Professional development of teachers at a private high school: a peer mentoring initiative

by

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DECLARATION OF ORIGINALITY

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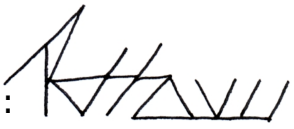
I declare that the thesis titled *Professional development of teachers at a private high school: a peer mentoring initiative* that I hereby submit for the degree Philosophiae Doctor (PhD) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

Signature: 

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The author, whose name appears on the title page of this thesis, has obtained, for the research described in this work, the applicable ethical clearance. The author declares that she has 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.*

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In loving memory of

my grandfather who 'rubbed shoulders' with Einstein at Princeton University and who inspired my time travels.

My father who always supported me unconditionally - and inspired me with his humble nature, excellent storytelling, singing and keen understanding of human nature.

Carlos and Thalia - words cannot express the sense of emptiness without you.

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ABSTRACT

In the South African context valuable academic contributions regarding Whole Brain® facilitating learning have been made in the last decade. Research has been conducted on professional development of teachers at primary schools, as well as professional development of lecturers at institutions of higher education. I identified a gap in existing literature, regarding what was being done at high school level and the possibility that Whole Brain® facilitating learning could be a beneficial learning tool to use in one's teaching practice.

Thus the study commenced with the research premises based on a mixed methods approach, including quantitative and qualitative data sets. This study investigates to what extent transformation took place in the teaching practice of a group of volunteer professionals at a private high school, using an Action Research design. My Action Research was supported by the professionals' own action learning during the commencement of the fieldwork and we would regularly collaborate and reflect on the new knowledge. The afore-mentioned underpins the constructivist theory, which assumes that collective life experiences and multiple realities of the participants and myself add to a collective knowledge base. Thus new knowledge and constructed knowledge becomes part of a living theories practice. The study also focuses on an *asset-based approach* where the assumption is made that the professionals take responsibility for their own learning, becoming professional self-regulated learners in an environment where they are supported and encouraged to become more flexible in their thinking styles, not only to utilise their non-preferred thinking preference but also to capitalise on their preferred thinking preference and to set Whole

Brain® learning tasks and plan Whole Brain® facilitating learning. Therefore the participants were challenged not only to be more flexible in their own thinking preference and to explore the possibilities of their less preferred thinking preference or preferences, but also to design learning tasks that would facilitate learning by accommodating those learners whose thinking preferences are divergent from those of the professionals.

The fieldwork consisted of workshops (including non-participants) and one-on-one peer mentoring sessions that included cooperative learning through collaboration and experiential learning to encourage the professionals to become more familiar with their iPads. The workshops and one-on-one peer mentoring sessions focused on the extent to which the iPads could be used as a tool to facilitate Whole Brain® learning. The fieldwork focused on exploring in greater depth the possibilities of innovative ideas to transform the teaching practice of each individual participant, promoting Whole Brain® thinking and learning. Since this is an Action Research study, more cycles were discovered and probed during the course of the fieldwork and it will still continue after submitting the thesis.

The data sets consisted of exploratory and preliminary interviews, observations of the workshops and one-on-one peer mentoring sessions that were recorded in my field journal, observations of the professionals' teaching practices, the completed HBDI® survey by the professionals and myself, as well as semi-structured interviews and observation sheets of my mentorship practice completed by the professionals.

In course of the professional development program I observed professionals taking up their role and taking responsibility for their own professional development and self-regulated learning,

underpinning lifelong learning. In the process I also observed that the professionals showed flexibility in their thinking styles, designing innovative ways of learning and applying them in their teaching practices. Moreover, I realised my own transformative learning that underpins the constructivist theory and I continue to aim to transform my own teaching practice as well as my mentorship practice with the knowledge that I am also a lifelong learner.

KEYWORDS

Action Research
Collaboration
Community of practice
Constructivism
Cooperative learning
Experiential learning
Lifelong learning
Mentorship
Mixed methods
Multiple intelligences
Peer mentoring
Professional learning
Thinking preference
Whole Brain® facilitating learning
Whole Brain® learning
Whole Brain® teaching

ABBREVIATIONS

App	Application
HBDI®	Herrmann Brain Dominance Instrument®
ICT	Information and communications technology
PGCE	Post Graduate Certificate in Education
PGCHE	Post Graduate Certificate in Higher Education

CHAPTER 1
BACKGROUND TO THE STUDY

1.1 INTRODUCTION

This study probes my professional practice by applying Whole Brain® facilitating of learning (De Boer, Du Toit, Scheepers & Bothma 2013), underpinned by Action Research (McNiff & Whitehead 2009). I was curious to extend my own knowledge as part of the professional development (De Boer et al. 2013) iPad program for teachers at a private high school. Using Herrmann's (1995) metaphoric Whole Brain® model for learning and facilitating learning (De Boer et al. 2013: 279) supplemented by a constructivist paradigm (Nieuwenhuis 2010:51) and the belief that human realities add to knowledge construction, I took up the role of peer mentor with the realisation that I was a co-learner and the professionals were co-mediators (Gravett 2005:23-24). Jim Stark (played by James Dean) in *Rebel Without a Cause* (Ray 1955) took the dare to drive full speed towards the antagonist. Just like James Dean I wanted to explore the possibilities of breaking the rules. That is not to say to take part in a *chickie-run* and break the law, but to take another look at facilitating learning. Thus, my light bulb moment (See Figure 1) or conceptualisation for this study was based on the premise that innovative facilitating of learning (Du Toit 2012) more often than not contributes to enhancing the quality of learning (Slabbert, De Kock & Hattingh 2009).

Figure 1 suggests the initial idea for this study as indicated by the light bulb that originated in the D quadrant. The D quadrant is part of Herrmann's metaphoric Whole Brain® model (1995) (See Chapter 2, Figure 5 page 39) described as the upper right with descriptors such as conceptual, synthesising, metaphoric, visual and

integrative (Herrmann 1995:415). Herrmann (1995:415) delineates the left-brain thinking preferences into the A quadrant or upper left, defined as logical, quantitative, critical, factual and analytical and the B quadrant or lower left as sequential, controlled, conservative, structured and attentive to detail (Herrmann 1995: 415). In the right-brain mode of thinking Herrmann (1995:415) defines the C quadrant as emotional, humanistic, expressive musical and sensory. The aforementioned can be related to Gardner's bodily-kinaesthetic intelligence (De Boer et al. 2013:42). Similarly the D quadrant relates to Gardner's spatial intelligence (De Boer et al. 2013:42) and it is my most preferred quadrant; I capitalised on this thinking preference by exploring new possibilities to discover (De Boer et al. 2013:278) new knowledge and construct meaning within my teaching practice.

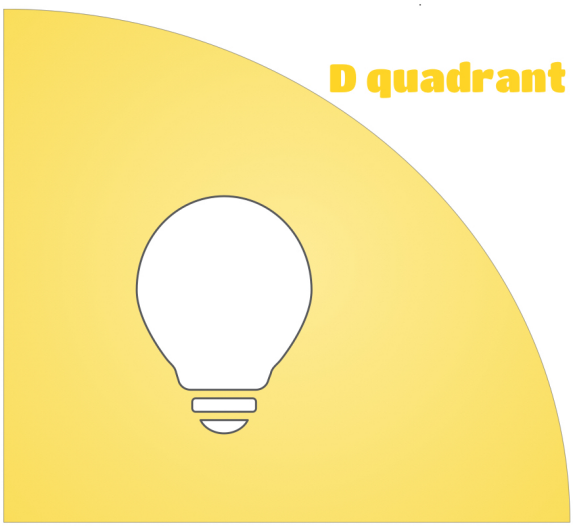


Figure 1: An adaptation of Herrmann's Whole Brain® model focusing on the D quadrant

Tabula rasa (a blank tablet) is what many teachers have regarding students when they start teaching. However, it is not the case. From a constructivist point of view every individual constructs meaning from own knowledge and the individual's existing knowledge contributes to learning (Gravett 2005:19-20).

Individuals create a reality underpinned by language and multiple truths (Morgan & Sklar 2013:73). Thus, seated in front of a teacher who believes the learners are a *tabula rasa* (Latin Phrases 2005), is in actual fact a class filled with individuals who have different thinking preferences. Moreover, the teacher has a unique preferred thinking preference. Herrmann (1995:20-22) states that some parents and teachers place too much emphasis on the development of the left-brain, when rather, an effort should be made to engage learners with different thinking styles in a Whole Brain® approach. Thus, Whole Brain® thinking should be emphasised (See Figure 2) and the focus should incorporate all learners' learning styles (Herrmann 1995:23).

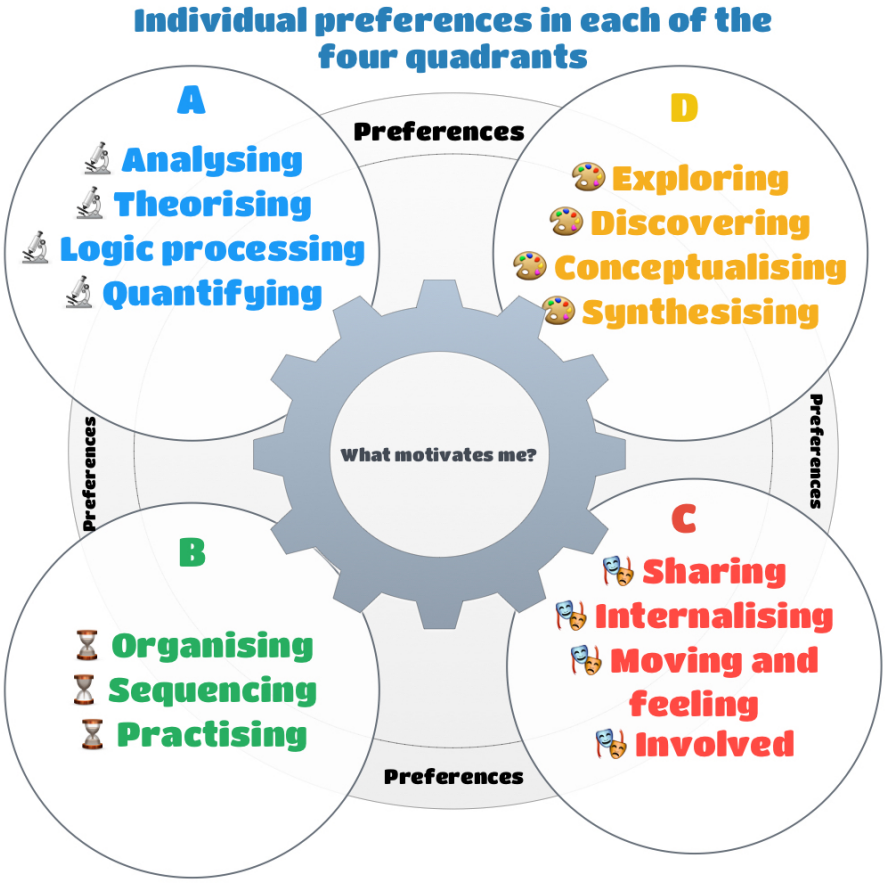


Figure 2: An adaptation of De Boer et al.'s (2013:275) individual preferences of learners in each of the four quadrants

In the post-modern educational context there is a shift of focus and the tendency is for teachers to observe the learning styles of the

learners in order to design learning tasks that will accommodate a variety of thinking preferences. A second objective of learning is to promote lifelong learning that suggests learners will become motivated to learn more (Coffield, Moseley, Hall and Ecclestone 2004:11).

I observed that when I was a learner at school my thinking preference was not accommodated during lessons, nor in assessments. At university a whole new world opened up for me, due to the freedom, although limited, when I reflect on those times, of choice and a greater appreciation of my creativity (D quadrant) in complementing the left-brain assessments. At post-graduate level I was introduced to the constructs of multiple realities, Whole Brain® thinking and the value of innovation, reflection and transformation as part of Action Research. Action Research can be described as 'facilitating beneficial change' (Davis 2004:5). Calhoun (2002:18) describes Action Research as a 'continual disciplined inquiry' that aims to observe, improve and transform the researcher's teaching practice. Winter and Munn-Giddings (2001:16) describe typical Action Research as an 'insider process' when professionals work together, developing their professional practices and in the case of this study professional learners also acted together, forming a community of practice, to transform their teaching practices. Furthermore Winter and Munn-Giddings (2001:16) argue that most Action Research is initiated within an organisation and the project facilitator becomes the 'facilitator' of Action Research. Similarly, I became the facilitator of professional learning at Wilberforce High School[1] coordinating workshops and one-on-one peer mentoring sessions with volunteer participant teachers (the construct professionals will be used for the purpose of this study).

[1] For the requirements of ethical clearance a pseudonym is used.

