom.
- Storage media to store and backup your work electronically e.g. flash drive, rewritable CD/DVD

END PRODUCT OUTCOMES
(As would be expected/required to be produced by a learner exceptionally well)

The Learning Process

The learners should provide the following in one or the other format

PHASE 1

1. Define the learning task
   a. Start with planning and creating a set of folders to store the information
   b. Understanding the task requirements:
      i. The learners must make sure that they know what is expected of them otherwise it will lead to confusion and problems. It is therefore essential that each learner develops a task definition which should direct you in your investigation and presentation. A task definition specifies the problem you have to solve, who it is for, what information you need to find, and how and where you will find it. In essence, you need to answer questions such as:
         - What do I know about the topic or problem?

- What information is missing or needed?
- Where and how can you find information you still need?

c. Identifying problems associated with the topic:

    i.   After defining the task, you can brainstorm the topic with a group of classmates to find ideas for possible headings. Select headings that will be useful in helping to organise the material.

    ii.   Ask questions that relate to the topic such as:

- Questions that lead to factual information – Level 1 questions starting with words such as: What? When? Where? Who? How many?
- Questions that explore – Level 2 questions that start with Why? or How?
- Questions that predict – Level 3 questions that start with If? or What if?
- Questions that help make judgments – Level 4 questions that will help you to reach a conclusion. They start with phrases such as: Would it be better if? How can I determine? What would be the best way?

    iii.   When you have your list of questions, arrange them according to headings that you have identified for the main parts of the topic.

    iv.   You can write questions under each sub-topic or simply write down questions and arrange them under each sub-topic at a later stage.

    v.   As you work with your questions and headings, you may identify and add new headings or remove existing headings. See this as part of the process of refining your methods.

    vi.   I arranges learners in groups of five to critique the sub-headings and questions of their peers. Guide them through identifying irrelevant or insignificant questions/headings by asking them questions.

    vii.   Keep reminding learners that the purpose of the learning task is, ultimately, to solve a problem or make a recommendation and/or suggestion.

d. Possible sources of information

    i. Once you have defined the task you need to consult a variety of sources, in both printed and electronic media, including:

- Publications: books, newspaper articles, magazines and brochures;

- Electronic media: the Internet, including encyclopaedias and social networks, etc.;

- Interviews: prepare questions in advance and take notes of the interviewees' responses; and

- Surveys are useful tools to find out more about people's attitudes and circumstances.

    ii. Gathering data starts with an understanding of why you want the data.

    iii. Think of ways to find the information that you need for your investigation. Find different ways to source data and information on your own. Alternatively, work in a group to find possible ways of solving the problem.

    iv. The way your questions are asked will determine the quality of the information you receive.

2. Quality Control Techniques

a. Not all information is reliable. Information, whether it is electronic or printed, may be biased. It is good practice to access more than one source of information to allow you to compare the information you find. Aspects to check include:

    i. Authority – who created the information?

    ii. Accuracy – can the statements and claims be substantiated?

    iii. Currency – is the information up-to-date, and is it still relevant?

    iv. Objectivity – does the source/author show any bias?

    v. Coverage – how well does the information cover the topic?

b. Evaluate the website

Use the following criteria to help you assess the reliability of websites:

    i. Affiliation: Who supports the website?

    ii. Audience: At what level it is written/who is it intended for?

    iii. Authority/the author: Who created the website and what are their credentials?

Use a search engine to find more information on the authors.

    iv.   Content: Is the content properly organised? Do the links work?

    v.   Current: Is the information on the web page up to date or still relevant?

    vi.   Design: Is it easy to navigate and is it visually pleasing?

    vii.   Objectivity: Does it reflect any preconceptions?

    viii.   Trustworthy: Would you be able to use it?

c. Sifting information

    i.   Go through the available information on websites and other sources and select the most relevant.

    ii.   Remind learners they should not use any content from any source that is not acknowledged. Their learning task needs to be in their own words, but they can make reference to sources such as books and authors.

PHASE 2

3. Manipulate data: Spreadsheet and Database

    a. You need to have insight into the problems raised in the learning task.

    b. Compare the data and identify the relationships between them.

    c. The information presented in your report must show your audience how your proposals will improve matters and solve problems.

4. Processing data using spreadsheets

    a. Group and sort your data with the use of a spreadsheet to:

        i.   identify the core meaning and the most important aspects

        ii.   summarise the information and add your own insights

        iii.   create charts and tables to make the material more understandable.

    b. The questionnaire results that you analyse in a spreadsheet are a sample of the responses obtained from the survey you did.

    c. Questions that often arise when you work with data samples include:

        i.   How many?

ii. What occurs the most?

iii. What is the most popular?

iv. What is least common?

v. How many more than?

vi. What is the average?

d. Spreadsheet functions that you could consider using include:

i. COUNTA, COUNTIF, IF, and SUMIF.

e. Other useful functions might be:

i. CONCATENATE, LOOKUP, AND, NOT, MIN, MAX, and AVERAGE

5. Processing data using a database

a. Create a database with the information you have gathered so that you can generate queries and provide database reports.

b. Verify that the information is relevant to the investigation by:

i. Capturing data that could be used to answer your questions.

ii. Ask yourself: Am I using appropriate field names and data types.

iii. Creating queries.

iv. Providing a database report.

c. You will need to have data in a database table, so will either have to export from the spreadsheet and import into the database, or capture it directly into the database.

(Avrakotos, F; Britton, M; Llewellyn, E; Mthombeni, S; Oelofsen, S; Rennie, B; Van Kampen, A, 2012)

(Jacobs, S; Barnard, R; Brenkman, R; Gibson, K; Labuschagne, E; Macmillan, P; Miller, P; Noome, C; Stoffberg, K; Wassermann, U, 2012)

The Learning Product
(Refer to the "End product (my example)" and "End products of learners" in the "Learning Task 1 Package" folder)

The Learning Content
• Learners did research on the Internet and developed the skill to find important information between the masses of information. They also realised that everything they researched and used must be referenced to prevent plagiarism. • Learners understood and created the electronic forms in Microsoft Word and developed basic tables, queries and reports in Access. • Integration techniques: All three application programmes (which included Microsoft Word, Excel and Access) were linked and learners understood how these integrations were taking place *(Refer to the "End product (my example)" in the "Learning Task 1 Package" folder)* *(Refer to the "The Learning Content" in the "Learning Task 1 Package" folder)*

RESOURCES
Avrakotos, F; Britton, M; Llewellyn, E; Mthombeni, S; Oelofsen, S; Rennie, B; Van Kampen, A. (2012). *Via Afrika Computer Applications Technology Grade 11.* Cape Town: Via Afrika Publishers. Department of Basic Education. (2011, January). *National Curriculum Assessment Policy Statements (CAPS).* Retrieved July 2, 2012, from SATeacher: www.sateacher.co.za Department of Basic Education. (2011). *National Curriculum Statement (NCS) for Computer Applications Technology for Further Education and Training Phase Grades 10 - 12. Curriculum and Assessment Policy Statement.* Pretoria: Department of Education. Jacobs, S; Barnard, R; Brenkman, R; Gibson, K; Labuschagne, E; Macmillan, P; Miller, P; Noome, C; Stoffberg, K; Wassermann, U. (2012). *Computers, part of your life - Grade 11. CAPS edition.* Dorandia: Study Opportunities. Slabbert, J. A., de Kock, D. M., & Hattingh, A. (2009). *The brave 'new' world of education: Creating a unique professionalism.* Cape Town: Juta and Company. South African Department of Basic Education. (2013). *Curriculum Learning Space. Practical Assessment Task. Computer Applications Technology. Grade 11 2013.* Retrieved 2014, from Thutong South African Education Portal: www.thutong.doe.gov.za/ResourceDownload.aspx?id=47333

I believe that I was fairly successful in the design of my first real-life challenge and the Personal Assessment Task served as an ideal guideline. The most important aspect of this task was that it would ensure the attainment of the essential human virtues that are the ultimate aim of all education.

4.2.2.2 Act: Presenting my first learning task

According to Slabbert et al. (2009), creating an atmosphere that is conducive to learning refers to the physical surroundings of the learning exercise. This means that the area in which the learning is to take place must feature all the necessary aspects demanded by the learning task in terms of area, boundaries, apparatus, materials, props, lighting, music, and the like. This can also be referred to as "setting the scene." (Slabbert et al., 2009). I had difficulty in creating an atmosphere conducive to the task in my own classroom, as there were computers on all the desks and CAT posters on the walls. This was when I remembered that the Grade 11 learners also discussed "careers" in Life Orientation, a compulsory subject for all learners. I thought that a career day would be an interesting and visual introduction to my challenge and would also assist the Life Orientation teachers. Thus, in conjunction with the Life Orientation and Guidance departments, our school hosted a career day for all the Grade 11 learners. The photograph below show some of the displays on the day:

10. **Figure 4.3: Career day exhibitions**

   (Source: Own photograph)

The day after the event, the learners entered my classroom, still excited about the items they had received the day before. I had also placed some of these items and brochures on various careers

on a "display table" in my classroom. The learners were keen to discuss the career choices open to them.

As an introduction to my lesson that day, I showed the learners two video clips on the smart board. They loved this as it was the first time that I had not started a lesson with a PowerPoint presentation. The first clip was from the film "The Internship", depicting the two main characters attending an interview for an internship at Google, an American multinational technology company specialising in internet-related services and products. The second video clip featured the advantages there might be in working for Google and in a career in technology.

I had the sense that my learning task presentation had aroused the learners' natural curiosity; something different was happening in class and they understood immediately that "careers" were the focus. I gave each learner a detailed, written presentation that required them to solve the problem, and I set them to work.

At first, the learners were rather puzzled; all of them had questions to ask. Some learners asked what activity from the textbook they should complete. Others wanted to know what data they should open on their computer to start solving the problem. Several learners wanted to know where in the textbook they could find the answers. I felt sorry for them and wanted to give them more information, guiding them as I had done in the past, but I could not. For the first time, they were on their own – discovering their own learning.

4.2.2.3 Observe

a. *My first learning task execution*

This learning task was executed over several learning periods, each one representing a sub-cycle of the comprehensive second cycle of my action research. Confronted with this challenge, learners showed some excitement but most struggled with getting going. They were left to their own devices and forced to find the solution "on their own" without the "help" of the teacher. They were certainly thrown into the deep end and they needed quite a lot of emotional encouragement from my side because I could not provide them with information (CAT knowledge and skills) to resolve this challenge because it will defeat the purpose of facilitating learning. From this point forward, I became acutely aware of the importance of emotions and

emotional intelligence in education, and I grew increasingly convinced that, as Claxton (1999, p. 37) observes, learning is essentially "an emotional business".

Their initial uncertainty was obvious. They were never challenged with starting an investigation at the beginning of a lesson before. So I did what a facilitator of learning should do and that is to encourage and support learners emotionally. I asked them where they would start if they needed to find something. They knew that they could surf the internet. Having asked a few more intermittent questions, they voiced the fact that they should search the internet as a starting point to investigate various career choices. I acknowledged their own discovery of what they thought they did not know with: "You see, you know what to do". This encouragement relieved their sense of uncertainty, but something else surprised them. It was probably one of the most amusing aspects of their learning task execution. Learners could not believe that they were being allowed to go online during class time. Some learners asked whether they could download information to their computers if they found relevant web pages, while others asked whether there was anti-virus software in place to protect their external storage devices. Of course, several enquired whether they could access social media sites such as Facebook. This was strictly prohibited, however!

I encouraged learners to start by planning what they intended to do, and I could see that they began to make sense of this challenge as they also discussed it among themselves. I think they realised that this project would be demanding when a learner asked me how long this project should be and I answered, "When you have found the answers to all the questions you are going to create".

The learners were immersed in researching, discussing, reading and writing about information related to these careers. During this period, learners did not view the research and information collection as an assignment with the goal of committing basic facts to memory. Rather, they saw the research and information as a vehicle for dealing with a much bigger task – narrowing down the number of careers they would like to pursue. By creating their own questions and searching for the answers, learners were provided with a real-life challenge; this opened the classroom to the real world.

b.   *Learning task feedback*

As has been discussed above, learning task feedback is an essential element of facilitating learning. It is also very difficult to master feedback as a function of the facilitating of learning because its practice both for the facilitator and the learner is radically different from traditional roles.