I had compiled a reflective self-development professional portfolio as part of Action Research (Du Toit 2002:269-270; Du Toit and Vandeyar 2004:135) that manifested a mode of inquiry to reflect on my professional practice. I continued to observe, assess, reflect on and evaluate my teaching practice in order to transform learning and implement constructive change. McNiff (2002:6) describes this form of Action Research as self-reflective and it forms the basis for the enquiry of a practitioner into his or her own practice. This self-reflective mode of inquiry inspired me to facilitate learning 'beyond the curriculum' on the premise of facilitating Whole Brain® learning (De Boer et al. 2013:72). Another important component of the professional portfolio was to make provision for learning style flexibility. By using Action Research to reflect upon my teaching practice and being in an environment that encourages innovative teaching, I have been empowered to continue to develop professionally and to facilitate inclusivity of learning, incorporating the different learning styles of Herrmann's Whole Brain® approach (1995:419). As a result of the success that I had within my own teaching practice by applying Whole Brain® learning and reflecting on its impact on learning I decided that this would be an innovative approach to further professional development at Wilberforce High School.

My initial investigation exposed a gap in the literature regarding Whole Brain® professional development at high school level. With this realisation in mind, I investigated to what extent Whole Brain® facilitating of learning can be applied within the context of Wilberforce High School. An opportunity was provided for this investigation when the researcher was selected as an ICT mentor with the focus on introducing the iPad as a tool for facilitating Whole Brain® learning. I made use of Whitehead's 'action planning'

construct where the objective is to ask critical questions (McNiff 2002:14) about my own teaching and mentoring practice and came to an understanding that might provide me with answers regarding the initial critical questions that I posed through Action Research.

1.2 MOTIVATION

Herrmann (1996:36-37) states that 'teachers who present information in ways that serve their own learning style deny learning to others who learn differently'. I have personally experienced this one-dimensional mode of facilitating learning and it nullified my creativity and holistic view of my teaching practice. As a student at school level I 'thought differently' than my teachers and some of my peers and could not fully comprehend why. Herrmann (1996:36) states that experiential learning can be infringed upon if the learning environment does not stimulate, but rather limit the learner's interest. Experiential learning was not part of my school career and I was not motivated in all the subjects I studied. Due to my experiences I now have a better understanding of why I felt stumped and it motivated me to be the complete opposite of the rote method of facilitating learning by my teachers.

I was selected as one of the 'ICT champions' for the implementation of iPads at Wilberforce High School. My passion for Whole Brain® facilitating of learning coupled with the use of the iPad seemed a perfect fit to explore to what extent the iPad could be used as a tool for facilitating Whole Brain® learning. Herrmann (1996:230-231) refers to so-called Whole Brain® champions – people who are motivated to become involved. He further refers to champions as people who will use new concepts to further the creative process, for example electronic brainstorming and the *Six Thinking Hats* (De Bono 2000). There are a variety of Apps (an acronym describing a

software application program) available today that simplify the process of creativity as prescribed by Herrmann. Apps that have been developed for the construction of mind maps include Mindjet Maps, MindMeister, Mindomo, BigMind, How To Mind Map, iMindMap HD, iThoughts and Total Recall, to name but a few. Six-Hats is an App based on De Bono's Six Thinking Hats that helps one to brainstorm ideas and to reflect upon these ideas using the Six Thinking Hats. The Six-Hats App also helps to generate ideas with a set of random words and I Ching. Apps dedicated to brainstorming ideas include Brainstorming, iBrainstorm, BrainSqueezer and iBrainStormer. The aforementioned Apps (App store) are available from the Apple App store and could be useful when establishing a community of practice with a view to becoming innovative in terms of teaching practice. Learning centres and learning stations incorporate learning styles that accommodate visual and audio options for the learners through image creation challenges, mind mapping (Holland 2015) iMovie and Garage Band. The iPad and a variety of Apps can be used to accommodate the different thinking styles as defined by Herrmann (1995).

Herrmann (1996:231) views the input of a variety of thinking styles as 'potential synergy' and adds that an organisation, such as a school, should promote these so-called 'creative process champions' to establish Whole Brain® teams. Similarly, Daccord (2015) states that the use of iPads in the classroom will promote creative thinking. De Boer et al. (2013:252-253) point out that a combination of face-to-face and online learning propagates flexible thinking in a so-called blended learning environment.

In this study I explore the possibilities of applying a blended learning environment through facilitating Whole Brain® learning as part of the professional development iPad program. I have used

Action Research to reflect upon my own professional development as well as my mentoring practice. Thus it is a personal inquiry reflecting critically (Davis 2004:7) upon the actions taken during the facilitating of professional learning. Underpinning the professional development programme[2] are the principles of Whole Brain® facilitating learning and to what extent the iPad can be used to promote Whole Brain® thinking. I collaborated with the professionals to plan more innovative and Whole Brain® learning tasks to be executed by learners during learning opportunities. The professionals reflected on their individual teaching practices and they planned interventions to apply the principles of Whole Brain® facilitating learning. At the same time we partook in a collaborative Action Research process; thus the professionals were actively involved in the phases of the research (Davis 2004:7) and were accountable for their own action learning. The lens that I used is a constructivist one (De Boer et al. 2013:248), assuming that there are multiple realities and that the experiences of the professionals add to the constructing of new knowledge.

A further enquiry was to what extent Whole Brain® thinking can lead to constructing new knowledge. Herrmann (1996:309-310) is of the opinion that one's thinking preference is mainly due to nurture, rather than nature, meaning that there is a very good chance of being able to become a Whole Brain® thinker. There are, however, a few inducements that motivate the process: if one wants to change, if one's job changes completely, if one is determined to learn (in the case of this study to develop professionally) and if one is mentored. I took the role of mentor to

[2] This professional development programme includes iPad software application programs and Whole Brain® facilitating learning. Thus the ICT professional development program refers to the iPad software application programs and when I refer to the professional development programme, it includes Whole Brain® facilitating learning and the professionals' own action learning process.

promote professional development at Wilberforce High School. A group of voluntary professionals shared my vision of transforming their teaching practices in order to become more innovative teachers with the application of action learning.

Walliman (2011:12) defines action, in the context of an Action Research or action learning, as a design that addresses the 'problem'[3] immediately without separating the 'problem' from the context. Action Research can also be described as action-orientated and collaborative (Davis 2004:11) where a community of practice might identify an opportunity for planning innovation as an 'asset-based approach' (Du Toit 2008). Thus Action Research is a mode of inquiry used for the purpose of monitoring changes that are introduced and to observe whether or not these changes benefit the given context, or if the mode of inquiry could be applied within a different context as well (Walliman 2011:12).

According to Robinson (2010) the current education system is out-dated and does not cater for our present-day needs anymore – he relates it to a factory system. It is clear that old methods of education have become obsolete in the digital generation. Some may regard Robinson's view as radical; however, others do see the merit of change that must be acknowledged and encouraged in post-modern education. Slabbert et al. (2009:42) are of the opinion that there is a need for a 'new order' that relates to socio-constructivism where the curriculum is transformed to focus on inspiring the learners. A more innovative and flexible approach (Robinson 2010) to facilitating learning needs to be encouraged, such as collaboration, reflection (Slabbert et al. 2009:42) self-discipline and adaptability. During Modernity a belief in a fixed

[3] 'Problem' is used in the context of how it was defined by Walliman; however, for the purpose of this study I will refer to 'asset-based approach' as used by Du Toit (2008).

reality (Morgan & Sklar 2012:77) existed and the education system could be seen as a factory-like system (in agreement with Robinson 2010) and creativity became subdued. Focus was placed on passing a test and learners were seated in rows with prescribed time limits for classes and no room for flexibility (Slabbert et al. 2009:38-39). Likewise Herrmann (1995:194) points out that the education system focuses on A and B quadrant thinking preferences. He suggests that there should be a balance and that visual literacy is as important as language-based logic. Edwards (1993:26) is of the opinion that 'creative individuals have recognised the differences between the two processes of gathering data and transforming those data creatively'. Edwards emphasises that both sides of one's brain are of equal importance to discover creative potential.

Perceptions of creativity differ. Generally creativity in the C and D quadrants is perceived as visual, imaginative and having an aesthetic appeal. However, the belief is that creativity in Science, which is presumably situated in the left hemisphere or in the A and B quadrants, is seen as focused, defined and planned (Herrmann, 1995:195). Herrmann (1995:195) points out that artists and scientists that are seen as geniuses, for example Leonardo da Vinci and Albert Einstein, actually utilised the thinking preferences that were not associated with their fields of study. Leonardo da Vinci's artistic interpretation was of the same value as his inventions and scientific mode of thinking. On the other hand Albert Einstein was of the opinion that 'creativity is more important than knowledge' (Calaprice 2005:9). Albert Einstein's thinking preference was double dominant cerebral in quadrant A and D. Therefore he was able to capitalise on his thinking flexibility, moving from the A quadrant (analysing and theorising) to the D quadrant (exploring and discovering new ideas). The deduction can be made that artistic (D quadrant) and scientific constructs (A quadrant) are needed to

become more flexible in one's thinking preference to promote creativity through the Whole Brain® creative process (See Chapter 5 Figure 43) as stated by Herrmann (1996: 217). I wanted to promote a more flexible thinking approach, challenging the professionals to step out of their preferred thinking preferences to utilise creative and innovative ideas to facilitating Whole Brain® learning.

Herrmann's (1995) Whole Brain® learning for effective professional development is best suited for the protocol and mission statement of Wilberforce High School (2012:1), promoting innovation, teaching beyond the curriculum and encouraging professional development. Herrmann (1995:340) states that the HBDI® is suitable in terms of professional development for the following reasons: firstly to know one's own thinking preference and to be able to understand other people's thinking preferences. Secondly, knowing one's thinking preference will lead to the improvement of facilitating learning. Thirdly, by knowing one's thinking preference one would be able to manage work better. Slabbert et al. (2009:47) promote creative thinking to encourage and stretch human potential to the limit. Thus one-on-one sessions and workshops were presented that tasked the professionals to become Whole Brain® teachers. The fieldwork started in April 2014 and was concluded in August 2015. The study added to the objectives of facilitating learning beyond the curriculum, Whole Brain® facilitating learning, professional development and the continued aspiration of Wilberforce High School's mission statement for 'innovative learning' (Wilberforce High School 2012:1-3) through an Action Research design. The ideal would be to encourage Whole Brain® development of the entire school to create a so-called 'Whole Brain®

culture'[4], nurturing a community of practice and continuing to transform learning.

Ultimately I propose that one should aim to be a Whole Brain® thinker and doer as part of one's meta-learning (Slabbert et al. 2009:109) and to reflect upon one's teaching practice to become more innovative to transform learning. Herrmann (1996:38) describes a Whole Brain® thinking approach as 'situationally whole brained as possible'; in other words, one must take advantage of one's thinking preference and at the same time incorporate and explore one's least preferred modes of thinking to 'supplement one's existing competencies' (Herrmann 1996:39).

In summary the purpose of this study is to validate innovative ways of transforming learning in teaching practice with reference to Whole Brain® facilitating of learning (Herrmann 1995:417; De Boer 2013:274). All learners have multiple intelligences; therefore they should aim to be more creative (Herrmann 1995:198).

1.3 PROFESSIONAL DEVELOPMENT AT A PRIVATE HIGH SCHOOL

De Boer et al. (2013:82) propose that the construct *Whole Brain® Thinking practice theory* can contribute to the scholarship of 'Whole Brain® thinking professional development'. At Universities Whole Brain® thinking is regarded as contributing to 'human capital development' (De Boer et al. 2013:82). Thus a mentorship practice should create innovative ideas that should be implemented in the mentorship practice. The construct *mentoring practice* will be replaced with *professional practice* for the purpose of this study (De

[4] Whole Brain® culture is a construct describing the promotion of Whole Brain® thinking in a community of practice at Wilberforce High School.

Boer et al. 2013:82). Du Toit (De Boer et al. 2013:82) coined the construct *constructivist mentoring*. It means that mentoring includes 'Whole Brain® thinking scholarly reflection.' It relates to constructivist mentoring (Du Toit 2012) and proposes that the professional learning of teachers include reflection. The assumption is made that scholarly reflection should lead to participating in learning and collaboration. Thus, the construct referred to by De Boer et al. (2013:83), namely *Whole Brain® Thinking professional constructivism* denotes a need to create a learning organisation where a Whole Brain® Thinking and learning environment is created to encourage Whole Brain® learning communities (De Boer et al. 2013:83). In the context of Wilberforce High School I want to promote the development of a community of practice, infused with Whole Brain® thinking and the facilitating of Whole Brain® learning.

An initial exploration to determine the professionals' professional characteristics (Slabbert et al. 2009:129) at Wilberforce High School and probe the premises to introduce Whole Brain® facilitating learning was undertaken (See Table 1 page 14). The first characteristic was to determine the collective knowledge constructs of the professionals to establish a community of practice. Secondly, the prescribed code of conduct of Wilberforce High School that the teachers must adhere to had to be observed. Thirdly, the teachers had to take responsibility for their own professional development, also taking responsibility of designing their own learning tasks leading ideally to scholarly reflection (De Boer et al. 2013:83). Slabbert et al. (2009:129) refer to 'cutting edge' instruction, assuming that the teacher makes use of new knowledge and is at the forefront of utilising innovative skills. Similarly it relates to creating a Whole Brain® thinking constructivist environment by introducing, in the case of Wilberforce High School, an ICT professional development program to assist teachers in creating a

Whole Brain® learning environment exploring innovative ways to accommodate the different thinking preferences.

Additionally the professionals were challenged to construct innovative ways of utilising the iPad to facilitate Whole Brain® learning and improve their teaching practices underpinned by action learning and to take responsibility for their own professional learning by reflecting on the workshops and one-on-one peer mentoring sessions.

Characteristic of a professional	**Comparison to professional ICT professionals from Wilberforce High School**
i. Expert body of knowledge	Objective is to establish a community of practice at Wilberforce High School
ii. Code of conduct	Each professional adheres to a prescribed code of conduct
iii. Professional practice	Professionals regulate their own teaching practices and professionals take up the responsibility for their own professional development
iv. Design own professional practice	Each professional takes responsibility in designing the facilitating of learning as well as setting learning tasks
v. Critically assess own actions	The professionals reflect on and critically assess their teaching practice
vi. Instantaneous decisions	Most of the professionals are able to respond innovatively and adapt their facilitating of learning to suit the needs of the learners
vii. Cutting edge	The professionals volunteered to be part of the ICT training group and this study, implying that they want to master the latest skills to supplement their teaching practice

Characteristic of a professional	Comparison to professional ICT professionals from Wilberforce High School
vii. Problem solvers/creative constructors	The professionals were looking for new innovative ways to use the iPad and Whole Brain® learning in their teaching practice
ix. Improving practice	The professionals' objectives were to be more innovative and to improve their teaching practice
x. Responsible	The professionals were encouraged to join the ICT training; therefore the one-on-one peer mentoring sessions were set at a time that suited them. They were also responsible for reflecting and constructing meaning to develop their professional learning

Table 1: An adaptation of Slabbert et al.'s (2009:129) characteristics of a professional compared to the professionals at Wilberforce High School

After the characteristics of the professionals had been identified I deduced that my initial assumption of professional development by means of facilitating professional learning, reflection and Action Research (Slabbert et al. 2009:132) was sound. De Boer et al. (2013:83) suggest that the principles of action learning should be applied to foster Whole Brain® learning that is self-regulated and is a subsidiary of Action Research. Du Toit (De Boer et al. 2013:84) describes it as a 'tandem, action learning and Action Research' becoming a process of synchronicity. I conducted Action Research while the professionals continued with action learning to investigate the 'how' and 'what' of learning (De Boer et al. 2013:84). I found Action Research very useful in my own teaching practice; however, I decided to extend it to my own professional development and promote professional development and action learning among my peers leading to the 'generation of living theories of practice' (McNiff

& Whitehead 2009: 15) in other words probing real-life explanations for my own professional practice as well as the professionals' teaching practices. De Boer et al. (2013:85) argue that Action Research permits 'lecturers' (the construct *lecturer* will be replaced with *mentor* for this study) to take up their role and assess the quality of their teaching practice. Professional development at Wilberforce High School is based on the premises of Whole Brain® facilitating learning (De Boer et al. 2013:276), reflection and Action Research (Slabbert et al. 2009:132). Simultaneously within the professional development programme collaboration and cooperative learning were promoted to create new knowledge and construct meaning.

Professionals were encouraged to promote collaboration and cooperative learning within their own teaching practices. For example, learners with different thinking styles should be grouped together and given a problem that they should solve. Cooperative learning provides a social support system for learning to encourage learners who, for example, grasp a Mathematics problem and then, with the instruction of the teacher, have to explain the solution to a learner who does not share the A quadrant thinking preference. It promotes success for all, since cooperation within a group relates to achieving a goal. Cooperative learning challenges professionals and it gives different insights into problem-solving (Slabbert et al. 2009:112). Explaining concepts and sharing meaning with other professionals make the content clearer, communication is refined and creative thinking opportunities are created (Slabbert et al. 2009:112).

Professional collaboration and professional cooperative learning are used in the course of this study. Professionals could form a 'community of practice' as stated by Du Toit (De Boer et al.

2013:106) and collaborate with one another through cooperative learning. Collaboration and cooperative learning lead to transforming the curriculum to accommodate Whole Brain® facilitating of learning, and aim to create an inner understanding of both teachers' and learners' thinking preferences.

1.4 FORMULATION OF THE RESEARCH QUESTIONS

1.4.1 Primary research question

How can I, as mentor, contribute to the professional development of teachers as a community of practice?

1.4.2 Secondary research questions

- How can the facilitating of Whole Brain® mentoring contribute to transforming a mentoring and teaching practice?

- How can the principles of Action Research be applied to promote scholarship of teaching and learning?

- How can the iPad assist in accommodating the facilitating of Whole Brain® learning?

1.5 RESEARCH DESIGN

1.5.1 Action Research

Action Research can be defined as a mode of inquiry to investigate and evaluate one's teaching practice for the purpose of improving learning (McNiff & Whitehead 2006:7). Promoting professional development has become all the more relevant across the globe (McNiff & Whitehead 2006:7); therefore this mode of inquiry is one of the constructs used to underpin this study. Action Research is a

methodical and systematic process (McNiff & Whitehead 2006:8) relating to Herrmann's B quadrant (Herrmann 1995). It is based on an action reflection cycle that can be delineated as observing one's teaching practice, reflecting upon it and acting upon one's reflection after which one evaluates the action that one took. Thereafter one modifies one's initial action and the next cycle starts (McNiff & Whitehead 2006:8-9).

Action Research is described by De Boer et al. (2013:83) as a scholarly process that one could use to monitor one's own professional learning, 'gathering evidence of one's practice in a scholarly way and contributing to the creation of evidence-knowledge'. The purpose of Action Research is to gather evidence from one's teaching practice and constructing 'evidence-knowledge' (Taylor & Colet 2010, 147). Furthermore the Action Research process is described as systematic, dynamic and open-ended (De Boer et al. 2013:86). Davis (2004:5) postulates that Action Research is not a linear approach to report writing. She describes the actions that are taken as spirals with overlapping cycles of planning, acting, observing, reflecting and critical analysis. Thus Davis (2004) describes the first cycle as a series of actions being taken and secondly that there is a continuum of cycles in which these actions are repeated.

The phases within the cyclic model, as defined by De Boer et al. (2013:88-89) are sequential and provision is made for de-routing cycles (See Figure 2), meaning that the original focus might shift during the Action Research and reformulation of the initial step might be needed. Thus, change is fundamental within the paradigm of Action Research (Davis 2004:5). The process in the de-routing cycles will be the same as in the main cycle. The phases are the following:

- 'Planning for innovation and transformation'
- 'Acting to innovate and transform'
- 'Observing effects of new actions' (De Boer et al. 2013:89)
- Continuous reflection
- 'Assessing' (De Boer et al. 2013:89)

Figure 3: An adaptation of, Du Toit's visionary Action Research model (De Boer et al. 2013:88) for transforming one's teaching practice in the context of Wilberforce High School

Problem identification according to Herrmann (1995:275) is a left-mode series of steps identifying a 'problem', analysing the problem, using logic to find a solution to the problem. It is pragmatic, structured and shows a clear direction. To delineate the 'problem'

Herrmann is of the opinion that the right brain should be incorporated, for instance to differentiate between the most noteworthy and frivolous aspects of the 'problem statement.' Problem statement is the construct used by Herrmann; however, for the purpose of this study *problem statement* will be converted to Du Toit's (2008) *asset-based approach* that is a more descriptive construct of the objectives for a Whole Brain® thinking approach to Action Research.

Action Research lends itself to an asset-based approach (Du Toit 2008) from a positive angle and gathers data contextualised with the social construct of the professionals' experiences (Ebersöhn, Eloff & Ferreira 2010:134-135). The gathered information helps in the reflection phase to improve certain areas; this was lacking in a Whole Brain® approach.

1.6 RESEARCH METHOD: A MIXED METHODS APPROACH

A mixed methods approach uses multiple approached to data collection (Ivankova, Cresswell & Clark 2006:264). Bergman (2011) describes mixed methods as a justification for quality control since research can never be arbitrary nor fully objective. Within a qualitative mode of inquiry the language may be subjective but still be descriptive and the samples are usually small (Bergman 2011) whereas in a quantitative mode of inquiry the assumption is that working with numbers and statistics leads to more objectivity. However, the quantitative mode of inquiry might lead to generalisations that are related to the type of testing used and the ideal is to identify universal causal laws (Bergman 2011). Thus a combination of quantitative and qualitative data gathering methods complement one another and the researcher is able to obtain a comprehensive analysis of the research (Ivankova et al. 2006:263).

A mixed methods approach complemented this Action Research study that utilised quantitative and qualitative modes of inquiry. Bergman (2011) states that mixed methods can pragmatically address a particular 'problem' (for this study the construct *asset based approach* is used) that underpins the asset based intervention and in the case of this study, the vision to promote professional development within an Action Research design. Thus, in this asset-based mixed method approach a positive intervention was planned to promote Whole Brain® learning within the teaching practices of the professionals.

In terms of the quantitative mode of inquiry of this study the Herrmann Brain Dominance Instrument® (HBDI®) is a scientifically validated instrument that quantifies the degree of thinking preferences for the specific quadrants within the Whole Brain® model. I designed observation feedback sheets that included rating scales to determine to what extent Whole Brain® facilitating of learning had been achieved.

The qualitative mode of inquiry for this study included observations of my peer mentoring practice by keeping a reflective journal, observations of the professionals' teaching practices, as well as exploratory, preliminary and semi-structured interviews. The HBDI® includes quantitative analysis within the survey.

1.7 RESEARCH PREMISES

1.7.1 Ontological assumptions

McNiff and Whitehead (2006:11) argue that an understanding of one's ontological perspective will, in essence, influence the construction of new knowledge and the multiple realities of the professionals in Action Research. In the context of Wilberforce High

School I am an 'insider researcher' (McNiff & Whitehead 2006:11) meaning that I am directly involved in the professional development programme and also a co-learner (Gravett 2005:24) in my own mentoring practice.

McNiff and Whitehead (2006:12) accurately state that it is necessary to be a sustainable teacher (for the purpose of this study the construct *professional development* will be used); this means the teacher should be willing to evaluate the facilitation of the learning process constantly and to adapt to its outcome. Riveros (2012:604; 609) suggests that teachers' pedagogical and context knowledge cannot be seen separately from their teaching practice, thus adhering to the principles of Action Research and evaluating the facilitating of learning.

The professionals' action learning related to the construction of new meaning and building their own knowledge, professional learning and teaching practice played a role to initiate transformation and it added to the dynamic discourse in collaborative tasks. Furthermore, opportunities for Whole Brain® learning and Whole Brain® task development were explored through collaboration in the one-on-one peer mentoring sessions. The actions that the professionals took led to creating further opportunities for professional development.

Professionals reflected on the professional learning that took place, keeping in mind that professional learning does not occur only within the collaborative professional learning environment, but also in diverse situations (Riveros 2012:610) that the professionals experienced in their teaching practices. I took up my role as peer mentor in the professional development programme.

I wanted to establish a Whole Brain® culture of professional

development through peer mentorship. Evaluating my own role as mentor and encouraging collaboration could be seen as an interpretivist (Maree & Van der Westhuizen 2010:32) of multiple realities. How teachers see themselves and what has led them in shaping their persona is not always clearly defined; therefore more emphasis must be placed on so-called professional awareness (Kincheloe 2004:57). Thus professional awareness was taken into account in this research and therefore interviews were conducted to obtain a rich narrative with a view to gaining a better understanding of the teachers' formative years that led to the shaping of their current teaching practice.

The participation was voluntary. Wilberforce High School boasts a commitment to innovative learning. Teaching tools such as Smartboards and iPads were used in the workshops and one-on-one peer mentoring sessions. Developing technical familiarity is a prerequisite; implementing the iPad in the creation of learning tasks should incorporate each of the four quadrants (Herrmann, 1995:417).

1.7.2 Epistemological assumptions

Epistemologically I see my role as mentor and my mentoring practice as inseparable. Bergman (2012) argues that epistemology in a constructivist paradigm is the relationship between the researcher and what is being researched.

The lens through which I examined my research is constructivism. There are no fixed truths. Reality and its meaning are for example dependent on time, space, language and views (Maree & Van der Westhuizen 2009:20-21) of the professionals; for example, the professionals' individual understanding of the interview questions

and the questions on the observation sheets. Furthermore, my understanding of the mentoring phenomenon took a 'pragmatic approach' (Martell 2012:4) and my interpretation of the data led to multiple outcomes as part of the constructivist view, assuming that there are multiple realities. An individual in an environment actively constructs knowledge where he or she exists. Therefore knowledge cannot be transferred, but the individual may construct meaning from the way in which he or she observes and interprets the world (Slabbert et al. 2009:54). Furthermore, constructivism and meta-learning may refer to a social process (De Boer et al. 2013:38) where learning takes place through collaboration and meaning is constructed within the community of practice context.