Learning task feedback almost overwhelmed me initially. Time and again, I caught myself wanting to revert to my old methods. I had great difficulty in stopping myself from answering my learners' questions – after all, I was the expert! When I stopped myself from responding to learners' questions, I found myself falling into another unfortunate trap of engaging in a discussion instead.   This led inevitably to my mentioning content, information, hints or instructions. I found it extremely difficult to avoid explaining things to learners when it came to the software programs such as Microsoft Word, Microsoft Excel and Microsoft Access. In my opinion, learners were asking legitimate questions, such as where they would find a particular function on the computer, or how they should work out a formula. I was not convinced that they would work out the answers to these questions themselves.

I soon realised that I could not hope to master everything at once. I decided instead to focus on one of the actions of the learning task feedback at a time, and to move to the next one when I felt comfortable to deal with a new function. This intentional focus on one aspect at a time was not successful in all respects, however, and with each failure I had to make a concerted effort not to revert to my previous teaching paradigm. I realised that some functions were easier to manage than others because they were more familiar and situated in real-life experiences. One such example was the apparently simple task of "asking for clarification". This was similar to asking someone in the course of everyday life, "What are you doing?" This was followed by "Why are you doing it?" in order to clarify where the learner was in the process. However, I soon realised that these two questions fulfilled a particular purpose. This purpose was to eventually respond to what my learners are doing and why they are doing it in the most appropriate way in order to facilitate the learners to proceed in a way that will improve their learning quality by asking a question like: "How will you make sure that what you are doing is the best way to proceed? Since the learners were initially prone to ask me many questions, I was fortunately rescued from answering their questions as I was used to, when I started to elicit metalearning from my learners by requiring from them to answer their own questions by asking questions like: "What do you think?" or "What/how will you do (it)?"

Every learning period became a challenge because of my difficulties with learning task feedback and I almost gave up more than once. It was very difficult to be seen to be "turning a blind eye" to learners' initial frustrations and their struggles to cope with this new learning reality. One example of this was an occasion when learners were asked to create a *questionnaire* in Phase 1 for a real-life challenge, making use of *electronic forms*. These were foreign concepts to my learners, and yet I expected them to manage the task. However, once I began to turn my attention from being successful in my execution of the functions to observing learners' reactions to my persistence in refraining from teaching them, I realised the purpose of it all. At first, the learners simply did not like my new behaviour, but when they realised that I was not going to stop, they began to look for solutions to the challenges from within themselves. I was pleasantly surprised to see that they began to take responsibility for engaging with the real-life challenge at hand and to achieve things that I had not thought them capable of. They turned the challenge that existed out there to a challenge to the self − a personal one. In this sense, their attaining essential human virtues became a reality because I could observe the following changes in their behaviour, which I did not witness in my previous education practices:

a. Learners took *responsibility* for their own learning and expended *effort* as they continued working through the phases of the task.

b. Learners took pride in their work as they investigated careers. They displayed *self-confidence* and *perseverance* as they worked through this real-life task. Learners *motivated* each other, and at times even guided each other in what to do next.

c. They were *committed* to the challenge and worked hard every lesson to hand in an accurate and creative task. Some learners started working on their tasks during their breaks; one learner even chose to work on his task during break when the school was celebrating "40 days" (40 days left of school year). The fact that this learner had previously been suspended for behavioural problems made this all the more remarkable.

d. Learners displayed *honesty*. They made use of various resources in their work and inserted automatic bibliographies (using endnotes), showing an awareness of the dangers of plagiarism. This had not been explicitly required from learners, but by spontaneously engaging in such behaviour testifies to the attainment of quire a number of associated human virtues like integrity, motivation, initiative and trustworthiness.

When it became apparent that learners were capable of taking on the challenge on their own I realised the extent to which we tend to underestimate our learners. It was then that the essence of facilitating learning fell into place for me. Learners do have the ability to engage in the

solution of real-life challenges on their own, but it is unlikely that they will produce the best solution. This is the function of learning task feedback: that the leaners will produce the best possible learning quality, not only in resolving one real-life challenge, but in all subsequent tasks.

All the learning task feedback functions immediately made more sense, but this did not make implementing them any easier. This could only be achieved through extensive engagement with facilitating learning in practice.

With my attention turned a little more to my learners, I noticed that they had become increasingly absorbed in completing the task. What was significant, however, was that the purpose of facing real-life challenges had become the focus, rather than the execution of the activities. Learners were determined to find a career that suited their personality.

Even though I had difficulties coping with learning task feedback, I realised that there was a now significant difference in my interaction with my learners. As mentioned above, I had observed my learners' own struggles to cope with the new demands of facilitating learning while I was fighting to restrain myself from helping them in ways that came naturally: answering their questions and showing them what to do. This changed the whole learning atmosphere; the way in which, the level at which, and the domain in which our interaction was taking place. In my previous education practice, knowledge and skills were the dominant focus of our interactions. In this new learning environment, I found myself interacting on a more personal, emotional level, encouraging and supporting my learners to stay on task, without telling or showing them what to do. On the other hand, I had to contend with the difficulty of constantly demanding high quality work from them although they no longer had my "examples" to guide them. Some learners abused this situation by doing as little as possible, expecting me to be satisfied with what they produced. I realised that this was becoming an inescapable aspect of my education practice. I did not like telling learners that their work was not up to standard, but if I overlooked poor work in order to bolster their self-esteem I would be defeating the purpose of education that demands that learners produce the highest possible quality of work. This is also how they develop essential human virtues. The nature and structure of authentic learning and facilitating this taught me that being honest with learners would become an inescapable part of being more resourceful in my own facilitating learning practice. I would ask learners questions such as "Are you really finished?", "Do you think you have done enough?", "Can you with certainty say that

the career you chose is best suited to you?", "Have you considered looking at…?", "Don't you think it would be better to include…?"

I soon realised that this kind of real-life challenge has a considerable impact on the learners' lives in the here and now, when they need to do exceptional work in order to make the best possible choice that will influence their lives, and is central to education. It is the focal point that gives meaning to education because everything that learners are required to do in relation to such a real-life challenge has a bearing on their *real* lives.

A demanding, real-life challenge that challenges learners connects everything they learn on a deeply meaningful continuum between the consolidation of one sub-cycle learning period and the next, until the final solution to the challenge becomes a deeply meaningful continuous endeavour. For this reason, at the end of each learning period I facilitating the consolidation of the learning by requiring learners to identify not only what they had learned that period, but also how the quality of that learning experience had contributed to their progress in resolving the challenge. What would they need to do to continue in the next learning period and to improve their learning quality?

Unfortunately, I was unable to facilitate the consolidation of the learning task in each learning period to the extent or level that I would have liked. One of the reasons for this was my preoccupation with learning task feedback. I believed this to be so crucial that I often spent all the time available on this function, or I simply forgot to consolidate. However, when I did manage to do it, even in a less than satisfactory manner, I realised how important it was to maintain the level of purpose in fulfilling it because real life demands nothing less. I had to become more consistent in my consolidation of the learning at the end of a learning period in each sub-cycle.

c. *Learning task consolidation*

Learning task consolidation refers to overall consolidation on the completion of the real-life challenge and its final product(s). This formed the conclusion of my first comprehensive action research cycle. Consolidation fulfils the purposes discussed above: establishing the rate of progress in resolving the real-life challenge contained in the learning task design; the quality of the learning that has been in operation as reflected in the quality of the outcome(s); and the challenges in which learners need to engage in the future.

I conducted semi-structured interviews with ten of the grade 11 learners after facilitating my first learning practice in my education practice. There was quite a revelation in their answers especially regarding the first two questions I asked in the interviews, which I report here.

14. Table 4.7: Semi-structured interviews with Grade 11 learners after facilitating my learning practice: Careers

What did you like most about this real life challenge?

- *What I enjoyed most was that I was able to grasp different aspect on Excel, Word, and Access and we learned new and different techniques on how to solve problems. We were also able to research our different careers.*
- *I really liked it. I enjoyed the challenge that it presented, because it was a lot of work and we had to break it down ourselves. The fact that we had to find out everything was interesting to me.*
- *I thoroughly enjoyed it – it was better than most challenges we do in class. Working on it by myself and doing it myself made me more comfortable to figure it out myself.*
- *I liked it, because you are doing it yourself and when you are doing it yourself it is easier because you discover things you did not know how to do. For example, I discovered Access. I did not know anything about that and by doing it myself I got to understand it better than doing it in class.*
- *I like the fact that I learned a few formulas and new skills like Access and Excel by myself.*
- *I enjoyed the interaction between learners and the questionnaires they completed.*
- *I learnt new things; like new formulas, how to get data, do research and put it into an essay.*
- *This challenge actually challenged me in upgrading my ICT skills, where with the activities they basically give you everything. The challenge literally improved my skills.*

What did you like least of this real life challenge?

- *The amount of research that we had to do was challenging, but even though I didn't like it, it helped me with this challenge to move forward and to better myself in the CAT field.*
- *I liked everything about it. I was finding information from a classroom of people, friends, textbooks, so it was pretty cool. I really liked the career day.*
- *Finding all the information was hard. I found my information from newspapers or*

> *magazines, Google, many kinds of different websites.*
>
> - *I did not enjoy the part where we had to do questionnaires. You had to come up with questions that people would understand and would be able to answer. People had different opinions about different things. So if you didn't have certain aspects that have been covered on that topic, people didn't really answer them accordingly.*
> - *I enjoyed the challenge; I don't think there was anything I disliked.*
> - *The time frame. There was a lot of work that you had to do and sometimes there wasn't enough time for you to finish everything and with the questionnaires, you had to get a lot of people and ask them questions.*

It is not difficult to detect that even though the second question required learners to share their dislikes about this real life challenge they have experienced, they seem to persist in that there seems to be little, if anything, that they dislike. When they did indicate that they disliked something the reference was to the amount of work (research) that they had to do that was also hard. This is not a surprise because in the past this work was probably mainly done by the teacher.

See the "End product (my example)" and "End products of learners" in the "Learning Task 1 Package" folder for examples of the learning products produced in this cycle of my action research.

4.2.2.4 Reflect

My reflection should contain a critical assessment of my success in fulfilling the requirements of facilitating learning during this comprehensive action research cycle.

First of all, I realised that my learning task design had some serious flaws. It was very much an assignment, rather than a challenge in the way it was formulated. In order to set appropriate parameters in which this real-life challenge should be executed also caused it to be quite an assignment with a number of instructions to follow. All of this, actually defeats the principle of real-life because when one has to make decisions like this important one in real-life, one is not provided with the kinds of instructions and information I have provided. Even though deleting the instructions and information might increase learners' discomfort and uncertainty, the way in which the formulation is rather enticing, and wowing the learners' into their engagement with it

is of critical importance because it will ignite the emotional propulsion and the parameters for the execution of the learning task. For the next time that the opportunity arises, I thought that this formulation for a verbal presentation would be much more appropriate, rather than using the wording given in the practical assessment task (PAT):

> *You are at this turning point of your lives that you will soon enter the demanding challenges of the world of work in real-life. Choosing a career is both exciting but also extremely important because your career – or rather your vocation – determines your overall well-being. In this sense, your career has to be a perfect fit for who you are. Although there is always a possibility that one would change a career, there is no alternative for making the best possible choice because one's career well-being is critical for one's overall well-being since a career will occupy most of our time in life.*
>
> *You have the opportunity during the next four weeks to ensure that you will be able to secure the best possible career for you in the field of technology according to all your own personal characteristics, capabilities and interests while considering all the demands and requirements (like qualifications and costs for education) in such a way that it will enhance your well-being and provide you with many other options of associated careers and promotional opportunities. But what is becoming evident is that computers are increasingly doing the highly sophisticated work and with associated emotions that were thought only humans will be able to do. There is, therefore, a decrease in careers in the field of technology. To make provision for an alternative career outside of the field of technology, it would be of crucial importance.*

Although I achieved some success – even with a learning task presentation that was far from perfect – there were several other weaknesses and deficiencies that I will have to address. I am grateful that I had the opportunity to experience the professional practice of facilitating learning for the first time. It proved a daunting task, but I gained some sense of what the practice entails and I was exposed to its uncompromising nature. I had experienced incredible spurts of joy and excitement at what I discovered what my learners were capable of, but I also had the moments of giving up and returning to what I know. My limited success was inconsistent and the result of trial and error in many instances. At the times that I became despondent at my progress – which may have been more often than not, I became encouraged by the words of a lifetime teacher on all levels and a true scholar in education which I could confirm:

> "I am a teacher at heart, and there are moments in the classroom when I can hardly hold the joy. When my students and I discover uncharted territory to explore, when the pathway out of a thicket opens up before us, when our experience is illuminated by the

lightning-life of the mind – then teaching is the finest work I know. But at other moments, the classroom is so lifeless or painful or confused – and I am so powerless to do anything about it – that my claim to be a teacher is a transparent sham. Then the enemy is everywhere: in those students from an alien planet, in that subject I thought I knew, and in the personal pathology that keeps me earning my living this way. What a fool I was to imagine that I had mastered this occult art …" (Palmer, 2007, p. 1).