Radical constructivism (Slabbert at al. 2009:57) assumes that individuals construct all knowledge as they experience it. Slabbert et al. (2009:57) warn that radical constructivist epistemology is faced with a predicament since no two people construct reality in the same way, thereby implying that a truly 'objective' reality cannot be resolute. De Boer et al. (2013:38) propagate authentic learning that implies deep level learning to ensure and sustain high quality learning. Thus constructivist learning contributes to high quality professional learning. Scholarly reflection (De Boer et al. 2013:83) assists the professionals in constructing meaning from their experiences and new knowledge.

Belbase (2011:4) describes constructivist epistemology as the belief that the participant knowingly constructs knowledge. Because of the interconnectedness of knowledge and the knower, knowledge is seen as subjective. Furthermore, one participant's knowledge can be completely different from another participant's knowledge. The professionals are knowledge producers, workers (Kincheloe 2004:51) and assume that they are self-regulated to take

responsibility for their own professional learning. The participant teachers' personal epistemology influenced their professional learning as well as their learning strategies (Walker, Brownlee, Whitefold, Exely, Woods 2012: 24-26) that they might apply in their teaching practice to facilitate learning. With this self-knowledge the participant teachers' can encourage their learners to construct their own knowledge within the constructivist paradigm. Thus it can be deduced that there is a close relation between personal epistemology and the teacher's teaching practice leading to facilitating of learning where the teacher does not merely partake in rote teaching, but also engages in the learning by becoming a 'co-learner' (Gravett 2005:24). The knowledge base of the teacher and the learners can thus be broadened.

Kincheloe (2004:52-53) refers to a knowledge base in education as a meta-epistemological construction that equips the participant to identify the different forms of knowledge, for example critical, empirical or experiential. It must be kept in mind that multiple lenses can be used from a critical complex empiricism to interpret the data; this adds to the complexity of the multidimensional nature of the professionals' teaching practices. Knowledge can be subdivided into propositional and interpretive knowledge. Propositional knowledge is related to *cause and effect* and this knowledge is impersonal whereas interpretive knowledge depends on the interpretation and meanings linked to it by the participant. Meaning is rooted in the participant's experience, reflection and the authenticity of a situation (Aróstegui, Stake & Simons 2004:2-3). Thus, the deduction can be made that knowledge is a multidimensional construct that relates to previous knowledge (cause) and the outcomes (effect) of reflecting on the experiences. It is presumed that the professionals' and my own knowledge will contribute to a body of knowledge that can be explored and probed

to construct new knowledge, promoting collaborative learning, co-operative learning, experiential learning (C and D quadrants) and becoming a lifelong learner.

1.8 DATA COLLECTION PLAN

Quantitative and qualitative data was collected to complete this study. The HBDI® is a quantitative and qualitative analysis of one's thinking style. Preliminary and semi-structured interviews were conducted at two different stages of the study. The preliminary interviews were conducted at the onset of the investigation to obtain a rich narrative of the professionals' teaching practice, preferred mode of thinking, 'fears' regarding the use of an iPad and their facilitating of learning. The interviews were recorded for further analysis. The semi-structured interviews were conducted after a year, firstly to assess the professional development practice and my role as peer mentor, and secondly to reflect on the use of Whole Brain® learning. These interviews were also recorded for further data analysis purposes.

The following table indicates the data collection techniques as well as a short description of the recording methods used. The information is adapted from Ebersöhn (2010:123-143); Nieuwenhuis (2010:69-97) and McNiff and Whitehead (2006:138-147).

Action Research		
Professionals	**Recording method**	**Short description**
Professionals Myself	Quantitative and qualitative HBDI®	The HBDI® was used to determine my own and the professionals' thinking preferences
Professionals	Qualitative Interviews Voice recordings	Exploratory interviews Preliminary interviews Semi-structured interviews

Professionals	Recording method	Short description
Professionals Myself	Qualitative Self-reflection sheets	Structured questions and some questions, using a Likert scale
Professionals	Qualitative Observation sheets	Professionals' critical feedback on the workshops
I observed the professionals' teaching practices	Qualitative Observation sheets	Observations of the professionals teaching practices after intervention
Myself	Qualitative Audio recording	Recording thoughts and observations after the interviews were conducted
Myself	Qualitative Journal Memo writing	I kept a journal to document my reflections on my mentoring practice and to make observations about the reactions of the professionals.

Table 2: Data gathering techniques

1.9 SAMPLING AND SELECTION STRATEGIES AT WILBERFORCE HIGH SCHOOL

After a Whole Brain® introductory workshop had been presented at Wilberforce High School, I called for professionals to take part in this study. They were a group of professionals that had been selected for ICT training, with the focus on using an iPad to facilitate learning. Participation in this study was voluntary, thus, adhering to the prescriptions of the ethical clearance committee. Seven teachers indicated that they wanted to be part of this study – one male and six females. They were from different backgrounds and did not teach in the same learning area. Not all of them had obtained a B.Ed. degree and three of them had only started teaching, having worked working in their respective fields of

specialisation, namely B.Sc. and M.Sc. A more in-depth analysis of each professional is provided in Chapter 4.

The following table shows the characteristics of the professionals. The idea was adapted from Martell (2012:8).

Professional	Gender	Qualification	Years actively in the teaching profession
i Kypris	Female	B.Ed.	23 years
ii Alexander	Male	B.Ed.	2 years
iii Heidi	Female	B.Ed.	22 years
iv Octavia	Female	B.Sc., B.Sc. (Hons) and M.Sc., PGCE	15 years
v Lana	Female	B.Sc. and PGCE	11 years
vi Helena	Female	B.Sc. (Hons) Metallurgy PGCE	10 years
vii Brynhildr	Female	B.Ed. (Hons)Mathematics	28 years

Table 3: The characteristics of the professionals at Wilberforce High School

1.10 SYNTHESIS

Chapter 1 elucidates the motivation (D quadrant) and reasons for undertaking this Action Research study. Jim Stark (played by James Dean) in *Rebel without a cause* (Ray 1955) was searching for his identity and a place in his community. Similarly, I wanted to rebel against the constraints of my creative slump and rekindle my interest in professional learning. Fortunately an opportunity for professional development was promoted at Wilberforce High School in integrating iPads in teaching practice. I decided to combine the aforementioned with Herrmann's Whole Brain® learning and investigate to what extent it enhances learning.

CHAPTER 2
THEORETICAL FRAMEWORK

2.1 INTRODUCTION

Paul Broca (physician) and Carl Wernicke (neurophysiologist) observed that patients who had damaged a specific part of the left brain hemisphere suffered from *aphasia* (speech deficiencies). They noted that a similar injury to the right hemisphere would not cause *aphasia* (Herrmann 1995:8). Ultimately deductions were made and in the nineteenth century scientists typified language as closely related to reasoning and thinking, and identified the left hemisphere as the major or dominant hemisphere and the right hemisphere as the minor or subordinate one (Edwards 1992:27). Valuable contributions were made to the initial steps in research regarding the split-brain theory. However, I find the aforementioned deduction too simplistic and in essence it does not explain divergent thinking styles. A more in-depth analysis of the existing knowledge of neural function and how knowledge is produced is required to come to a better understanding of thinking preferences and also to underpin the importance of Whole Brain® thinking.

According to Herrmann's Whole Brain® model (1995:417), the A quadrant constitutes a thinking preference that relates to logical, rational, quantitative and theoretical thinking. A person with a high thinking preference for the A quadrant might be seen as the proverbial 'stick in the mud' or a 'square', for example in Quentin Tarantino's *Pulp Fiction* (1994). Vincent Vega (played by John Travolta) has to take Mia Wallace (played by Uma Thurman) out;

however, he wants to keep her safety in mind and does not want to take her out to dance. Mia then states, 'Don't be a square' and draws a square in thin air and the viewer can see it appearing on the screen as she draws it. This is perhaps not a new concept, since Tarantino makes use of pastiche; it is, however quite a powerful reference to a person who is rational in his decision making. Descartes stated: *cogito ergo sum* (I think, therefore I am), underpinning the age-old question, 'Who am I?' and 'Why am I here?' In this study I had to reflect on my thinking preference (2005 HBDI® result) and use my secondary A quadrant preference (See Figure 5) to delineate the theoretical framework for this study, and become more familiar with the different thinking preferences.

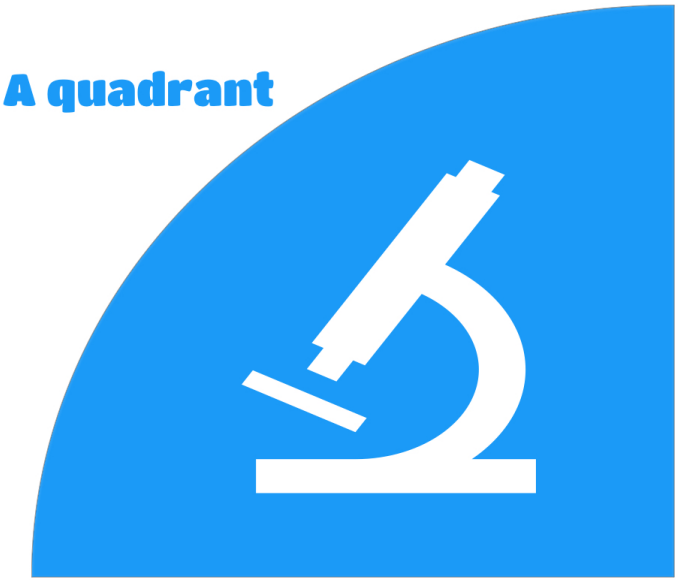


Figure 4: An adaptation of Herrmann's Whole Brain® model representing the A quadrant

One's thinking preference is not merely limited to one specific quadrant; therefore one needs to be very careful of making assumptions. Greater emphasis must be placed on understanding the history of the left-brain, right-brain theory, Kolb's learning

styles (Slabbert et al. 2009:72) as well as Gardner's (1995) theory of multiple intelligences.

In order to create a Whole Brain® culture at Wilberforce High School, several factors had to be taken into consideration. Firstly, literature had to be reviewed to find the most complementary framework to conduct the study. A constructivist approach was used with the assumption that the professionals' knowledge would lead to multiple realities. Professionals volunteered to take part in the study and they collaboratively took part in professional development workshops and professional one-on-one peer mentoring sessions, which I had organised as part of my mentoring practice that introduced ideas of cooperative learning, Action Research, action learning and Whole Brain® facilitating of learning. Action learning and the constructs used by De Boer et al. (2013), namely Whole Brain® facilitating of learning, Whole Brain® cooperative learning and Whole Brain® collaboration were integrated.

As part of the planning of professional development at Wilberforce High School I had to immerse myself in the reading and analysis of the source material to obtain a direction as to where the one-on-one peer mentoring sessions and workshops would lead to, as well as to delineate this study and to find the gap in literature where this study might contribute to the existing knowledge in terms of Whole Brain® facilitating of learning. A few constructs were focused on, for example professional development, the facilitating of professional learning, peer mentoring and Whole Brain® thinking. Reference is also made to South African studies that contributes to the knowledge of professional development and underpins Action

Research (See Chapter 3), professional development, mentorship and Whole Brain® thinking.

2.1.1 From the split-brain theory to Herrmann's metaphoric Whole Brain® model

A neuronal network accumulates knowledge; knowledge is produced through creation and modification. Subsequently, when new knowledge is produced, the brain starts with existing neuronal networks (Gravett 2003:32). Slabbert et al. (2009:55-56) note that according to contemporary research neural networks grow when there is direct interaction with the environment through challenging experiences. Neural networks grow virtually instantly after a profound emotional experience but grow only from what is particularly encountered. Slabbert et al. (2009:56) are of the opinion that thinking and learning styles as well as knowledge are determined by the activation and structure of neural networks.

Gravett (2005:31) states that functional knowledge of the neurobiology of learning provides an additional useful lens through which to examine learning and teaching. Thus it is important to analyse this phenomenon to understand where the Whole Brain® thinking styles metaphor originated. Boström and Lassen (2006:181) note that there are more than 70 models with conflicting assumptions to determine learning styles. Coffield et al. (2004:iii) investigated thirteen of the most influential models, including Kolb's learning style inventory and Herrmann's Whole Brain® model and the HBDI®.

Herrmann (1995:8-11) describes Sperry, Bogen and Gazzaniga's split-brain research with reference to research that was conducted on end-state epileptics. Sperry, Bogen and Gazzaniga pioneered split-brain methodology. Van Wagenen and Herren performed the first callosotomy operation in 1940. Vogel and Bogen successfully carried out a complete commissurotomy that controls seizures. Split-brain research indicates that each hemisphere can function independently of the other (Gazzaniga 2005:653-654). Dryden and Vos (2005:159) believe that the split-brain theory is too simplistic and note that the left brain and right brain are not two separate brains; they argue that both sides have different functions.

According to Gazzaniga (2005:654) the majority of people's left hemisphere is the language domain; speech, for example, is solely solidified with the left hemisphere. The ability to write is also generated from the left hemisphere and the right hemisphere has only a limited ability to read words. The assumption can be made that Slabbert et al.'s (2009:56) 'higher' level thinking relates to the successively connected neural networks that produce linear, logical and stimulus-response thinking.

Herrmann (1995:11) links Sperry's split-brain theory to lateralisation. Sperry, together with Ornstein, developed the lateralisation theory that indicates the different functions of the left and right hemispheres. Ornstein used electro-encephalographic techniques where he monitored the brain activity of each hemisphere with tasks such as writing. The left hemisphere promotes analytical thought, factual evidence, discipline, sequence, mathematics, rationality, reading, speaking, writing and knowledge.

The right hemisphere is associated with feelings, spatial awareness, risk-taking, patterns, perception, geometry, mind map-making, a holistic view, rotating shapes and spontaneity (Herrmann 1995:11-13).

Dryden and Vos (2005:159) argue that if one is right-handed the left hemisphere of the brain processes logic, mathematics, numerals and sequential tasks. In the right hemisphere a more creative process takes place in the form of imagination, pictures, music, rhyme and rhythm. Herrmann (1995:12) argues that it is not so simple to regard brain functionality in the mode of lateralisation; it is more complex. Herrmann's focus is on the language centre. The assumption is made that language is linear and sequential; therefore it is plain to see that the left hemisphere would govern arithmetical thinking. For a left-handed person the modes of thinking will shift.

Just as one develops a dominance regarding dexterity, one develops dominance with regard to the way in which one thinks (Herrmann, 1995:17). Herrmann (1995:17) refers to brain dominance as a 'preferred mode of knowing' and this mode of thinking is the preferred mode that one uses in order to solve problems. Thomas and Thomas (2001:49) noted that when a participant was given a negative space drawing, the left hemisphere could not recognise the negative spaces; however, the right hemisphere could. A further suggestion was to draw a picture upside down to promote the right hemisphere. Thomas and Thomas (2001:50) argue that the two hemispheres do not contribute equally, due to the split-brain

theory; therefore creative exercises, for example drawing, must be done in order to develop the right hemisphere.

Mintzberg argues that if a left-brain dominant person does planning, there is a lack of creativity. He infers that organisations should train employees to become more aware of their creative side or right side of the brain (Allio 1977:10). Herrmann (1995:20) differs from Mintzberg in the sense that one with a thinking preference will adapt to the working environment due to the economy-driven world. However, this does not mean that there is not a need to promote Whole Brain® thinking. Dryden and Vos (2005:159) argue that the brain works better if both hemispheres are used; for example, remembering the words to songs better than merely just the words. In fact, to promote the full potential of divergent thinking styles, collaboration should be promoted by assembling a team that will represent Whole Brain® thinking (Herrmann 1995:146). The professionals at Wilberforce High School formed a Whole Brain® community and their different thinking styles are not seen as confining them; their knowledge of thinking preferences and their ability to become more flexible thinkers have equipped them to have a better understanding of thinking preferences that differ from their own. Herrmann's promotion of Whole Brain® thinking is grounded in the idea that we do not merely have one thinking style or are either a so-called 'left brain thinker' or a 'right brain thinker'; it is more complex than this. We have a thinking preference that can be related to the left and the right brain. Thus the profile score of the HBDI® can indicate single dominant profiles, double dominant profiles, triple dominant profiles or quadruple dominant profiles (Herrmann 1995:85-89).

The single dominant profile constitutes 5% of more than three million profiles in the Herrmann institute database. The preference code variants include 1222, 2122, 2212 or 2221 (De Boer et al. 2013:7). The advantage of a single dominant profile is that one is not confronted with a constant dualism when making decisions. Thus the individual with a single dominant profile observes the world from a consistent set of lenses (Herrmann 1995:86). The challenge for a single dominant profile individual is that they are surrounded by people with divergent thinking preferences, thus using only a single dominant lens may be challenging in a world of multi-dominant preferences where people view the world through different lenses (De Boer et al. 2013:7). The individual with a single dominant profile will have a better understanding of other thinking preferences if he or she is aware of his or her own thinking preference and practises to be more flexible in thinking.

Double dominant profiles constituted 58%, the majority of people in the Herrmann database in 2009. Double dominance can occur between left hemisphere (1122), right hemisphere (2211), cerebral or upper mode (1221) and limbic/lower mode (2112) (De Boer 2013:7). The double dominant left hemisphere or right hemisphere profiles may refer more to the left brain-right brain or split brain theory. Herrmann (1995:87) states that the double dominant right may look 'flakier' or scatter-brained and therefore 'less reliable,' whereas the double dominant left is more controlled. A person with a double dominant profile in the same hemisphere tends to use the other modes less frequently (De Boer et al. 2013:7).

When a double dominant preference occurs in opposing hemispheres directly across from each other, the advantages are that the person may relate to characteristics of the right and left hemisphere (Herrmann 1995:88). It supports the person to be flexible in either the left or right hemispheres and it helps him or her to relate better to other thinking preferences. Individuals with opposing double dominant profiles, left-right 1212 or 2121, experience internal conflict between the primary quadrants; however, they may benefit from a greater understanding of their own mental opposites and it is easier for them to be more flexible in thinking or to 'cross the bridge between the different styles' (De Boer et al. 2013:7). Under pressure a person with an opposing double dominant thinking preference might switch erratically between the two modes of thought (Herrmann 1995:89). Thus, the variants of double dominant profiles influence their flexibility in thought, where a person who has a double dominance in the left hemisphere is seen as organised and logical but may find it difficult to become flexible in thinking in the right hemisphere. However, double dominant profiles that are dominant either in the cerebral or limbic, or that are diagonal opposites give the individual the advantage of being flexible in his thinking preference by utilising the opposing hemisphere.

The triple dominant profile constitutes 34% of the Herrmann database. Eighty-one per cent of the triple dominant profiles are 2111, 1121 and 1112. The triple dominant profile indicates that only one quadrant is not a primary thinking preference (De Boer et al. 2013:7-8). Herrmann (1995:89) states that a person with a triple dominant thinking preference can associate more freely with

other thinking preferences. In most triple dominant preferences the secondary fourth quadrant is usually a strong secondary (Herrmann 1995:89). De Boer et al. (2013:8) point out that interaction is easier since at least one preference will be shared with the person with a triple dominant profile one communicates with. The challenge for a triple dominant person is not to delay decision making, since there are so many alternatives available (De Boer et al. 2013:8).

Only 3% of the profiles in the Herrmann database represent a quadruple dominant profile. The 1111 profile expresses primary level preferences for every one of the four modes and it is a multi-dominant profile (De Boer et al. 2013:8). Herrmann describes the quadruple dominant preference as someone with a balanced view of any given situation. One with this profile communicates easily with a person who favours a specific quadrant (Herrmann 1995:90). De Boer et al. (2013:8) characterise the quadruple dominant person as someone who can move 'seamlessly from quadrant to quadrant' as is required in day to day life. The challenge that may arise is that a quadruple thinker might struggle with internal conflict because of the easy interaction between the quadrants (De Boer et al. 2013:8).

Figure 5 is Herrmann's (1995:411) metaphoric Whole Brain® model. Quadrant A is situated in the left cerebral hemisphere and represents someone with a logical and analytical thinking preference. In the left limbic hemisphere the B quadrant represents someone who is organised, plans and pays attention to detail. The C quadrant is situated in the limbic right hemisphere and represents the feeling-self, a person who is interpersonal and kinaesthetic. In

the right hemisphere the D quadrant represents a person whose thinking preference is based on a holistic and integrated view.

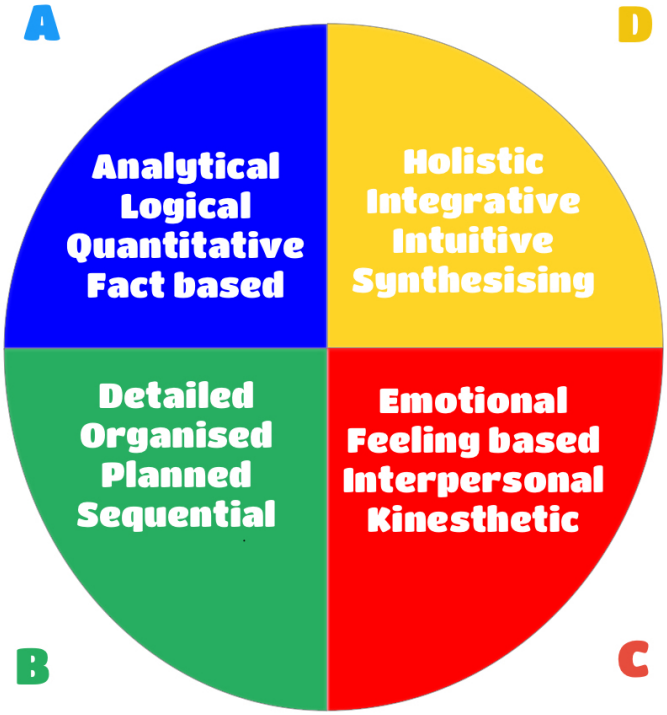


Figure 5: Herrmann's metaphoric Whole Brain® model (Herrmann 1995:411)

2.2 LITERATURE REVIEW

2.2.1 Professional development

Gravett (2005:7) describes an adult as a person who is defined as an adult within society and one who undertakes responsibility for his or her own welfare and livelihood; an adult learner is a person who takes part in learning activities. The term *adult learner* is a construct that Gravett (2005:1) regards as problematic as it is a generic term; therefore, for the purpose of this study, the term *adult learner* is replaced with *professiona*l.

De Boer et al. (2013) stipulate that learning is a lifelong process and it starts from an early age and continues into adulthood. There are no separate forms of learning for adult and children. Ideally

more than one learning theory should be constructed (De Boer et al. 2013:37) when planning professional development. Porter (2011:14) describes professional development as establishing a collaborative and collegial environment in order to develop a community of practice.

McNiff (2002:29) states that Action Research supports a model of learning for professional development instead of a 'model of instruction.' Thus, by using Action Research to underpin the professional development within the community of practice, the emphasis is on teaching practice, and the peer mentor acts as facilitator of the professional learning of peers. The teacher as professional can then act upon the advice that was given and later evaluate the action that was taken.

The professional's life experiences can add to his or her professional development. However, the professional's life experiences may also prohibit learning if the person has strong convictions and is used to a 'teacher-centered dialogue' (Gravett 2005:10) from school experiences. Murray (2010:2) stipulates that one of the main reasons for professional development is to gain confidence and to be empowered to put one's ideas into practice. Many professionals participate in professional learning if it can be linked to a 'life-changing event,' enrichment or for specific goals (Gravett 2005:11). De Boer et al. (2013:38) believe that constructivist learning accentuates learning-centredness and promotes transformation within the teaching practice and facilitating of learning. Thus, the challenge lies in using mentoring to convey Whole Brain® facilitating of learning, moving away from the 'teacher centred dialogue' that

the participant teachers were familiar with. Their expectations varied (See Chapter 4); however, they shared a common ideal to expand their knowledge and to transform their teaching practices. De Boer et al. (2013:104) argue that the application of Whole Brain® principles should be employed to advance learning.

2.2.2 Facilitating professional learning

Gravett (2005:41) states that a mentor and professional should engage in a cooperative inquiry, thereby linking the facilitator, professional and knowledge in a reciprocal unity. Slabbert et al. (2009:130) are of the opinion that authentic learning should be used and that a professional practice entails professional praxis knowledge. Thus, professional knowledge develops from practice. If a professional is challenged during experiences, he or she constantly reflects upon these challenges in order to construct understanding. This practice contributes to the development of a more successful teaching practice (Slabbert et al. 2009:130). The constant reevaluating of experiences leading to transformation is known as 'a practice theory of and for facilitating learning' (Slabbert et al. 2009:130).