What encouraged me most was that, as time went by, I became aware of certain behaviours of my learners that provided an indication of their authentic engagement with the learning task and resolving the real life challenge. From my observation phase of this cycle I could identify the following pointers as to learners being immersed in the real life experience, reflecting on it and constructing meaning from what they are learning:

- Are the learners deliberately engaged because they are immersed in meaningful challenges that provide major connections to their world?
- Is there a sense of freedom and creation in their individual pursuits when metalearning is taking place?
- Is there a heightened pride in the collective team event goal as part of co-operative learning?
- Are the learners' genuine curiosity triggered and am I observing prolonged bouts of concentration?
- Are the learners engaged in dialogue that refers to the outside world?
- Is there a spark of excitement or urgency in my learners' questioning?
- Do I have to remind my learners that it is time to go to break or go home?
- Do I find that certain learners with absentee problems are starting to show up more regularly?
- Am I seeing tendencies of improvement in learners, who are normally disorganised and disconnected to schoolwork?
- Am I experiencing less behaviour problems?

The affirmative way in which I could start to answer these questions, made this encounter of my first facilitating learning practice, something that I will not forget. It helped me to prepare myself for the second comprehensive action research cycle and my second learning task design and its operation.

4.2.2.5 Review

In reviewing my experiences during this cycle, I can conclude that both my learning task design and its presentation were valuable exercises that made a contribution to the success of this first attempt. The challenge now was to enter my third comprehensive action research cycle with a more structured and more conscious attempt to target specific facilitating learning actions where I would like to improve my education practice.

4.2.3   Cycle 3: Engaging in my second facilitating learning practice

The positive experiences of my first facilitating learning practice prompted me to engage in my second facilitating learning practice.

4.2.3.1 Plan: Designing my second learning task (Conservation)

The previous learning task suited the CAT learners well as a demanding real-life challenge since it concerned one of their chosen subjects and the pursuance of a prospective career in that field. In addition, since career opportunities in the field of technology is decreasing (Colvin, 2015, p. 41), or should the learner's interest in the field of technology diminish, an alternative career has already been explored. The learning task was interpersonally directed.

The following year I wanted to challenge myself into designing a learning task for the same group of learners whom were now in grade 12. The Practical Assessment Task to follow that year was more interpersonally directed and/or focused on the external environment. Since our natural environment has become the object of many challenges, this seemed to be a relevant challenge for a learning task. Overhearing a discussion among the learners, which concluded that conservation is everyone's responsibility, I was convinced that my second learning task should revolve around an environmental challenge. I realised that even if one does not spend much time in nature or appreciate its beauty, everyone needs access to food, clothing, medicine, clean air and water, as well as a variety of other resources on which one depends upon every day. Thus, it is in everyone's best interests to take care of the environment. I, therefore, wanted learners to investigate an environmental issue that would interest them. However, the aim needed to be the mobilisation of their community to participate actively in a continuing project to vitalise their environment. For this, they would need to design a webpage as required from them stipulated in the curriculum.

I became aware of the YouTube video clip of 12-year-old Severn Cullis-Suzuki from Canada who, with her four friends, raised the money themselves to travel 5 000 miles to Brazil to address the United Nations Conference on Environment and Development (UNCED, 1992), in which it was stated that we must change our ways if we are to have a future. Severn Cullis-Suzuki delivered a speech (Cullis-Suzuki, 1992) that was so powerful that she silenced all participants for six minutes – the duration of the address. This prompted the design of my second learning task.

Table 4.8 reveals my second learning task design created after receiving the grade 12 PAT document at the beginning of that year (South African Department of Basic Education, 2014).

15. Table 4.8: My second learning task design: Conservation

PHASE AND GRADE	Further Education and Training (FET) Grade 12
SUBJECT	Computer Applications Technology (CAT)
CURRICULUM CONTENT (Copied from the official Curriculum or Syllabus documents (South African Department of Basic Education, 2011, pp. 12-17)	*Solution Develo*pment is the actions and processes involved in developing a computer-based solution by utilising appropriate tools such as application packages to solve a variety of problems represented by real-life scenarios. For Computer Applications Technology these applications are end-user applications which include word-processing, spreadsheet, database and presentation applications; *Systems technologies* refer to the physical and non-physical components of a computer system. The components of the system are independent units which are designed to perform a particular function. These components which include hardware, peripherals and software components are connected as a unit to perform the basic functions of a computing system, which include input, processing, output, storage, communication and transfer of data in an electronic format; *Network technologies* include various network technologies to facilitate the management and dissemination of digital data from one point to another. Network technologies also refer to the electronic systems used for electronic data interchange used to facilitate information dissemination between various individuals or groups at a single point or dispersed locations; *Internet technologies* include the WWW and all interrelated processes in the digital presentation of multimedia data on a web page. Internet technologies are defined as a set of related and interconnected technologies, which enable the establishment of global networks, for various purposes such as collaboration, electronic data interchange, electronic commerce, electronic communication and social networking. *Information management* refers to the techniques and technologies involved in the collection, storage, processing of data into information that leads to knowledge and decision-making. It includes the use of appropriate communication and presentation tools to communicate new knowledge and recommendations;

TOPICS FOR GR.11 (Copied from the official Curriculum or Syllabus documents)	APPLICATION TO BE COVERED WITHIN THE TOPIC FOR THIS LTD	CONTENT TO BE COVERED WITHIN THE TOPIC FOR THIS LTD (shaded below)
		• *Social implications* refer to issues relating to the digital age and bridging the digital divide and include issues that lead to the responsible use of ICTs. This section of the CAT curriculum should consider the impact the use of computer technology has on everyday life.
TIME TO EXECUTE LT	6 months (2 month for completion of 1 phase). 3 Phases to complete.	
Solution Development (South African Department of Basic Education, 2011, p. 12)	Word Processing	• Advanced file handling • Customise templates • Import/export data • Data sources • Professional documents • Use/reinforce word processing skills • Integration techniques • Troubleshooting • Problem solving
	Spreadsheets	• Complex functions • Text manipulation • Date and time calculations • Advanced graphs/charts • Validation of data

		• Integration
		• Troubleshooting
		• Problem solving
	Databases	• Reports
		• Grouping information
		• Calculation fields in queries and reports
		• Data validation techniques
		• Troubleshooting
		• Problem solving
	HTML/Web Design	*HTML / Web design*
		• What is HTML?
		• HTML syntax
		• Basic HTML tags
		• Basic text and text formatting
		• Structure of a simple
		• HTML page
		• HTML links
		• HTML images
		• HTML lists
		• HTML tables
Systems Technologies (South African Department of	Introduction to Concepts of Computing	• Computer systems for different uses
		• Case studies/scenarios regarding use of ICTs

		• Use of computers in a variety of contexts
Basic Education, 2011, p. 13)	Hardware (Systems Unit)	• Appropriate use of devices • Buying decisions • Productivity issues • Factors influencing performance • Case studies • New technology
	Software	• Productivity issues • Role of operating system • Utilities • Buying decisions • Human error potential • Case studies • New technology
	Computer Management	• File properties, attributes and metadata • Housekeeping • Case studies • Troubleshooting
Network Technologies (South African Department of Basic Education, 2011, p. 14)	Networks	• Types of networks: WAN • Internet as a WAN • Internet services • Buying decisions regarding Internet connection and access

Internet Technologies (South African Department of Basic Education, 2011, p. 15)	Internet and WWW	• Overview of Internet services • Features of browsers • Browser plug-ins • Evaluation of websites • New trends and technology
	Electronic Communications	• Communication devices • Extension of types of digital communications • Advantages, disadvantages and limitations • Good practices • Extension of uses of computer communications • New trends and technology

Information Management (South African Department of Basic Education, 2011, p. 16)	Find and Access Data and Information	• Reformulation of problem/task into a complete statement
		• Questions and questioning
		    o Formulate main question
		    o Formulating other questions
		    o Quality control of questions
		• New questions and discarding irrelevant questions as investigation develops
		• Identifying appropriate sources
		• Finding information and gathering data
		    o Set a questionnaire
		    o Using two other sources
		• Advanced searching techniques

		• Quality control of information
		  o Information evaluation
		  o Website evaluation
		• Manage volumes of information

	Process Data and Information	• Using a variety of information • Using the most appropriate information and data for processing • Effective manipulation of information o Rework and/or combine • Processing data correctly into useful information using a variety of tools and techniques leading to a solution • Use correct software for processing and manipulation • Formulating data questions • Data handling - the role of the spreadsheet and the database • Meaningful analysis of data and information - trends and patterns
	Present Solution	• Utilising best software tools in an integrated fashion to communicate findings • Comprehensive report • Interpreted knowledge and new understanding • Present information in logical grouping and flow supported by appropriate texts and graphics to enhance understanding • Cohesive and logical recommendations/conclusions • Complete referencing using variety of tools and techniques • Quality control of report

		o Clear link between original task/problem, discussion
Social Implications (South African Department of Basic Education, 2011, p. 17)	Impact on Society	• Distributed computing power • Impact and use of social networking and virtual communities • Tele-working/telecommuting • Information overload • Different scenarios and case studies • Making recommendations • New issues
	Legal, ethical and security issues	• Computer criminals and crimes • Fraud scams • Internet attacks • Misuse of personal information • Malware and safeguards • Different scenarios and case studies • Making recommendations • New issues
	Health and Ergonomic issues	• User-centred design in software • Usability and functionality issues • Interpret adverts • Interpret scenarios • Making recommendations • Buying decisions

		• New issues
	Environmental issues	• Interpret scenarios
		• Make recommendations
		• New issues

The Facilitator of Learning has to ask and answer the following fundamental learning questions regarding the CAT curriculum content (knowledge and skills) that the learners need to learn in order to eventually arrive at the real life challenge that the learners needed to be confronted with:
REAL-LIFE CHALLENGE
Why do learners need to learn this curriculum content?

Why do learners need to learn this curriculum content?

- The curriculum content covered in this learning task design is very extensive. The contents of some of the above topics have been discussed in Grade 10 and Grade 11. Revising and building onto this foundation with a fresh approach is necessary to understand the new applications fully. Learners need to work on three different application programmes: Microsoft Word (established in Grade 10), Microsoft Excel (established in Grade 10 and Grade 11) and Microsoft Access (established in Grade 11). The learners will also work on HTML – website development. The real-life challenge will confront learners on all three known applications, but *HTML is considered "new content".*

- Learners need to learn Microsoft Word as this section of the curriculum allows users to type (create), save and print documents. It is a powerful tool that allows them to create from a simple letter, to a research paper, to professional book length manuscripts. Their finished work can be simple text or include special formatting, illustrations, tables, columns and more. This application programme can and will be used in everyday life – from creating typed tasks for school to creating documents in their professional working environment. The learners will make use of this package to do their final presentation in the form of a report.