When a professional development programme is planned, the professionals must construct their own experiences throughout the entire programme that will result in their own practice theory for facilitating learning. Thus each participant's practice theory will be personalised (Slabbert et al. 2009:130). McNiff (2002:9) describes 'enlightened' professional learning programmes as assuming that the professionals can utilise their own knowledge and that they are

self-regulated professionals. However, professional learning can be enhanced by the support of a mentor who motivates the professionals to exploit their own knowledge fully, but also to contribute to new knowledge (McNiff 2002:9) to be constructed. The mentor is also part of the learning and the professionals may probe assumptions that are made by the mentor. The mentor initially provides support and recommendations in the context of professional learning; however, due to the constructs of collaboration and Action Research, the mentor is also a learner (Winter & Munn-Giddings 2001:19). An example of collaboration would be if the professionals kept, for example, a journal to reflect on their teaching practices. As a community of practice they could then get together and share their experiences (Murray 2010:5). Gravett (2005:41) stipulates that professionals and the mentor (Gravett uses the construct *educator* that is replaced with *mentor* for the purpose of this study) cooperatively investigate the learning content; thus a professional practice is 'learning-centered' (Gravett 2005:41) and both the professional and mentor obtain new knowledge and construct meaning from the new knowledge and promote the idea of taking responsibility and become a self-directed professional.

One of the objectives for professional learning is to encourage the professionals to become self-directed professionals. Du Toit (2012:1220) refers to 'professional self-regulated learning'. This does not necessarily mean that the professionals have to do individual tasks, (Ültanır & Ültanır 2010:11-12) but professional self-regulated learning could be incorporated into collaborative designing of tasks. Slabbert et al. (2009:49) warn that the

facilitating of learning should not be stereotyped as making learning easy; it should, instead, challenge the learner to maximise his potential. Similarly, professionals should be challenged in their own professional development and ideally apply their new knowledge of Whole Brain® facilitating of learning within their teaching practice. Du Toit (2012:1218) postulates that the interdependence found in professional cooperative learning should ultimately lead to independent professional learning, promoting one's full potential and engaging in lifelong learning. Dzubinski, Hentz, Davis and Nicolaides (2012:104) state that professionals should be encouraged to become innovative thinkers, make use of critical reflection and focus on transformation. Critical reflection can be described as reflecting on underlying assumptions, beliefs and values (O'Neil & Marsick 2009:19). Critical reflection also supports transformative learning.

Transformative learning refers to a revision of our worldview; in other words, it is a process of delineating meaning. Transformative learning is based on constructivist theory and the term was coined by Mezirow (Gravett 2005:26). Mezirow (2003:58-59) defines transformative learning as a 'uniquely adult form of metacognitive reasoning,' transforming problematic frames of reference of fixed assumptions and expectations to make them more inclusive, justifiable actions. There are two dimensions as defined by Mezirow, namely 'habit of mind' and 'points of view'. Habit of mind is regarded as a set of assumptions that is used as a lens to construct meaning from experiences. One may either reject or transform the experience in a process known as critical reflection on assumptions. Critical reflection is an analytical process of reflection and may lead

to a critical reappraisal of meaning (Gravett 2005:27). Points of view are a set of established ideas, for example values, beliefs and judgements that characterise our interpretation and guide our actions. Point of view learning can also be transformed by assumptions and reflection (Gravett 2005:27).

Mezirow (2003:58-59) links transformative learning to Habermas's instrumental and communicative learning. Mezirow describes instrumental learning as controlling the environment. Communicative learning relates to communication and the way in which someone communicates. Mezirow points out that one must assess the legitimacy of claims through a process of 'critical dialectical discourse' to analyse the claims and be the judge of the legitimacy thereof. Similarly, De Boer et al. (2013: 38) mention that when one becomes aware and revises and acts upon these new perceptions, there will be a facilitating of learning in the place of 'teaching'.

Gravett (2005:41) defines dialogue as a 'commutative educational relationship' characterised by dialogue that explores and cross-examines. Secondly, the dialogue analyses and endorses new insights. Thirdly, the dialogic process denotes cooperative inquiry through comments, questions, reflective observations, redirection and responses and it forms an incessant developmental sequence. Fourthly, dialogue requires commitment to nurture engagement within the educational context. Lastly, dialogue is characterised by interchange among professionals, and is underpinned by mutual interest and respect for each other. Thus, dialogic teaching can be described as learning-centred (Gravett 2005:41). De Boer et al.

(2013:40) relate dialogue to authentic learning as it constructs meaning from conversations. They relate conversation to cooperative learning (preference of the C quadrant thinking style). De Boer et al. (2013:40) agree with Gravett regarding the reflective purposes of dialogue. McNiff (2002:9) points out that dialogue can lead to constructing new knowledge and she stipulates that dialogue must always be a 'dialogue of equals'. In other words, the mentor does not dictate the learning, but shares in the value of the professional's learning.

In Australia, Britain, Canada and the United States of America professional learning is promoted through peer collaboration within a professional learning community. Due to the teachers' different interpretations of their experiences and the creation of learning opportunities, it is suggested that collaboration (Riveros 2012:603-604) will lead to innovative teaching practices.

The community of practice at Wilberforce High School collaboratively constructed knowledge during the workshops. The professionals were made aware of the changing school environment and that they had to use their knowledge to direct future action to be taken to transform their teaching practice. Burke, Marx and Lowenstein (2012:115) believe that experience influences future actions to transform learning. Porter (2011:14) underscores the idea that establishing a community of practice will provide a basis for collaboration, inquiry and reflection.
Collaboration is described as 'an evolving process' by De Boer et al. (2013:231-232) and may include teamwork and exchange with a shared goal. It is further noted that multi-disciplinary collaboration

includes professionals with different thinking preferences and if the professionals are aware of Whole Brain® thinking it will contribute positively to the dynamics of the collaboration.

Cooperative learning is underpinned by collaboration and openness and it is learning-centred. Wolvaart and Du Toit (2012:1255) support a 'learning in a learning-centred' approach where learning underpins the learning of, for example, the learner (for the purpose of this study, the professional is used) and the lecturer but for the purpose of this study, the mentor. Gravett (2005:43) suggests that professionals might suffer from anxiety that might be due to previous educational experience when faced with educational tasks. Thus, the professionals should be reassured that they do have valuable insight to contribute to the professional learning process as well as the mentor's practice, therefore a 'learning in a learning-centred' (Wolvaart & Du Toit 2012:1255) environment should be created within the mentoring practice. O'Neil and Marsick (2009:21-22) describe peer mentoring as a 'two-way process,' allowing 'mutual learning' and they underscore this benefit by further stipulating that due to a lack of a hierarchical structure, there is a more open approach regarding communication, collaboration and support.

2.2.3 Peer Mentoring

Leidenfrost, Strassnig, Schülz, Carbon and Schabmann (2014:103) categorise mentoring as firstly workplace mentoring, secondly mentoring in higher education and lastly youth mentoring. For the purpose of this study the focus is on workplace mentoring. De Boer

et al. (2013:98) describe mentoring as an umbrella term that includes a variety of activities. Furthermore, they state two positive outcomes of mentoring: Firstly, that a mentor provides guidance regarding specific skills, and secondly mentor's professional practice becomes less isolated and knowledge is shared. It manifests cooperative learning. De Boer et al. (2013:98) opt for a mentor being 'competent' rather than 'skilled.' In agreement with De Boer et al. (2013) my mentee practice is aligned with the scholarship of Whole Brain® facilitating of learning and the incorporation of the iPad in the teaching practice; thus my mentee practice can be defined as peer mentoring. Murray (2010:6) emphasises the importance of peer mentoring as a form of support, sharing experiences and knowledge rather than evaluating and critiquing your peers. Synonymous with the aforementioned O'Niel and Marsick (2009:22) describe a peer mentor as someone who provides confirmation and emotional support as well as personal feedback, adding to the existing knowledge and sharing information.

Murray (2010:6) stipulates that peer mentoring can motivate experienced teachers to reflect upon their own teaching practices and facilitating of learning. She states that although peer mentoring is time consuming it does empower professionals to find constructive solutions to challenges within their teaching practices. Murray (2010:7) suggests that mentoring also benefits the mentor in the sense that the mentor can reflect on the responses of the mentees and improve his or her mentee and related teaching practice. In accordance with Murray, De Boer et al. (2013:98) describe one-on-one mentoring as the mentor and mentees being peers and the mentor practice is reciprocal. However, if professional

learning takes place in a group, the peers could mentor one another and this can be defined as 'co-operative professional learning'.

Du Toit (2012:1218) describes peer mentoring as an 'enriching learning opportunity' for all who are involved in the cooperative learning. Furthermore Du Toit (2012:1218) relates professional cooperative learning to Action Research. Workshops that included cooperative learning as well as one-on-one peer mentoring sessions, including communication in a variety of ways, reflection and follow-up sessions were facilitated at Wilberforce High School. Weisblat and Sell (2012:67) define one-on-one mentoring sessions as the facilitation of regular meetings, communication via email and follow-up meetings to reach the outcomes. Du Toit (2012:1218) uses the construct *critical reflection* and identifies it as a fundamental part of peer mentoring.

According to Weisblat and Sell (2012: 66) there has been a paradigm shift in learning and facilitating learning from an individualistic to a collective endeavour, and multiple individual contributions incorporating inclusive and shared experiences. Du Toit (2010:1218) is of the opinion that a community of practice is built on the sharing of information, providing community support and engaging in critical reflection. Weisblat and Sell (2012:66) promote an asset-based approach (similar to Du Toit 2008) to utilise existing scholars and establish a 'mentoring-focused' programme. Weisblat and Sell suggest that kinaesthetic experiences, collaboration and co-learning should underpin the mentoring programme. A collaborative group of professionals provides the mentees with a safe environment, where the mentor is also a co-

learner and learning takes place independently of others, but at a professional level (De Boer et al. 2013:99). Zachary (2005:3) describes mentoring as a 'reciprocal and collaborative learning relationship' where individuals share responsibility and accountability of the learning objectives.

De Boer et al. (2013:99) suggest that peer mentoring should involve role modelling the different roles of the educator. Mentors take up the role of leadership and constructs, such as Whole Brain® thinking methodology (Du Toit 2012), 'constructivist mentoring' and 'facilitative mentoring'. If, for example, the mentor introduces Whole Brain® learning to the mentees, Whole Brain® learning should be applied in the mentorship practice (De Boer et al. 2013:99). The principles of Whole Brain® facilitating of learning were applied at Wilberforce High School and the mentees were challenged to think outside their preferred preferences to accommodate divergent thinking preferences. De Boer et al. (2013:99-100) emphasise that self-knowledge, as a point of departure, is important to determine the thinking preferences of the mentor and mentees. They suggest that the mentor should use a holistic view (D quadrant) to challenge the mentees to construct a holistic view of their teaching practices.

De Boer et al. (2013:99) suggest that the mentor practice should consist of fact-based learning (A quadrant) that can relate to constructivist mentoring where the mentee learns from experience and new ideas. Structuring regular meetings (B quadrant) relates to organising, planning and monitoring the mentoring process. Furthermore De Boer et al. (2013:99) suggest that on an emotive level (C quadrant), the mentor must take up the role of supporting

the mentees. Leidenfrost et al. (2014:103) identified mentors who were unconditionally supportive as motivators of their mentees, providing motivational feedback. Secondly, Leidenfrost et al. (2014:103) define an active mentor as someone who provides tasks and informative feedback with detailed information. Thus, the first type of mentor that Leidenfrost et al. identified shows characteristics of a predominantly C quadrant thinking preference whereas the second type of mentor indicates mentors with a B quadrant preference. Chances are that the mentees, as mentioned by Leidenfrost et al., do not benefit equally from their mentors, thus there is a need to accommodate the different thinking styles in one's mentee practice by becoming more flexible in one's own thinking preference.

Greyling and Du Toit (2008:959) describe the mentor-mentee relationship as a developmental alliance where the professional cooperates, pursues 'construct-based experiments' to optimise workplace functionality. They further suggest that the mentor and mentees should participate in cooperative learning and 'critical-reflective-meaning-making' interactions. In addition they describe mentoring as the starting point to probe the network constructs of the workplace. Holbeche (1996:24) stipulates that peer mentoring is mutually beneficial for the mentee and mentor, specifically relating to their professional development.

2.2.4 Learning styles

Kolb's experiential learning is credited for introducing the modern learning styles movement of the mid-1980s. Kolb cites four

different learning types, namely the convergent style that is regarded as abstract and active where learners prefer to ask 'how' questions and they want clear structured tasks. Secondly, the divergent style that is based on concrete experience and reflective observations forms part of this learning style. Divergent style thinkers are usually feeling-orientated (De Boer et al. 2013:34) and this might be linked to Herrmann's (1995:419) C quadrant thinking preference that is feelings- and emotionally-driven. Thirdly, Kolb defines the assimilating style and learner who assumes this thinking style focuses on 'what?' explanations. An assimilator likes to reason inductively and is more concerned with ideas, theories and abstract concepts than with people (De Boer et al. 2013:34). The assimilating style relates to Herrmann's (1995:419) A quadrant thinking preference where the participant likes to formulate theories and think through ideas. Lastly, the accommodating style characterises students that respond to 'what if?' questions and they want to apply learning to new situations in order to solve problems (De Boer et al. 2013:34). The accommodating style relates to Herrmann's (1995:419) D quadrant thinking preference where the person wants to harmonise with the content and wants experiential opportunities, thus integrating experience with the self. The accommodating style is also described by De Boer et al. (2013: 34) as students who wants to 'maximise discovering'.