- Microsoft Excel is another application programme that needs to be learned by learners due to its calculation and graphic features. Excel has a reputation for use in accounting departments, and while its math functions are vital for bookkeeping, the programme's spreadsheet and

charts help out with everything from building a budget to analysing scientific records. Learners need to know this content of the curriculum as Excel makes organisation and sorting of data simple. This data can also be visualised automatically as a chart or a graph. Excel's functions (calculations) automate math formulas, simplifying data tracking.

- Microsoft Access must be learned as it is a database creation program that allows for anyone to easily maintain and edit a database. It is suitable for anything from small projects to large businesses, and is a very visual program. This makes it great for performing data entry, as you do not need to work with tables (Microsoft Word) or spreadsheets (Microsoft Excel). There are several ways in which the learners can format, interact and filter the data in Access which includes tables, forms, queries and reports.

- Microsoft Word, Microsoft Excel and Microsoft Access are part of an office suite, which means these programs "talk" to one another. Learners can import and export necessary data from the one document to the other and integrate these packages as they see fit.

- HTML (HyperText Markup Language) is the standard mark-up language used to create the basic elements of web pages. Web design as a profession is a distinct and conspicuous segment of the design industry and can learners now consider web designing as a profession. It is however not only a commercial imperative, but a cultural and moral imperative, which learners in turn need to discover. The purpose of this content is to introduce learners to an alternative way of presenting information, i.e. a web page. As learners are familiar with the Internet and the World Wide Web, they are now offered an opportunity to create a web page using a text editing program, such as notepad.

What are the role, function and value of this curriculum content in the lives of learners they are living right now?
Web designing as a profession is a distinct and conspicuous segment of the design industry and can learners now consider web designing as a career option. It is however not only a commercial imperative, but a cultural and moral imperative, which learners in turn need to discover.
Where/when in the lives of the learners right now will they be required to do what they are expected to do?
Learners will make use of web designing if they choose it as a career path. They can also provide valuable input and assistance in a normal working environment towards the companies/organisation's website they are working for. Privately creating their own web pages.
What is the challenge (problem) you want learners to solve (resolve)?
The real life challenge that the learners should be confronted with should compel them to construct (discover, find, acquire, and use) all the

CAT curriculum content (knowledge and skills) indicated in this learning task design in order to resolve the real life challenge. Since obtaining everything necessary to engage in an in-depth interrogation of conservation issues in order to compile a comprehensive personal profile of conservation concerns explored and possible solutions provided to ensure that one would be able to create an environmental awareness seems to be a challenge that will demand such a learning endeavour.

FUNDAMENTAL HUMAN VIRTUES TO BE ATTAINED FOR AND DURING THE EXECUTION OF THIS LT			
Intrapersonal		**Interpersonal**	
Self-confidence	X	Humanisation	X
Motivation	X	Communication	X
Initiative	X	Dealing with feelings	
Effort	X	Justice	X
Perseverance	X	Forgiveness	X
Common sense		Inspiration	
Responsibility	X	Leadership	X
Independence	X	Engagement	
Honesty	X	Compassion	X
Integrity	X	Service	X
Courage	X	Caring	X
Respect	X	Kindness	

LEARNING TASK PRESENTATION
After viewing the YouTube video clip "The girl who silenced the world" (Cullis-Suzuki, 1992) the following will be presented):

Verbal Presentation
Conservation is everyone's responsibility. Even if you do not spend a lot of time in nature or appreciate her beauty, everyone needs access to food, clothing, medicine, clean air and water, and a variety of other resources you depend upon every day. It is in everyone's best interest to try to conserve natural systems. Your school wants to inform learners about conservation issues, the importance of conservation and create an awareness to address these issues. The school management team wants you to investigate a conservation issue that may interest you. They also want a formal report regarding your investigation which they can use in their awareness campaign. Your investigation should address a conservation issue/problem, the impact thereof, possible solutions and the role learners could play or any other interesting facts and statistics that will inform learners about this issue. You must share information, such as the knowledge and insights that you gain through your investigation, by creating a website for fellow learners (South African Department of Basic Education, 2014)
Written presentation
Conservation is everyone's responsibility. Even if you do not spend a lot of time in nature or appreciate her beauty, everyone needs access to food, clothing, medicine, clean air and water, and a variety of other resources you depend upon every day. It is in everyone's best interest to try to conserve natural systems. Your school wants to inform learners about conservation issues, the importance of conservation and create an awareness to address these issues. The school management team wants you to investigate a conservation issue that may interest you. They also want a formal report regarding your investigation which they can use in their awareness campaign. Your investigation should address a conservation issue/problem, the impact thereof, possible solutions and the role learners could play or any other interesting facts and statistics that will inform learners about this issue. You must share information, such as the knowledge and insights that you gain through your investigation, by creating a website for fellow learners (South African Department of Basic Education, 2014).
LEARNING TASK ASSESSMENT
I used the criterion-reference tool received in conjunction with the Practical Assessment Task in order to do the assessment (South African Department of Basic Education, 2014) *(Refer to the "Assessment" folder in the "Learning Task 1 Package" folder.)*

AUTHENTIC LEARNING CONTEXT
Organisation of learning space
The learners will be working in the educator's computer lab at their individual work station. *(Refer to "Learning Space" in the Learner Task 2 package" folder.)* Posters of animals will be put up everywhere in the classroom so that learners are constantly reminded of the conservation issue at hand.
Roles, functions and organisation of participants
Since conservation is of utmost importance to all of humankind, it will need careful consideration and planning from the Grade 12 learners. Each learner must investigate a probing conservation issue. The idea is to get a formal report regarding this investigation, which should address a conservation issue/problem, the impact thereof, consequences, possible solutions and the role learners could play or any other interesting facts and statistics that will inform learners about this issue.   Learners must share the information, such as the knowledge and insights that they gain through their investigation, by creating a website for fellow learners.   The facilitator of learning will facilitate the entire learning process of the learners in resolving the challenge.
Material and equipment

To complete the challenge, we will need:
 	
 • 30 computers for each learner in the classroom which includes:
 	
 • An office suite with the following software
 	
     o Word processing software
 	
     o Spreadsheet software
 	
     o Database software
 	
 • HTML editor (Notepad ++) and browser (Internet Explorer)

• Internet access to
o Find data and information
o Administer electronic questionnaires, e.g. use e-mail to send questionnaires to respondents and receive completed questionnaires from respondents
• Access to other sources such as printed media (e.g. magazines, newspapers, brochures, textbooks.)
• Access to facilities to convert hard copies to electronic documents, e.g. scanner, digital camera
• Storage media to store and backup your work electronically, e.g. flash drive, rewritable CD/DVD

END PRODUCT OUTCOMES
(As would be expected/required to be produced by a learner exceptionally well)

The Learning Process

The learners have to provide the following in one or the other format.

1. GENERAL

1.1 Information management concepts

- Managing information involves gathering, selecting, organising and interpreting data, and presenting processed data as information.

- The real-life challenge for Computer Applications Technology describes a topic that learners need to research.

- The real-life challenge consists of phases where they need to demonstrate:

    o Data gathering skills and techniques

    o Data manipulation skills

    o The ability to produce quality output using computer application skills.

1.2 Gather data

- Gathering data starts with the learner understanding why they want the data. They should do the following:

- start by asking questions that identify the problems linked to the topic that they have been given. They need to ask questions because the answers will help them define the problem and work out what data they must find;

- identify different sources of data and information;

- design a questionnaire as one of their sources of data;

- use the questionnaire to get answers from a sample of people;

- find and evaluate information from the Internet.

1.3 Select, organise and interpret information

- Once they have collected data, they will need to process it to make it meaningful.

- They must use their spreadsheet skills to process and analyse the data they gather from the questionnaire to show trends and patterns.

1.4 Present information

- The final presentation of the information will be:
    - A formal report prepared in a word processing application (outline the problem and recommend a plan of action to solve it)
    - A summary in the form of a presentation such as a web page.

2.   PHASE 1

2.1 TASK DEFINITION AND DATA GATHERING

- Before attempting any project, the learner must understand what is expected of them.

- The learner must follow the real-life challenge instructions carefully, and then write a task definition in their own words.

- A task definition specifies the problem they have to solve, who wants them to do this work, what information they need to find, and how and where they will find the information.

- They need to answer questions such as these:
    - Why are you doing the investigation?

- What are the main tasks that you need to carry out?
- How will you go about it?
- What information do you need?
- What do you know about the topic or problem?
- Where and how can you find information you still need?
- Who wants the information?
- How must you present the information?

- The learners must plan and create a set of electronic folders to store the information.

2.1.1 Identify problems associated with the topic

- After defining the task and selecting possible headings, learners must ask questions that will guide their research and their report writing.
- Some ideas include the following:
  - Questions that lead to factual information: level 1 questions usually starting with words such as "What", "When", "Where", "Who" or "How many".
  - Questions that explore: level 2 questions starting with "Why" or "How".
  - Questions that predict: level 3 questions starting with "If" or "What if".
  - Questions that help make judgments: level 4 questions that help you reach a conclusion, that start with phrases such as "Would it be better if", "How can I determine" or "What would be the best way".
- When they have their list of questions, arrange them according to the headings they have identified for the main parts of the topic.

2.1.2 Find possible sources of information

- After the task definition, learners will need to find information.
- Different sources they can use are:
  - Publications: Books, newspaper articles, magazines and brochures.

o   Electronic media: The Internet, including encyclopaedias and social networks.

o   Surveys (electronic form): These useful tools help learners to find out more about people's attitudes and circumstances. They will need a questionnaire with questions that respondents can complete in a short time.

2.2 SETTING QUESTIONNAIRES

- People use questionnaires to get data or information for a survey or research task goals

- Learners must keep the following in mind:

    o   Keep the questions short and simple, direct and easy to understand;

    o   Focus on only one point at a time;

    o   Make sure that people are able to give unplanned answers;

    o   Ask your respondent "Why" when learners create a yes/no answer, you may want to;

    o   Ask the question in such a way that you do not guide people to the answer;

    o   Get someone else to check your questions to see whether he or she interprets them the way you intended;

    o   Keep the final questionnaire short.

3.   PHASE 2

3.1 Gathering information

Learners need to think of ways to find the information they need for their investigation.

3.1.1   Quality control techniques

- Not all information is reliable.

- Check these aspects:

    o   Authority: Who created the information?

    o   Accuracy: Can the statements and claims be substantiated?

    o   Currency: Is the information up to date, and is it still relevant?

- o Objectivity: Does the source/author show any bias?

- o Coverage: How well does the information cover the topic?

3.1.2 Evaluate websites

- Use the following criteria to help to assess the reliability of a website:

  - o Affiliation: Who supports the website?

  - o Authority/the author: Who created the website and what are the author's credentials?

  - o Content: Is the content properly organised? Do the links work?

  - o Current: Is the information on the web page up to date and still suitable?

  - o Design: Is it easy to navigate and is it visually pleasing?

  - o Objectivity: Does it reflect any preconceptions?

  - o Trustworthy: Would you be able to use it?

3.1.3 Sift information

Learners must go through the available information and select the most relevant websites and other information sources.

3.2 Process data: spreadsheets and databases

3.2.1 Process data using a spreadsheet

- The first stage in manipulating data is to get it sorted and grouped.

- Learners must understand that a spreadsheets help them to:

  - o Analyse data and use calculations to extract meaningful information;

  - o Summarise the information and add their own insights;

  - o Use formatting features such as borders, word wrap and font styles;

  - o Create charts and tables to make the material more understandable;

  - o Analyse questionnaire results in a spreadsheet;

  - o Ask questions such as: How many? What occurs most often? What is the most popular? What is least common? How many more

than? What is the average?

- o Use spreadsheet functions such as COUNT and IF functions, such as COUNTA, COUNTIF, IF and SUMIF; and
- o Other functions are CONCATENATE, LOOKUP, AND, NOT, MIN, MAX and AVERAGE.

3.2.2 Process data using a database

- Learners must create a database with the information you have gathered so that you can generate queries and provide database reports.
- They must use suitable field names and data types.
- The must use the information from their database queries and reports in their word processing report, and the slide show or web page.

4. PHASE 3

In the last phase of the real-life challenge, learners should bring all their findings and supporting documents together in a report and a web page.

The final phase of the real-life challenge is where learners present their work to their target audience.

4.1 Write a formal report

- A report is a document that gives information about an investigation or research done. It should include analysis, evaluations and recommendations.
- When writing a report, learners should:
  - o Analyse the information they were given;
  - o Find more information by reading books, visiting websites and consulting other sources relevant to the investigation;
  - o Draw conclusions from the facts presented;
  - o Give general trends or patterns;
  - o Make recommendations, persuade or give an opinion; and
  - o End with a conclusion.
- The structure of a report is usually as follows:

- o   Title page
- o   Table of Contents
- o   Introduction: Outline the task definition and the reason for the investigation.
- o   Body paragraphs: Use main headings and subheadings to organise the themes.
- o   Recommendations or findings: Say how the problem may be solved or how the situation may be improved.
- o   Conclusion: Draw all the main points together to present an overview.
- o   Bibliography or list of references: Use the Harvard or APA (American Psychological Association) method.
- After gathering the data and information, learners, must organise and interpret the data they have collected.
- Spreadsheets and databases will help them process the responses from the questionnaire.
- Learners can create graphs in spreadsheets to show trends and patterns.
- Learners can also record the responses to their questionnaire in a database and then generate queries and reports to place in their formal written report.

4.2 Create a web page

- The web page that the learners must create for the real life challenge covers the same information they covered in their report.
- However, the web page deals with the information much more briefly than the report does.
- Select only the main points.

5. Declaration of authenticity

- Learners hand in a declaration of authenticity to confirm that they have not plagiarised on any points included in their real life challenge.
- Before they hand in their work, they must proofread their work carefully.
- Correct any spelling and grammar errors.
- Check the visual appeal of their documents, including the layout, font styles, colours, pictures and charts.
- Learners must make sure that all sources are acknowledged correctly.

The Learning Product
(*Refer to the "End product (my example)" and "End products of learners" in the "Learning Task 2 Package" folder*)

The Learning Content
(*Refer to the "End product (learners)" in the "Learning Task 2 Package" folder*
(*Refer to "The Learning Content" in the "Learning Task 2 package" folder*)
Even though the learners will ultimately revise Grade 10, Grade 11, and Grade 12 knowledge through this real life challenge, the ultimate goal is for them to understand website design.

RESOURCES

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4.2.3.2 Act: Presenting my second learning task

In view of my second learning task design and within the limitations of security and protection of the equipment in my computer laboratory, I attempted to create a conducive learning atmosphere for this real-life challenge by utilising all the open wall spaces to display posters regarding conservation and the environment.
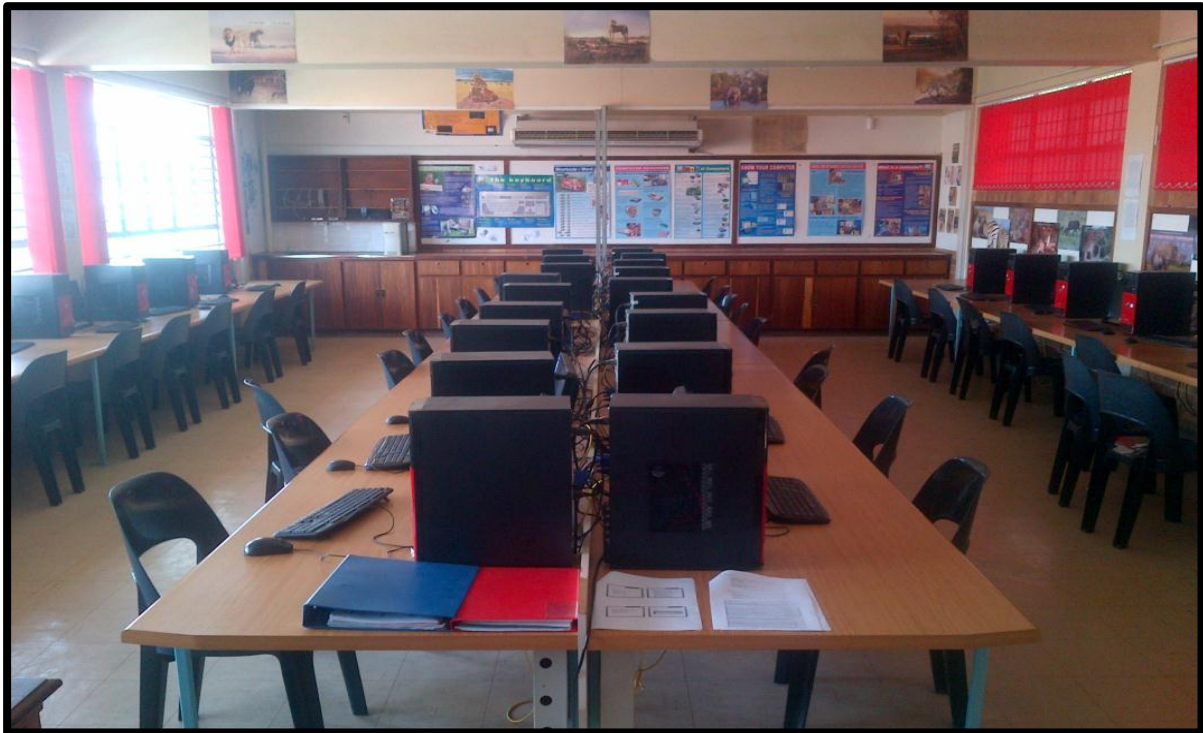
11. **Figure 4.4: My computer laboratory: A conducive learning environment**

(Source: Own photograph)

The group consisted of the same learners as the previous learning task the year before. Upon entering the classroom and seeing the posters, the learners knew immediately that a new challenge was ahead. Learners began asking me in an excited tone, "What are we doing today, Ma'am?" and, "Is it another challenge?" By now, the previous strict, formal, almost militaristic entrance and greeting was replaced by a more open, relaxed and informal, but still respectful, arrival each learning period. I encouraged them to take their seats without revealing anything and started by playing the video clip, "The girl who silenced the world". My learners were in absolute silence as Severn Cullis-Suzuki called on adults to follow the same rules that teachers and parents expected their children to follow to ensure a future for all (Cullis-Suzuki, 1992).

The learners were in awe of the content and the professional way in which Severn Cullis-Suzuki addressed the adults about conserving the environment and ensuring a future for all. At this time, I presented the learners with the challenge, as indicated in the learning task design and provided them with the same presentation in written form.

4.2.3.3 Observe

a.   My second learning task execution

It was thrilling to see how excited the learners were about this learning task, not only because of its real-life relevance but also because of what it might entail regarding Computer Applications Technology. Despite the excitement, it was a very comprehensive learning task, requiring them to plan the way in which they would resolve this real life challenge – their own learning.

In the past, they had initially approached and asked their peers at this stage. Educationally speaking, this is not ideal. Knowing that this had happened during the previous learning task execution in my Action Research Cycle 2, I realised that I might need to deviate slightly from my intended structured target of becoming more competent with particular learning task feedback actions such as the variety of metalearning questions that could be asked. I should rather focus my facilitating learning on ensuring that learning task execution through metalearning and co-operative learning in the broader sense of the structures would be enhanced in order for the learners to realise how important and valuable these structures are for improving their learning quality.

Without abandoning the metalearning questions or not utilising them as appropriately as possible, consciously focusing on facilitating the learners' learning in the metalearning and co-operative learning structures became the focus of my learning task feedback.

b.   Learning task feedback

Essential human virtues became a reality during the learning task feedback, because I could observe the following changes in their behaviour during the education practice:

a. I requested the learners return to their working stations and facilitated their realisation that they must become appropriately structured in the way they resolved this real-life challenge

through planning (their own learning – first metalearning strategy) as the first step. Taking *responsibility* for their own learning is an essential human virtue. As an explanation to the learners, a range of questions with hypothetical answers that I would expect from learners was presented. The expected answers are hypothetical because certain questions can only be posed after a number of other questions and answers, and these cannot be predicted.

- *What is the most important thing that you need to do first?* Plan.
- *What will happen if you do not plan?* You might not be efficient or successful in what you want to achieve.
- *If you need to do something, who is the best person to do the planning?* You.
- *What is the first thing that you will need to do in the planning process?* Find out exactly what it is that you want (need) to do.
- *And then?* Determine how you are going to do it – step-by-step.
- *In how much detail should you go with the plan?* In as much detail as necessary for you not to forget something that should be done.
- *And then?* Determine what you have and what you need to do to carry out the plan.
- *And then?* Obtain what you still need.
- *And then?* Make sure that you will now be able to execute the plan without failure – as far as the plan is concerned.
- *And then?* Execute the plan.

This was time consuming and not liked by all, but it was crucial because of our ontological being of finding ourselves through finding out what we know and what we do not know. This whole process could have been more 'authentic', but I felt it important for the learners to work individually at their own working stations initially and discover the meaning of the challenge and their initial relationship to it, as I felt this would build their *independence* and *self-confidence*

During this metalearning of the learners, there were many interruptions because the learners were not familiar with performing a real critical analysis of things, as they were now expected to do. On numerous occasions, I had to ask questions that related to their superficial attention to detail, which needed improvement: "How will you make sure that you have identified everything you should?" I expected them to compile an inventory that lists all the elements of the written presentation of the challenge. Thereafter, I needed to deal with learners' questions regarding their own uncertainty about having identified everything.

The phrase, "What do you think?" and all its variants was common after their questions of: "Is this right, Ma'am?" in all its variants.

b. Ideally, after their individual analysis of the challenge, the learners should form small communities of truth through coming together in their co-operative learning groups. I prompted them by asking the same question as during their metalearning: "How will you make sure that you have identified everything you should?" The way they *communicated* with one another, displayed *compassion*, mutual *respect* and *leadership* qualities. After additional intermittent questions, the learners came to appreciate the value of co-operative learning in improving their learning quality, demonstrated by the way they enthusiastically participated and enjoyed working in co-operative learning groups.

c. I challenged them to determine how best to continue with their planning. They eventually resolved this challenge, displaying *courage and motivation,* by recognising that they could, and should, execute the rest of their planning in a metalearning setting. Although each individual had a different plan due to the differences in the focus of their chosen individual environmental development project, their co-operative learning groups again acted as the community of truth that ensured that each individual learner generated the best possible quality plan for resolving the real-life challenge, which further more displayed *initiative* and *effort.*

d. During the progression of the learners in executing their plan without instruction from me *(*which displays their *perseverance*)*, I continually reminded them of monitoring their learning through their own critical reflection of how well they are executing their plan and how their co-operative learning groups play a role in the monitoring process as they come together from time to time.

e. After learning task completion, the learners displayed *honesty* and *integrity* when they critically assessed their own learning as the final metalearning strategy, with the co-operative learning groups again contributing to the improvement of the quality thereof.

Unfortunately, because of certain unforeseen circumstances, I occasionally reverted to my traditional teaching of telling, showing or doing, which bothered me because I felt incompetent. I then recalled the principle that a FOL must operate from a professional and ethical viewpoint in the transcendental paradigm of education, which demands authentic learning and facilitating it.

The disposition of the learners may express a particular unforeseen need that will not allow the learners to achieve the learning outcomes in the way required by the transcendental paradigm. In this situation, the FOL may make a professional decision to sacrifice the authentic educational intervention of acquiring what is needed by the learners in order to achieve the higher education aim through edutainment, providing that it is only a short interruption of the normal course of authentic learning. If what needs to be acquired is of more substance and will take a relatively greater amount of time, the FOL may professionally decide to utilise the education paradigm closest to the transcendental paradigm on the level of quality that will allow the learners to acquire what they need.