According to the HBDI® the C quadrant can be called kinaesthetic. Experience is reality (Herrmann 1995:83). Thus Herrmann's C quadrant can be linked to Kolb's experiential learning theory (KELT). Experiential learning is seen as a 'widely influential' (Bergsteiner, Avery & Neumann 2010:29) theory for professional

learning. Experiential learning is an alternative to the traditional didactic approach and provides personal change and development as part of the learning cycle (Bergsteiner et al. 2010:29). The experiential learning cycle consists of *concrete experience*, *reflective observations*, *abstract conceptualisations* and *active experimentation* (Schenck & Cruickshank 2015:74). Instead of using Kolb's reflective observations, I agree with the construct of critical reflection, or scholarly reflection that represents multiple intelligences, thus relating to the C quadrant of intrapersonal intelligence (De Boer et al. 2013:41). Furthermore, Kolb's experiential learning as stated earlier can be linked to Herrmann's (1995: 217) C quadrant but also the D quadrant thinking preferences.

Gravett (2003:36) infers that the most fundamental learning takes place when multiple memory lanes are activated, since the brain does not have a memory bank. In other words, the five memory pathways, automatic, emotional, episodic, procedural and sematic should be implemented to create learning by activating multiple pathways. Thus experience leads to the activation of the memory pathways.

Gardner (Gardner & Hatch 1989:4-5) wanted to develop a more encompassing approach to intelligence and two factors led to the development of Gardner's *Theory of Multiple Intelligences*. Firstly Gardner felt that other theories about intelligence were limited, and secondly he was disillusioned with the focus on logical-mathematical symbolisation and linguistic symbolisation in education (Gardner & Hatch 1989:4-5). Herrmann (1995:2-3) experienced first-hand the

dilemma of excelling in Science and Mathematics as well as belonging to the Glee and Drama clubs. Herrmann felt that there was a dualism and he could see the difference in his two sets of friends. These experiences would lead Herrmann to develop the HBDI®. De Bono (1990 37-39) compared vertical thinking with lateral thinking and deduced that both methods are important, and that both should be promoted. In the HBDI® professionals whose primary quadrant is D are individuals who are innovative and see a variety of new possibilities. They would even regard uncertainties as possibilities (Herrmann 1995:84). Quadrant D relates to Slabbert et al.'s (2009:56) higher level thinking, specifically where neurons in associative neural networks that are found over large areas of the brain produce intuitive, creative and inspirational thinking.

According to Gardner (Gardner & Hatch 1989:6) intelligences differ and individuals have different profiles that should be measured. He promoted the idea that a standardised test should be set to determine the strengths and weaknesses of students. At this stage Gardner found standard tests to be limited to testing only logical and linguistic skills (Gardner & Hatch 1989:6). Herrmann (1995:43-55) wanted to develop a brain dominance instrument that would represent the different thinking styles that would cover all the modes of thinking. He wanted to ensure that it would be inclusive and people who had one or more thinking preferences would be included; therefore he decided to divide the thinking styles into four categories, which would ultimately lead to the development of the HBDI®.

It does not matter what one's specific intelligence or preferred thinking preference is; what is important is that one uses the knowledge thereof to guide one's 'personal growth' (Herrmann 1995:246). *Personal growth* is the construct used by Herrmann; however, *professional development* is used for the purpose of this study. De Boer et al. (2013:42) suggest that learning theories should be used to construct meaning underpinned by one's own experience and the comprehension thereof. Furthermore they advise that scholarly discussions should take place, taking account of multiple intelligences and Whole Brain® thinking.

Sources written about multiple intelligences, such as the work of Armstrong (2000); Campbell, Campbell and Dickinson (2004); Lazear (2004); Silver, Strong and Perini (2000) and Gardner (1995; 2005) were used to generate ideas for the development of inclusive and holistic learning. Other publications such as Given's *Learning Styles: a guide for teachers and parents* (2000) was consulted in collaboration with the above-mentioned sources to develop the facilitating of Whole Brain® learning.

Robinson (2010) is of the opinion that divergent thinking is not the same as creativity, but it is the catalyst leading to creative thinking in the sense of finding a variety of possible answers to a certain question, adding to the constructivist view of knowledge of the individual contributing to multiple realities. De Bono (1990) refers to divergent thinking as 'lateral thinking'. In De Bono's *Teach your child how to think* (1993) he refers to developing lateral thinking skills and using the *Six Thinking Hats* (De Bono 2000). He provides interesting 'thinking exercises' by using newspapers and looking at

headlines, taking pictures of the newspapers and matching them to a headline (De Bono 1993:287-291). Herrmann (1996:227) categorised 77 creative processes in terms of the Whole Brain® model and he listed De Bono's Six Thinking Hats as a process that can be used to promote multi-dominant thinking or Whole Brain® thinking.

Table 4 shows the differences between virtual, lateral thinking by De Bono (1990:37-42) in comparison to Herrmann's (1995) Whole Brain® thinking flexibility. De Bono describes lateral thinking as 'rich', whereas Whole Brain® thinking leads to flexible thinking that enables one to think through ideas by moving through the four quadrants. A virtual thinker may choose only one solution, and a lateral thinker may see different possibilities. A Whole Brain® thinker is more flexible and moves into other quadrants (as mentioned before), therefore being able to find a variety of possibilities. Ultimately, where a lateral thinker will look at different approaches, a virtual thinker will look for the best approach; a Whole Brain® thinker will look at a variety of approaches when using the Whole Brain® Walk-Around. The Whole Brain® Walk-Around (Herrmann 1996:129) begins in quadrant A with the problem definition (for the purpose of this study I am adapting it to Du Toit's (2008) asset-based approach). Secondly, a process of brainstorming (D quadrant) is advised after which force fitting (B quadrant) challenges the person or persons to suggest constructive and planned ideas. Lastly the sensory processing (C quadrant) completes the Whole Brain® Walk-Around process storming and a final outcome or decision can be reached.

Thus, the Whole Brain® model complements De Bono's lateral thinking. Other constructs, for example the six steps of the Whole Brain® creative process, are discussed in Chapter 5.

Virtual thinking	Lateral thinking	Whole Brain® thinking
'Rightness'	'Richness'	Whole Brain® flexible thinking
Choose one solution	Choose many different possibilities to solutions	Become flexible in using less preferred thinking preference
Look for the best approach	Generate different approaches	Whole Brain® Walk-Around
Experiment to show effect	Experiment to provide opportunity for new ideas	Six steps of the Whole Brain® creative process
Sequential	Can make jumps	Flexible in thinking preferences
Be correct in every step	One does not need to be correct in each step	Switch between quadrants to find the most effective answer
Logical and mathematical	Exploring	Whole Brain® thinking accommodates the A quadrant and D quadrant
Exclude irrelevancy	Welcome change intrusions	Accommodate less preferred quadrants
Classification and labels are fixed	Classification and labels are not fixed	Flexibility in thinking preference leads to best solution
Structured, look at most likely approach	Look at least obvious approaches	Whole Brain® Walk-Around looks at a variety of options from each quadrant
Finite process	Probabilistic	Asset-based (Du Toit 2008)

Table 4: A comparison of De Bono (1990:37-42) and Herrmann's (1995; 1996) thinking styles

2.2.5 The Whole Brain® approach to learning

Gravett (2005:37) underscores the importance of learning through personal knowledge, repetition, emotional involvement and feedback by others. Emotional involvement and feedback by others can be linked to Herrmann's C quadrant (1995:417-419) that is feelings-based. Gravett (2005:37) argues that the more complex the learning experience is by using a mixture of movement, smell, sound, talking, vision and writing, the easier it would be to recreate the memory of what was experienced during the facilitating of learning.

Leonardo da Vinci and Albert Einstein used creativity instead of traditional modes of inquiry in their fields. Da Vinci had a clear artistic vision and he also had the technological understanding to create inventions. Einstein was inspired by dreams and owing to his creativity major breakthroughs were made in Science (Herrmann 1995:195-196). The split-brain theory does not quite fit Da Vinci or Einstein; therefore Herrmann's Whole Brain® model classifies their thinking preferences in a constructive manner, making sense of how they were able to capitalise on their preferred quadrants.

Herrmann (1995:197) states that there are three groups of creative people: Firstly, people who are already practitioners of creativity; secondly there are people who would occasionally be creative, and thirdly there are people who can be creative, but they are yet to realise their potential. In short, he believed that everyone has the potential to utilise creativity in order to become a Whole Brain® thinker. I wanted to create awareness of the thinking preferences of

the professionals to encourage them to become more flexible in their thinking preferences and create a Whole Brain® culture and Whole Brain® community of practice.

Thus, by creating a Whole Brain® culture, professionals were encouraged to be creative and innovative in their teaching practices. Herrmann (1995:198-205) suggests that we should reclaim our creativity by looking at children as an example. Firstly we need to 're-learn' from children, for example to follow our interests, take risks, look for rhythms and daydream. We must use mistakes to learn from, and making mistakes or re-evaluating our teaching practice forms part of the Action Research process (See Chapter 3). To be innovative, like a child, would be, for example, inventing a game or a story to better explain a concept. An example of Whole Brain® assessment is described by De Boer et al. (2013:191-193) where toothmorphology students were given the task to create artefacts. The artefacts included games, such as 'Toothalopoly' and 'Dental Pursuit'. The students shared a positive experience and performed on average 30 per cent better than previous groups. The students felt motivated in this supportive learning environment. Another suggestion is that we need to affirm ourselves. Herrmann (1995:198-205) further suggests that one must reflect upon one's life and this correlates with the practice of reflection in Action Research. The question here pertains to encouraging the participant to become an innovative facilitator of learning. Herrmann suggests that one can write an epitaph, rekindle a past passion and act on it.

Herrmann states in *The creative brain* (1995:63-69) that brain dominance cannot be confined to only left brain and right brain, but it should be seen as a quadrant concept. The HBDI® is used to determine which thinking preferences a person has. Herrmann describes it as a *metaphoric* interpretation of thinking preferences. Using these creative ideas developed by Herrmann, professionals were encouraged to develop a culture of creative thinking and a Whole Brain® approach (Herrmann 1995:194) in their teaching practices.

The metaphoric thinking styles of Herrmann (1996:15) represent the cerebral cortex's two halves, based on Sperry's work and the two halves of the limbic system, based on MacLean. Herrmann (1996:15) describes the four-quadrant model 'an organising principle of how the brain works.' Additionally, one's preferred thinking style depends on the dominant quadrant or quadrants. Thus one's interests would lead to further development of aptitudes and can influence career choices (Herrmann, 1996:25).

Herrmann's (1995:63) metaphorical quadrant concept is divided into four main categories representing the different thinking preferences. Quadrant A represents the theorists or rational self; Quadrant B represents the organisers or the so-called 'safe-keeping self'; Quadrant D is the innovator who experiments and Quadrant C constitutes the humanitarian who relies on his or her feelings. Herrmann's C quadrant would relate to Slabbert et al.'s 'higher' level thinking (2009:56), specifically to associatively-joined neural networks that produce interpersonal and emotional thinking.

Herrmann's approach does not confine one's thinking style to one quadrant only. One can have two, three or even four thinking preferences. From the HBDI® database, the most common pattern is evidenced in people who have strong preferences in two quadrants. One who is quadruple dominant is very rare, accounting for only about 3% of individuals in the database. Such a person can easily adapt to a situation where people have a variety of thinking styles. Therefore the goal is to know one's own thinking preference and then be flexible enough to be able to understand and incorporate people with different thinking styles and plan for innovative approaches to facilitating learning (Coffield et al. 2004:80; Herrmann 1995; Herrmann 1996).

The Herrmann model is more inclusive than other learning style models and it makes provision for all thinking styles. It is also inclusive in the sense that different intelligences as identified by Gardner (2005:7-8) can be linked to each of the quadrants. Intelligence is diverse and one thinks, for example, in abstract terms, visually, kinaesthetically and in movement. Furthermore, intelligence is also interactive and one obtains original ideas by regarding it in different disciplinary ways (Coffield et al. 2004:80).

2.2.6 Whole Brain® learning: South African studies

There is a selection of Action Research studies in South Africa that incorporate Herrmann's Whole Brain® approach for facilitating learning. De Jager (2011) focuses on professional development of teachers in a primary school. The following study is similar to what I introduced at Wilberforce High School, namely reflective

professional learning coupled with a Whole Brain® approach: a study was conducted by Van der Watt (2008) on the development of educating health science practitioners. This study relates to professional development, but at university level. A similar study was conducted by Boshoff (2014) who focused on professional development of staff at a higher education institute.