The FOL may, therefore, 'leave' the transcendental paradigm for the time period necessary for the learners to acquire what they need and re-unite with the paradigm as soon as possible. This emphasises the required professionalism of the FOL to make the best possible decisions within the moral context of education and its ethical imperatives.

In time, my learners did not question me as frequently and astonishingly, I did not need to explain work to the learners regarding the computer software programs such as Microsoft Word, Microsoft Excel and Microsoft Access and HTML. Learners made use of numerous resources (as mentioned above) to understand the functioning of these programs. Questions directed to me were sometimes interrupted by the learners themselves saying, "Oh, never mind, Ma'am. I figured it out."

Implementing all the different learning task feedback functions now became easier. This was only achieved due to regular engagement with facilitating learning in practice.

c.   *Learning task consolidation*

The research that the learners carried out and, ultimately, the projects they submitted were very pleasing. The websites that the learners created were extremely impressive, particularly since I had not given any instruction regarding websites (HTML) to them at all.

Learners displayed that they had obtained the knowledge that the curriculum required, which included background and font colour, inserting bullets and numbering, horizontal lines and inserting images and hyperlinks into their webpages. However, they demonstrated much more. Some learners added animation effects, with text running across their webpages. Other learners
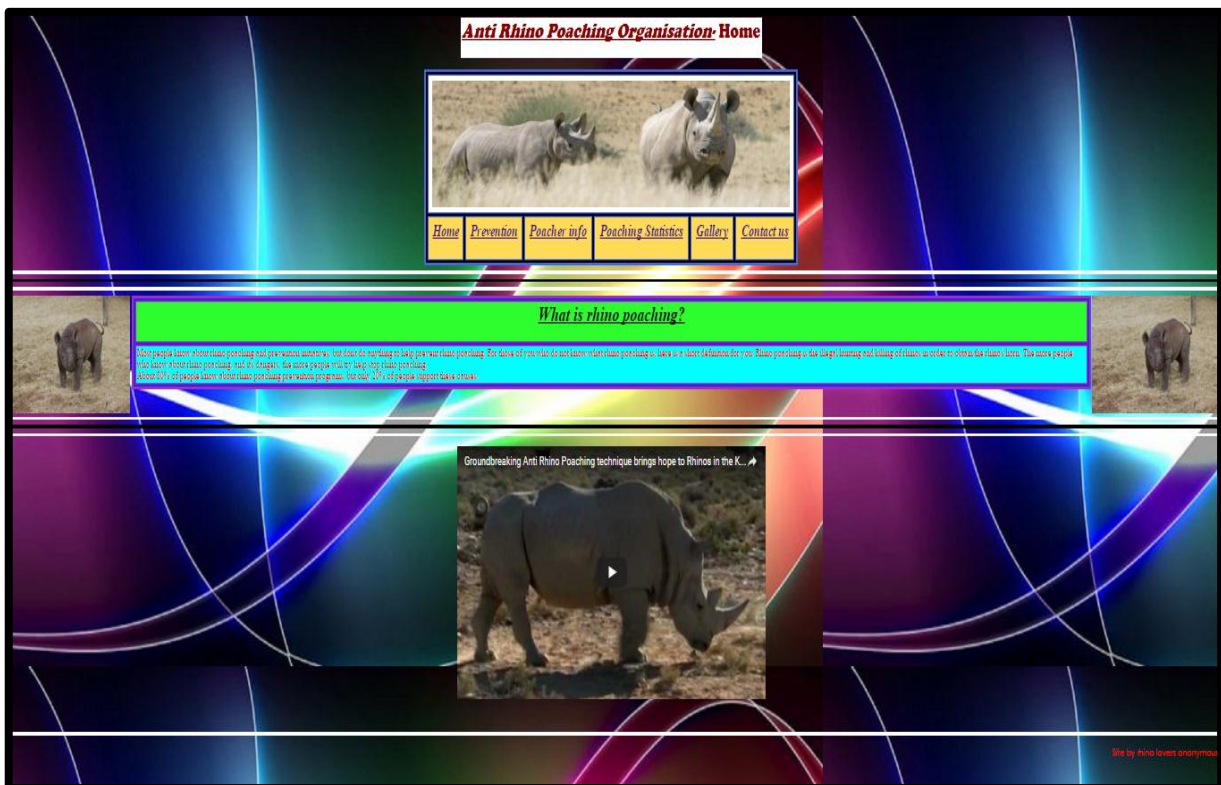
included advanced hyperlinks in their webpages in order to access, for example, video clips from YouTube. Below is an example of a learner's newly created website, which includes the coding page and the actual display of the website's homepage:

12. Figure 4.5: Extracts from a learner's website's homepage: coding page and website display

   (Source: Own screenshot)

In assessing all the challenges of the learners, they did well. One learner who received 98% for her project approached me two weeks after she had submitted her project and stated, "You would have seen I made a mistake on the one question I created. I put the wrong answer underneath it. I noticed it when I did more research on it over the weekend. Can I please correct it?" This anecdote indicates the lengths to which a learner went beyond an already demanding real-life challenge (still doing research, still looking for more answers and comparing notes with other learners in the class *after* the project had been submitted) to improve the quality of her learning: Although all learners did not go to these lengths, I observed a general tendency of learners to remain on task for increasingly longer periods of time, which was not the case before. In fact, learners would rather complete an assignment as soon as possible in order to do things that were not task related. The way in which learners were taking responsibility for and control over managing their own learning was remarkable. As a reflective practitioner, I was curious about whether my peers were also having such experiences. During *ad hoc* discussions with my peers, I received confirmation that the tendency that what my learners were exhibiting was uncommon.

I conducted ten semi-structured interviews the following year with the grade 12 learners, which were the same group of learners that I interviewed the year before when I facilitated my first grade 11 learning practice. I relay the highlights here.

16. **Table 4.9: Semi-structured interviews with Grade 12 learners after facilitating my learning practice: Conservation**

What was different in this real life challenge as opposed to the previous one?

- *It differed because we were not spoon fed anymore, and instead of doing one activity we did more than one thing; we had all the different aspects of Word and Access and Excel in one, rather than doing one small question at a time.*
- *We got to do it ourselves and this differed from the activities we did in class.*
- *I enjoyed the challenge. You had to give your own input and do it for yourself.*

What did you like most about this real life challenge?

- *I enjoyed that we had to do so many different things in Microsoft Word, Excel and Access. What was most exciting is that we had to do a lot of research ourselves without you helping or showing us. We solved the problem ourselves.*
- *I thoroughly enjoyed it – it was better than most challenges we do in class. Working on*

- *I liked it, because you are doing it yourself. When you are doing it yourself it is easier and you discover things you did not know how to do. For example I discovered Access. I did not know anything about that and by doing it myself I got to understand.*
- *This challenge actually challenged me in bettering my ICT skills, opposed to the activities in class which basically gives you everything. The challenge literally improved my skills.*
- *Designing a website was really cool.*

What was the biggest challenge you has with this real life challenge?

Numerous challenges were mentioned here depending on what each learner found challenging. What should be highlighted however is that the researcher asked a follow-up question that stated: 'did you *solve the challenges you faced*/encountered in this real life challenge?', and every single learner answered in the affirmative when replying to that specific question.

How well would you say did this learning task contribute to preparing you for the challenges of real world outside regarding ICT?

- *This challenge made me really aware of CAT and showed me how to develop a skill. It is going to benefit me after school, as I know how to use all the programmes.*
- *It prepared me because it showed me that when you are really focused and you do planning properly, it is going to work out.*
- *The challenge helped me a lot. By researching it helped me to discover what I wanted to do after school. I plan on studying computer sciences and IT.*
- *The information you had to gather helped us a lot, because I didn't know what I wanted to do and it taught me how to and where to go.*
- *It is preparing me for the future – I believe I can go to a large business and create forms, websites or help them with their ICT problems.*

> **What would you propose to improve on my lessons?**
>
> **The following response was most representative of the question asked:**
>
> - I think it went well just the way we had it, because we learned more by ourselves than it being given to us. So you remember more stuff when you figure it out yourself and it is interesting that way, instead of it being spoon fed to you.

See the "End product (my example)" and "End products of learners" in the "Learning Task 1 Package" folder for examples of the learning products produced in this cycle of my action research.

4.2.3.4 Reflect

I was somewhat disappointed with learners' responses to my questions during these interviews I conducted. Perhaps this was due to the conditions under which it was conducted, namely, at the end of the year when the learners' focus seemed to be at another place and me being under pressure to complete it before the learners will leave school to prepare for writing their exams. But in my reflection, not only in this final cycle of my action research, but regarding all interviews I have conducted, I am lacking sufficient skill and technique to probe the interviewees answers with penetrating questions that will provide a much richer set of data – something I need diligently work on.

Fortunately being a participatory action research approach with concrete experiences of my own personal interaction with my learners during my observation phases of all my action research cycles, but in particular this one, I can confirm a much more vibrant and vivacious participation of the learners than the interviews seem to convey – especially regarding their excitement of the construction of a website as their instrument of managing their conservation project.

My learning task design and formulation was an improvement on my first learning task in that it is much more enticing and inviting and less than an assignment that should be executed according to the instructions given. However, I discovered another critical deficiency in the formulation of this learning task: It lacks the characteristics of a *challenge* because it does not imply the requirements of the highest possible quality of learning through the use of adjectives in the setting of the parameters. A better formulation of my learning task presentation, to rectify this shortcoming of the practical assessment task that I made use of, could be the following:

> *How will you ensure a sustained environmental development project within which every resident in your community will participate to the best of their ability in a continuously well-informed way to create an environment for the community that will consistently enhance the well-being of every resident while you will manage the entire project and keep everyone constantly informed about new developments and the progress of the project.*

I set out to make a systematic improvement in my asking of the different kinds of metalearning questions to learners during learning task feedback. My early observation prompted me to deviate from my original intent. I decided rather to improve the quality of my facilitating learning capability within the nature of the two learning task execution structures, namely metalearning and co-operative learning. This focus allowed me to review all the aspects that these structures demand from learners, and how I could and should improve the quality of my facilitating learning within these parameters. This was a great advantage because once I managed to facilitate the establishment of the metalearning and co-operative learning structures, I could concentrate on my original intent.

My learning task design was good and, in spite of serious weaknesses in my learning task formulation and subsequent presentation, the quality of the learners' end product outcomes and their attainment of fundamental human virtues were remarkable. Going forward, I am curious to experience what will happen if my learning task presentation and especially my learning task feedback – that needs lots of improvement and much more experience in all of its actions, requirements, options and structures – approach its best possible quality.

4.2.3.5 Review

I am satisfied with my learning task design. This is confirmed by the students' response to resolving the real-life challenge, but my learning task formulation for presentation needs more attention. I need to especially improve my learning task feedback through much more experience through an extended period of time.

This third and last cycle of my action research afforded me the opportunity to discover and experience the appropriate structures of metalearning and co-operative learning within which learning task feedback is situated. My aim is to continue with improving my facilitating learning in practice in all dimensions and on all levels.

At the end of my first professional facilitating learning experience in practice, I have quoted Palmer (1998) with at the end of my first facilitating learning experience with a slight inclination of despondency at the challenges of education for the twenty first century. After my second experience, I have become so inspired, at not only what is possible, but also how authentic learning and the professional practice of facilitating it, allows us access to what we are in desperate need of. Slattery (1995, pp. 296-297) calls it a proleptic curriculum: something ahead of its time, which answers objections before they have been raised:

> A proleptic curriculum offers a postmodern vision of justice, complexity, compassion, ecological sustainability, spirituality, and internal relatedness. A proleptic understanding of the integration of time place, and self is one of the most essential elements of curriculum development of for the postmodern era … of the postmodern curriculum that is radically eclectic, determined in the context of relatedness, recursive in its complexity, autobiographically intuitive, aesthetically inter subjective, embodied, phenomenological, experiential, simultaneously quantum and cosmic, hopeful in its constructive dimension, radical in its destructive movement, liberating in its post structural intents, empowering in its spirituality, ironic in its kaleidoscopic sensibilities, and ultimately, a hermeneutic search for greater understanding that motivates and satisfies us on the journey.

I have had a glimpse of this future right now.

4.3 CONCLUSION

My participatory action research took me on a life-changing journey. I was aware of my education practices before I was introduced to authentic learning and facilitating it. Theoretically and from the little exposure to the practice of facilitating learning during my BEd (Hons) studies, I realised that there was a significant difference between my previous traditional education practices and the professional practice of facilitating learning. However, I was not prepared for the impact that it would have on my learners, the school, the wider education fraternity, and me.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The Waste Land

We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time.
(T.S. Elliot 1922)

5.1 INTRODUCTION

As indicated in Chapter 1, I have been practising CAT education for nine years. Since my education practice does not differ much from the generally accepted education practices of my colleagues in my own and other schools, I have become quite comfortable with my CAT education over the years. My promotion to Head of Department confirmed my confidence in my expertise in my teaching, management and mentorship of other teachers in the subject. I maintained a passion for the subject and its teaching, partly because of its 'technicist' nature. Although the curriculum and the recommended Learning and Teaching Support Material (LTSM) endorsed the prominence of such a generally accepted 'technicist' education practice, it seemed as though the purpose of solving real-life problems did not feature as prominently as it could or should. This subtle discontent was confirmed when I was introduced to the concept of authentic learning and the facilitation of it.

I, therefore, engaged in this research challenge with the purpose of pursuing an authentic CAT education in practice. In this chapter, I attempt to reach conclusions regarding my research as a whole through answering my research questions and make some recommendations for the future of my own CAT education practice that may be valid to other CAT education practitioners.

5.2 ANSWERING RESEARCH QUESTIONS

In this section, I aim to draw conclusions regarding my research questions. I repeat the questions here for easy reference:

Primary research question

How can teachers ensure that their education practice will fulfil the requirements of an authentic Computer Applications Technology education in practice?

Subsidiary research questions

In order to explore the primary research question, the following subsidiary research questions should be addressed:

- What are the current curriculum requirements and the current dominating education practices in Computer Applications Technology?
- What constitutes an authentic Computer Applications Technology education in practice?
- How can I improve my education practice to ensure that it fulfils the requirements of an authentic Computer Applications Technology education in practice?

5.2.1 Current CAT curriculum requirements and dominant education practices

The source for drawing conclusions regarding the curriculum requirements is primarily the official CAT curriculum documents, namely the Computer Applications Technology (CAT) National Curriculum Statement (NCS), which includes the Curriculum and Assessment Policy Statement (CAPS) of the Further Education and Training (FET) phase, Grades 10 – 12, as well as its associated materials and its recommended LTSM.

Regarding the question of what is Computer Applications Technology, the CAPS curriculum in the form of the CAPS document (Department of Basic Education, 2011, p. 8) states: "Computer Applications Technology is the study of the integrated components of a computer system (hardware and software) and the practical techniques for their efficient use and application to solve everyday problems." It denotes the main topics in the CAT curriculum as solutions development, system technologies, network technologies, Internet technologies, information management and social implications, which are then translated into the six specific aims of CAT.

There is no doubt that the aims and the corresponding curriculum content and scope cover all the necessary aspects of such a proposed CAT curriculum, and its suggestion that the topics be integrated is admirable. Since teachers have been provided with such a complete set of ready-made supporting teaching and learning materials (Dvorak, 2011, p. 24), it is difficult not to adopt them and utilise them as they stand. In addition, since they are recommended by the

authorities, it is more convenient to use them as they are. Because they are also used in CAT teacher meetings and training sessions by the authorities, it appears that the use of them as they stand is officially condoned. Since teachers are provided with such a comprehensive and detailed set of teaching and learning support materials, which must have been very time consuming to produce, it seems pointless to spend additional time producing one's own LTSM.

Perhaps not intentionally but the current CAT curriculum requirements appear to compel teachers to adopt a technicist approach to CAT education practices. I have practised CAT education in this way from the beginning of my career and have become increasingly competent in it to the extent that my expertise can be affirmed by my promotion.

The first subsidiary research question also included a search for the current dominant CAT education practices. This investigation took place primarily through the first comprehensive cycle of my participatory action research project when I lodged an inquiry into my initial CAT education practice in accordance with the CAPS curriculum requirements. Needless to say, this endeavour is a direct consequence of the answer to the first part of the first subsidiary research question. I observed and reflected on the way in which I have become so familiar with its application when I am conducting my CAT education practices.

It was easy to identify the characteristics of my CAT education practices to which I have become so accustomed. The practices do require pedagogical expertise (Harris, Mishra, & Koehler, 2009, pp. 393-416) to translate technological potential into solutions for pedagogical problems that must challenge learners to solve real-life problems in new and innovative ways (Kirkwood & Price, 2005, pp. 257-274). With regard to what was needed to be taught next, my point of departure was the CAPS curriculum document. From this provided work schedule, I would consult my textbook that provided me with the complete lesson plan to be followed. In my own preparation at home, I would familiarise myself with what was prescribed for the particular lesson as provided in the textbook. This included the theme of the lesson, the learning outcomes and assessment standards, content details, the scenario and its context, the lesson outcomes and the LTSM, as well as the learning activities for the learners to carry out and the daily assessment that should be done. In my computer laboratory, with lock-step precision, I would follow the suggested procedure while using all the provided LTSM.

Unsurprisingly, my investigation revealed that my colleagues conducted their education practices in the same way, with perhaps minor deviations in the finer detail. As far as I could establish

through my networking with other teachers and heads of departments where these issues were part of the discourse, this was the generally accepted CAT education practice – with the undeniable exceptions to the rule.

My conclusion regarding the second section of my first research question is that the current dominating CAT education practices are characterised by a generally accepted technicist education practice that may have detrimental consequences when using computer software applications to solve a challenging real-life (ill-defined scenario that refers in essence to a virtual reality) problem. I have amended this CAT specific aim in view of my conclusions regarding my second subsidiary research question.

5.2.2   Requirements of the contemporary CAT curriculum

The conclusions from this second subsidiary research question have been drawn from Chapter 1 and Chapter 2. From these two chapters, the following could be concluded regarding computer technology and ICTs in general and a contemporary CAT curriculum in particular. Computer technology and ICTs are well established and will continue to develop rapidly; however, future developments are not only unknown but also unimaginable and unpredictable. Presently, it is clear that we are unable to be without computer technology and ICTs but in many instances, this is not an issue because of its potential to enhance the quality of our lives.

However, there are negative aspects to the unsolicited and unpreventable invasion of computer technology and ICTs in all domains and levels of our lives. These include:

a.   an increasingly unknowable, supercomplex world;
b.   a diminishing, humanising, face-to-face society and an increasing, dehumanising, face-to-screen society;
c.   a society that is increasingly losing touch with living real-life and knowing and living no other life than virtual reality (online);
d.   an increasing experience of personal uncertainty, causing personal anxiety in a world full of insecurity;
e.   the addictive qualities of contemporary computer technology and ICTs that cause a progressive, overbearing, short-term memory, an escalating inactive, long-term memory – an effective loss of memory – a brain dwindling in its higher functions, a growing numbness to

dopamine excretion (hormone responsible for the experience of pleasure), a magnification of emotional stuntedness and loss of feeling; and

f. the reality that computer technology and ICTs are creating humanoids that resemble humans in the very tasks that were assumed reserved for humans alone. The resemblance includes reading emotions of other humanoids and human beings and emotionally responding.

These are the cause of the increased loss of our personal identity and our sense of being.

All of the above hold serious consequences for a contemporary CAT curriculum. However, there is a dilemma. As a subject, Computer Applications Technology, in its nature and structure and even in its end-user software application, is characteristically technicist. Its curriculum is in essence an instrument – an 'extension' of the human brain. Its 'curriculum', therefore, is 'limited' to knowing what it is and how to use it – its technological domain. What it can and/or should be used *for* is determined by the user.

Within the framework of this study, an authentic CAT curriculum is determined by education. This is the reason that the exploration of what constitutes a contemporary authentic CAT curriculum reveals little regarding Computer Applications Technology but rather what constitutes the education of a human being in our 21st-century world with its perplexity.

This perplexing future "poses radically different challenges [to education] and that is why we require a qualitatively different approach to teaching in the twenty-first century" (Hargreaves, 2003, p. x). Barnett (2004, p. 256) describes this radically different challenge and its consequent qualitatively different perception of education as follows: Education is, in principle, not an epistemological task of the acquisition of knowledge and skills but is primarily the ontological challenge of the transformation of the human being – nothing less. It is in essence a change from a 'learning to know' paradigm to a paradigm of 'learning to be'. Its foundation is pursuing authenticity, "the key concept within the deep structure of … education" (Barnett, 2007, p. 40). In a pragmatic educational sense, this means that the 'instrument' of CAT must be utilised by learners ultimately to 'find themselves'. This is achieved through being confronted with a personally demanding, supercomplex, real-life challenge that simultaneously activates the whole being of the learner (PQ, IQ, EQ and SQ), thus accessing the learner's potential human qualities and transforming them into essential human virtues. The conclusion regarding this second subsidiary research question is well summarised by Slabbert's (2015, p. 132) aim of education:

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

"The aim of education is to design the most powerful learning environment possible that will compel learners to empower themselves to maximise (completely develop and fully utilise) their human potential (essential human virtues – ethical qualities of moral excellence) through facilitating (demanding the highest possible quality of) lifelong, authentic learning (resolving real-life challenges) for the purpose of creating a safe, sustainable and flourishing future for all. (p. 132)"

5.2.3 Fulfilling the requirements of an authentic CAT curriculum in practice

The source for the conclusion of the third subsidiary research question is the comprehensive cycle 2 and cycle 3 of my participatory action research. While cycle 1 was the in-depth discussion and investigation of my initial (or at that point in time, my existing) education practice, cycles 2 and 3 were iterative cycles of employing a transformative curriculum and pedagogy in an attempt to fulfil the requirements of an authentic CAT curriculum and subsequently, to improve my CAT education practice through an iterative process of action research.

Chapter 2 indicated that one way of fulfilling the requirements of an authentic CAT curriculum is to adopt the corresponding professional practice of facilitating learning (Brierley, 2003) with its three purposes (initiating learning, learning and maintaining learning) and its six functions (learning task design, its presentation, authentic learning, learning task execution, feedback and consolidation), each with its essential requirements, actions, options and structures for meaningful learning (Jonassen, Howland, Marra, & Crismond, 2008). This professional pedagogy is both radically and qualitatively different from the traditional pedagogy of teaching and for all practical purposes, is its direct opposite. Moreover, since the pedagogy of teaching is inevitably teacher and teaching centred, its justification in education may be questionable. However, since facilitating learning is designed for the sole purpose of ensuring the highest possible quality of learning and personal development of the highest order, there could be little doubt about its learner and learning centeredness and its subsequent justification in education.

My first superficial introduction to authentic learning and the professional practice of facilitating it was exciting because I could identify that it may fulfil the void I subconsciously observed in my own education practice. Subsequent exposure with more of its substance left me with the feeling that I might be applying this already in my practice. With more exposure, I quickly realised how wrong I was about this assumption. Its complete novelty in my frame of reference

frightened me because of my growing uncertainty regarding my education practice. As my exposure increased, I became weary and with a mounting number of unanswered questions, I began seriously to doubt almost everything about it. When it was suggested to me to perform my research within this context, I wanted to withdraw but subconsciously, I was prompted to accept the challenge. However, nothing could prepare me for the day I needed to engage with my first fully fledged facilitating learning practice of which this is a report.

Everything was significantly different – a truly out-of-comfort zone experience. In Cycle 2, I endeavoured to experience as much as possible regarding the practice of facilitating learning and my improvement of it. In Cycle 3, the focus of my facilitating learning practice was turned to facilitating learning within the metalearning framework for the attainment of the essential intrapersonal human virtues within the co-operative learning framework and, as in Cycle 2, my improvement of it.

The crux of my conclusion regarding the fulfilment of *an authentic CAT curriculum* in practice is summarised below within the context of the professional practice of facilitating learning.

5.2.3.1 Facilitating learning in general

Facilitating learning is a highly professional and demanding task. Every action, requirement, option and structure within each function of facilitating learning is professionally substantiated and justified. The FOL, therefore, must be professionally able to justify every decision that is made during the execution of each function of facilitating learning.

5.2.3.2 Two crucial functions of facilitating learning

Although every function of facilitating learning is crucial, two of the functions are determinants for the success of facilitating learning, namely learning task design and learning task feedback. My conclusions regarding these two functions follow.

a. *Conclusion regarding learning task design*

Even though life presents a continual and overwhelming quantity of decisions to be made or challenges to resolve, finding the demanding real-life challenge with which learners should be confronted in an authentic educational context has proven, ironically, to be a major task. The

idea for a challenge may arise with relative ease, but it is its eventual accurate formulation that sets the boundaries within which it is to be resolved – clearly but implicitly ill-defined, just as a challenge will appear authentically in real life. (See the difference between my attempts in the original learning task designs and the updated versions of the subsequent attempts in the review phases of my first and second comprehensive action research cycles.) What is also very important is that learning task design and its resultant presentation is the only function that can be designed, planned and prepared. All other functions and their successful execution are dependent upon learning task design.

In addition, learning task design significantly identifies an unguided (as opposed to a guided) discovery learning in that the real-life challenge is *personally* demanding and can be resolved only through the learner producing the *highest possible quality of learning* and *personal development of the highest order*. To accomplish this achievement requires the professionalism of a significant other in the form of an FOL to design and present an appropriate learning task.

b.   *Conclusion regarding learning task feedback*

The second determinant for the success of facilitating learning is its function of learning task feedback. As with learning task design, this function is to maintain learning for the sole purpose of producing the highest possible quality of learning and personal development of the highest order. This function is completely dependent upon the learner's responses and cannot be designed, planned or prepared but facilitates the metalearning and co-operative learning frameworks within which it should take place.

Besides the highest quality of learning and personal development of the highest order achievements, a professional significant other is indispensable, especially for the most vital educational outcome within the super complexity of our unknown, 21st-century future. Claxton (2014) paraphrases:

> Education is essentially a moral enterprise. Whether overtly or covertly, every aspect
> of a schooling system is riddled with value judgements about what is worth knowing,
> and what kinds of young people we are trying to turn out.
> (Claxton G. , 2014)

With the advent of technology, each individual human being has been endowed with an extraordinary freedom and power to make sense of the world through their own constructions thereof. However, within a world of super complexity, these constructions are perpetually contested. This means that each one of us must ensure absolute integrity in our constructions in order to create a safe, sustainable and flourishing future for all. This requires us all to manage ourselves individually (metalearning) in an optimal way and willingly to submit our constructions to the severe scrutiny of others in the community of truth (co-operative learning) (Palmer, 2007, pp. 89-113) in order to pursue moral excellence (essential human virtues) to an extent never expected before and on levels never imagined before.

5.2.3.3 The risky character of education

Since education is primarily an ontological challenge of the transformation of the human being, it requires a transformative curriculum and pedagogy that is fulfilled by the professional practice of facilitating learning. Such a transformative curriculum and pedagogy "have to be practiced as endeavours of high risk; high risk not just for the participants but also for the academic staff in their educational roles … For that, the actual learning processes themselves will also need to be both high-risk and transformatory in character" (Barnett, 2004, pp. 257-258). Demanding moral excellence in education is an ethical imperative with such high risks involved. The first high risk is to allow the learner the freedom to explore whatever may be necessary to produce the highest possible quality of learning and at the same time, ensure that the exploration is educationally justified and that all safety and protective measures are appropriately maintained. The other high risk is one of a more personal nature. It is the incessant demand for the highest possible learning quality when the learners are required to submit their own learning quality and by implication, themselves as human beings to the ruthless scrutiny of the FOL and their peers (Palmer, 2007, p. 104). "Socrates was a master at penetrating behind perceptual and emotional surfaces to the deeper, core 'presence' of the other. To be in dialogue with Socrates was to find one's precious opinions and certainties, which were based on appearances, dismantled and shuttered – and then, as a result, to discover some deeper truth about oneself" (De Quincey, 2005, pp. 173-174). This is a risky business, but there is no alternative for the required outcome. Teachers may try to avoid this confrontation because it is never easy or pleasant, but it is essential if we are to ensure the learner's personal development of the highest order.

Defining these conclusions emphasised the gross deficiencies in my initial education practices and the enormous remaining imperfections, even after my attempt to improve my education

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

practice to fulfil the requirements of an authentic CAT curriculum in practice. Standing at the very beginning of a journey into the continual improvement of my professional practice of facilitating learning to fulfil the requirements of an authentic CAT curriculum in practice, I have been privileged to have experienced the potential of something in which I have succeeded, albeit in the smallest of margins. It may be argued that the noble, intended outcomes of facilitating learning as they are pronounced in Slabbert's (2015, p. 132) aim of education will never be achieved because they are too idealistic. My counter argument is only if they *are* the ideal, is their achievement worth pursuing.

5.3   THE RESULT OF A SMALL SUCCESS

There may be many weaknesses in the research design and its execution and similarly, this report may contain many shortcomings. However, what cannot be denied is unsolicited feedback that is closely associated with the research. Although some feedback may be anecdotal, it represents an indication of observable change, while other aspects are more substantial in what they portray. Although these results were not anticipated in this research, it is likely that they are the direct result of my attempt to improve my CAT education in practice since I could not establish any other likely parameter that may have been the cause.

My second comprehensive action research cycle continued through most of the learners' Grade 12 year in the CAT classroom before the students wrote their mid-year preliminary and final examinations. The learners were confronted with the real-life challenge of motivating their community to become involved in a conservation project. This required the learners to monitor and keep the community continuously informed about their progress and implied that a website would possibly be most appropriate. Although the learners enjoyed their first real-life challenge, which was presented the previous year and involved their career choice, it was the conservation challenge and in particular, the idea of the website design that made the largest impact on the results of my research.

Below are the 'general' accolades that were received. However, there was an observable increase in the number from both learners and their parents at the end-of-year awards ceremony through emails and on social media, which was unusual. These accolades also extended into the following year when learners would visit me or contact me to share their experiences of the real world regarding work and their achievements (attainment of high marks and certificates) at

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institutions where they were continuing their education. A few of these deserve mentioning as representative:

- "I started programming today! I am really enjoying it. Yesterday I did end-user computing that is basically CAT and then analytical techniques, which is maths. Today, however, I must calculate the area of a rectangle in my programing software – going to be quite a challenge (but then I am used to that – I was taught by you)." And, six weeks later: "Hi Ma'am. Ah, I miss you so much! I have been so busy with college, studying for tests and completing assignments, but it has been fun. College is really amazing. I have created my own game and a few other things. I got 95% for my first assignment – thought you would like to know."
- "Look at this Ma'am" (a certificate with a 100% score). I know you will be proud of me. Thanks for always challenging me and believing in me."
- "Well, you were and still are the best educator I have ever had. Thank you Ma'am."
- "I'm so glad that I got to have you for a CAT teacher."
- "Ma'am, thank you for inspiring me; you are such a huge inspiration."
- "I am excited for my future, and I am going to explore website development because of what you taught me Ma'am – **no, what I have discovered** [original emphasis]."
- Ma'am, can I come back to your class? Your class was more challenging than my current work environment."
- From a parent: "My son always said that CAT was the only valuable subject that prepared him for the real world. He is currently pursuing a career in website development thanks to you."
- Two emailed letters:

Dear Mam,

When I chose CAT, I didn't think I would love it so much, but getting to learn all the elements of a computer, learning Word, Excel, Access and HTML was the best experience for me as I will need all this knowledge when I grow up. I also use it now that I am in college studying WEB Development. Learning HTML in school has helped me with the course that I am studying currently because it is part of what I am studying.

The reason I loved CAT so much was because of my great teacher and also because I will need it in any job that I apply for. I found it interesting, and it was the subject that always held my

attention. In all jobs these days, you need to have computer skills and doing CAT allowed me to have these basic skills. The main reason for choosing to study something in the IT field is because of my passion for technology. There is a demand for web developers, so this will ensure that I always have employment. Another reason for choosing to study is because it is something that I can practise from anywhere in the world as long as I have Internet access. I have always loved technology and have always been interested in learning more about technology and computers in general, but you developed this love through your real-life challenges in class. You made me realise that in today's day and age, it is important to have computer skills because technology is constantly moving forward and becoming rife in everyday life.

Love you always

"Special K"

Mrs Venter

As a child of the technological era, it just came naturally to choose Computer Application Technology as a subject in Grade 10. This is such a fun, enjoyable subject; you learn so much like things you never knew about. This subject is just so nice because every career path you go down requires you to have some sort of computer background.

I am currently studying Software Development and as part of our course, we have to do a module called End-User Computing, which is for people who do not have a computer background. CAT provided us with a computer background for college and for any job that we would want to apply for. Choosing CAT as one of my subjects was one of the best decisions that I made as this was the reason I ultimately decided to follow a career in computers. In class, I faced a lot of challenges, which required me to study a lot and do a lot of extra work at home to make sure that I understood the work at hand. This is a subject that requires a lot of research, planning and hard work but once you have put in that hard work, everything becomes easier.

I want to thank you for your hard work, Ma'am! Attached is website for you, Ma'am – just for fun – it captures our Grade 12 year … LOL!

Love

"Hail-Smail"

The most surprising for me was the announcement at our year-end awards function. The Department of Basic Education awarded the CAT Department a certificate for the highest average CAT mark in the Johannesburg West district. In addition, the learner with the highest score for CAT in the district (95%) attended my class.

From this point forward, things developed quickly:

- The Johannesburg District CAT Facilitator from the Department of Basic Education asked me to assist them in compiling the Grade 11 Practical Assessment Task (PAT) for the entire Gauteng province.

- In view of this, the principal of my school was of the opinion that something 'magical' was happening in the CAT Department and asked me to train all staff members in facilitating authentic learning in their classrooms. The CAT teachers are currently learning together to accomplish this, and it will soon be transferred to all staff members.

- The Head of the Guidance Department at my school thanked me for my positive contribution to the learners' lives. The department felt strongly that CAT should be implemented at an earlier Grade than it is currently because the subject clearly made a difference in the learners' lives.

- It was most remarkable when I was called in by my principal who told me that the news of CAT being taught 'differently' to the other subjects and this 'different' type of education is delivering exceptional results has spread quickly – so much so, the Grade 9 learners' choice of CAT as their preferred subject has caused next year's CAT learners to increase from three Grade 10 classes of about twenty learners each to four classes of about thirty-five learners each. Subsequently, the governing body of the school is currently deliberating the upgrading of the current computer laboratories and/or adding more.

5.4   RECOMMENDATIONS

The preceding results are also an indication of what the recommendations should be. If these successes could be achieved with a highly deficient authentic CAT education in practice by a single teacher, then the possibilities and potential would be remarkable if the professional practice of facilitating authentic learning becomes the focus of continuous research and professional development.

The rather superficial explorative nature of this research project was important, not so much with regard to particular results but rather becoming aware of the vast scope, depth and value of facilitating authentic learning. In this regard, a thorough analysis and wise prioritisation of every aspect of the professional practice of facilitating authentic learning will be necessary to ensure that a systematic programme of research and practice will complement each other in the process of pursuing excellence. With the focus on one meaningful unit of facilitating authentic learning at a time, valuable research can be done since participatory action research is not an add-on to a teacher's workload but rather a more conscious way of the education practice one is conducting with the aim of improving it, all teachers at a school could collaborate in a community of participatory action researchers to improve the education of facilitating authentic learning continuously.

5.5   CONCLUSION

If I, as one teacher, with a severely imperfect attempt at improving my professional education practice could achieve the results that are portrayed in this research, then the same is possible for all teachers. Moreover, if everyone collaborated in this effort, the results could be remarkable. This is my real-life challenge, not only for all CAT teachers but also for all teachers to ensure that their education practice will always be subject to the pursuit of excellence.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

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