De Jager's (2011:ii) study closely resembles the lens that I used for my study. Her focus is on mentoring beginner teachers by using Herrmann's (1995) Whole Brain® facilitating of learning as part of a peer-mentoring group; the study was conducted within a primary school context whereas my study was conducted within a high school context; De Jager made use of constructivist theory and implemented mentoring sessions instead of workshops; her finding was that a once-off workshop on Whole Brain® learning was not enough; she worked with beginner teachers (De Jager 2011:4-13) while my study included a variety of professionals, from second-year teachers to more experienced teachers; I used one-on-one peer mentoring and workshop sessions to introduce the ideas of Whole Brain® facilitating of learning and the use of the iPad with the objective ultimately to create a Whole Brain® culture at Wilberforce High School.

Boshoff (2014:xviii) observed that at a private higher education institute the facilitating of learning was lecture-driven with little student participation. She postulated that if an Action Research professional development programme were presented it would motivate the facilitators to transform their practices and become more innovative. The aim of the study was to promote lifelong

learning in the context of the higher education institute. Boshoff believes that a scholarly approach should be considered to establish a 'culture of lifelong learning' and similarly a scholarly approach should be followed in facilitating and assessing learning practices. Boshoff promoted lifelong learning by setting an example for her mentees (2014:23).

Boshoff's (2014:295-297) analysis after a reflection session with one of the professionals showed that the participant was excited about the new knowledge gained regarding Whole Brain® thinking styles. Contrary to the involvement and emergence into the dynamics of Whole Brain® facilitating of learning, Boshoff (2014:298; 304-306) describes her interaction with a participant whose thinking preference is the complete opposite of hers. After the explanation of the HBDI® results and facilitation of professional development the participant was interested to get more involved and he started to create slideshows that included more visual aspects. I observed that three of Wilberforce High School's professionals whose thinking preferences differed considerably from mine, also included more visual aspects in their slideshows as part of their learning style flexibility. An in-depth analysis of all of the professionals' thinking preferences was done in Chapter 5 of this study.

Thus, initially I regarded De Jager's (2011) study similar to the study that I proposed to do as one of the few South African studies that incorporated Whole Brain® learning, Action Research, professional development and the use of constructivist theory. De Jager's (2011) focus is on the professional development of teachers

at a primary school. Boshoff's (2014) study also focuses on Whole Brain® learning and professional development of facilitators at a higher education institute. I saw a gap in the literature and a niche for my study to fill. I realised that my study would add to the body of work considering the promotion of professional development through Action Research and developing learning style flexibility to become a Whole Brain® facilitator of learning.

Other similar studies on Whole Brain® learning include Oosthuizen's (2002) master's dissertation, in which he used a Whole Brain® approach to facilitate learning in Tooth morphology. This study includes Action Research; however, it does not relate to high school learners. Another master's dissertation by Ngozo (2012) is based on learning style flexibility in teaching and learning. This did not relate directly to the study that I conducted; however, it did not focus on professional development through the implementation of Whole Brain® workshops.

Voges (2005) evaluated the Whole Brain® learning programme for professional development within the military as context in her doctoral thesis. This could be referred to a limited extent in my study as it does not relate to professional development within the high school context. Steyn (2003) investigated applying the Whole Brain® method in mathematics for engineering students. Although the application is relevant to the study that I envisioned, the focus of Steyn's study is on using learning style flexibility for students and it does not relate to the professional development of a group of teachers, but rather to professional development of a single facilitator. Tembe's (2012) doctoral thesis is devoted to improving

teachers' teaching practice through professional development. Although the emphasis is on professional development, it is aimed at primary school teachers making use of Action Research. This study does not define using Whole Brain® learning as a method for professional development. Therefore it is not related to the lens that I used for conducting my study. Wolvaardt's (2013) doctoral thesis emphasises an Action Research living theory design, making use of constructivist grounded theory. It is a valuable study regarding Action Research in the context of the School of Medicine.

De Jager's (2011) study pioneered professional development through Whole Brain® learning at primary school level; however, there is a gap regarding the professional development of secondary school teachers. The deduction can be made that there are no relevant studies introducing the Whole Brain® approach to facilitate professional development by using Action Research and Whole Brain® learning at high school level. Therefore it was considered important that such a study be undertaken so that the findings could then be adopted for use in other private schools. Furthermore I used collaboration and cooperative learning within a community of practice. Riveros (603-604) refers to professional learning communities and argues that although this term is widely used, the implementation of professional learning communities is still lagging behind.

2.2.7 Technology in education: iPad

Slabbert et al. (2009:12) state that the information revolution led to communication technology that exceeds the limitations proposed by distance, time and space. It contributes to globalisation. Slabbert et al. (2009:13) further stipulate that almost everyone has access to instant information. So the deduction is made that the most sought after careers involve technology and careers in information and communication technology. We are moving to a virtual world where the working hours have become a flexitime work life and communication changes to *faceTime* in an audio-visual world (Slabbert et al. 2009:13-14).

Education should be regarded as a service industry infused with technology. Interestingly, major breakthroughs in technology and education have come from the business world or young entrepreneurs outside of the educational field (Slabbert et al. 2009:14-15) such as Mark Zuckerberg, the creator of Facebook. Facebook has become a platform for education with links to social network sites. Zuckerberg was chosen as *Time* magazine's Person of the Year in 2010. He is regarded as someone who changed the way people communicate. Some describe Zuckerberg as a prodigy; at the age of 13 he already designed a family network called ZuckNet. He conceptualised the idea of a network when his father complained that he wished there was another way of communication when a patient arrived for his dental appointment, rather than the receptionist calling out. ZuckNet made use of a ping to alert Dr. Zuckerberg when a patient arrived. It was extended to their home environment as well and the siblings would ping one

another. Facebook is a far cry from the prototype Zucknet and can be used to share personal information, photographs (Lüsted 2012 6-9; 20-21) videos and links to groups. One can follow pages of actors, music groups, activist groups, religion and more. Facebook, MySpace and Twitter are known as social networking and one can connect with friends, an online friend, family, colleagues and it is also a platform for popular culture (Lüsted 2012:9).

The origin of Facebook is quite interesting. Zuckerberg conceptualised a website for Harvard students where they could post their photographs and add comments (Lüsted 2012:12, 14). It quickly grew to the phenomenon of today. Thus it was conceptualised in a college dormitory room, but not with a preconception of the role that it might play in education. Similarly more platforms are developed to promote learning and to establish collaboration, for example Google classroom. Various ways of sharing files and photographs are readily available, for example Evernote, Dropbox, iCloud and Google Drive. With the increase and affordability of using social media, multimedia technologies and platforms for collaboration it is a natural step to implement a mobile device in the classroom to streamline ideas, collaboration and instigate a new mode of facilitating learning. De Boer et al. (2013:252) refer to 'blending learning environments,' postulating that due to the introduction of the Internet learning has changed irrevocably.

Rossing (2012:68) states that there is an increase in the use of mobile devices among students; in 2010 the increase was noted especially among eighteen- to twenty-nine-year-olds. Furthermore

he notes how many institutes are providing mobile devices for their students. Despite references to mobile technology engaging students Rossing (2012:69) observed that students might be engaged at the beginning of the term, but the novelty wears off and they become distracted as time progresses. De Boer et al. (2013:252) note that online learning contributes to a new way of learning and collaborating, using learning management systems that are effective, convenient and low in cost. However, they stipulate that students who make use of these online learning opportunities need more choices, for example social contact, relevance and context to ensure that the students stay engaged in the learning. Rossing (2012: 70) points out that some students might not be so familiar with technology and struggle to understand how the device works instead of focus on their learning. Slabbert et al. (2009:26-27) refer to the 'gamer generation' and are of the opinion that in their inquiry for meaning they are able to analyse the logic of games and win every time. Thus, the 'gamer generation' or digital generation has emerged as intellectually superior to the adult world due to being 'digital natives' growing up in the world of communication technology. Secondly, the digital generation can interpret and process audio-visual information 70% faster than adults. Thirdly, multitasking is second nature to them. They are idea-driven and adhere to innovation and a new way of doing. These are valid deductions; however, I cannot agree that all who belong to the digital generation have had equal opportunities to explore the digital world. At Wilberforce High School something similar was observed in my teaching practice where basic instructions or technical questions had to be given to the students. One can deduce that within one's teaching practice special care

must be taken not only to observe the different thinking styles but also to take careful note of students who need extra support during sessions where technology is used.

Regarding the possibilities of sharing information, for example between an iPhone and iPad, Rossing (2012: 69) observed that it promotes cooperation between students becoming increasingly collaborative. The size of the device helps to break down physical barriers, thereby promoting more interaction between the students. Rossing (2012:70) describes the mobile device as a medium that has a dual benefit of firstly instant access to information, and secondly for collaboration.

With the establishment of a community of practice among professionals, professionals can share their experiences to reflect upon their teaching practice and to facilitate 'similar modes of inquiry' (Rossing 2012:70) in their respective teaching practices.

Teachers must not only be able to facilitate learning with mobile devices, but they must also critically inquire and reflect on the usefulness of the technology itself (Rossing 2012:70). This study investigated to what extent the iPad would be useful in the context of Wilberforce High School to promote Action Research and to facilitate Whole Brain® learning.

Peluso (2012:126) warns that when teachers decide to incorporate technology they should not be driven by band-wagon propaganda, without fully understanding how it will enhance/distract learning. She further warns against assumptions that are made, such as that

these devices will 'engage' the learners and will lead to 'innovative learning'. Further assumptions must also not be made that all students have equal access and technological understanding of these devices. The iPad's innovative multi-touch interface, software distribution and long battery life are advantages that are, at this stage, not fully utilised for learning; most of the educational applications are not focused on the needs of skills development of the 21st Century (Murray & Olcese 2011:48). Murray and Olcese's critical view on the applicability of the iPad can no longer be validated. In the past few years great leaps in new, innovative Apps and programs geared for education were taken. Software compatibility problems are also becoming fewer; for example, one can now connect one's iPad to a Smartboard using AirServer and be completely mobile. One should, however, keep in mind that a WiFi connection is needed.

Hashim and Yusup (2014:102) states that participant teachers in Malaysia agreed that the iPad assisted them in their professional learning and teaching practices by the quality of the touch screen and legibility of text, long battery life, reliability of storing documents in the cloud as well as that the iPad was small and lightweight with good resolution. The teacher professionals in Malaysia experienced some limitations with the iPad. Professionals felt that the iPad was too reliant on Internet connectivity and that there were too many applications on the screen that make it look 'crowded'. Furthermore a VGA cable was not provided, thereby limiting teachers' use of the iPad with a digital projector in their classroom (Hashim & Yusup 2014:103). Similar problems were evident at Wilberforce High School.

Murray and Olcese (2011:42-43) investigated to what extent the iPad could be used in education. They made use of Means's (1994) four categories and added an extra one to develop skills for the 21st century (See an adaptation of Means's four categories in Chapter 5, Table 38). The iPad has the capacity to store a large amount of data sets collected (Murray & Olcese 2011:46). Ideally this means that a teacher is able to have real time access to a cloud to update documents or to make use of documents in the cloud. One can either store information on the iPad by using iFiles or upload data to iCloud, Dropbox or Google Drive.

In a study conducted in 2011 by Murray and Olcese (2011:45) they came to the conclusion that developers of social media, for example Facebook and Twitter, did not focus on collaboration. Not even a year after this study it became clear that Facebook could be used for collaboration by setting up groups and in 2014 the development of Google classroom provided a platform for teachers and students to build a website collaboratively.

Murray and Olcese (2011:45-46) are critical about the application, stating that they are 'interactive' and note that many applications still rely heavily on content, flash cards, quizzes and lack functionality. It might have been the case in 2011; however, new Apps, for example Aurasma, provide a platform to create an augmented reality where students can take their mobile devices and point it in the direction of the trigger and more information is given in the form of a web link, video or animation.

Murray and Olcese (2011:48) concluded that although Apple brought about transformation in software development it was found that the iPad would not revolutionise learning. According to their findings the target market was just for content-based applications and not focused on collaboration of content creation.

Murray and Olcese's finding may have been the finding of 2011; however, a mere three years later many changes occurred with regard to content development and using the iPad to facilitate learning. In terms of this study I proposed to investigate to what extent the iPad could be used within a teaching practice to promote Whole Brain® learning.

In 2011 Murray and Olcese (2011:48) could not identify any application focused on the 21st century concept of learning. They concluded that many of the applications were nothing new and could very well be run through other devices as well. They proposed that there be a greater emphasis on the construction of knowledge, collaboration and methodology that is related to the 21st century. Contrary to Murray and Olcese, Holland (2015) uses QR codes and Augmented reality to extend the physical perimeters of digital learning. QR codes may be used to promote collaboration by brainstorming ideas. Any smart phone or tablet can be enabled to scan a QR code if an App is downloaded. QR codes can be used to create clues for 'scavenger hunts' (Holland 2015) or creating games for exploring a language or a physical science. For the purpose of this study I explored the possibilities of augmented reality with one of the professionals. The Aurasma App can be used to create the augmented reality experience (Holland 2015) by taking a photo of a

trigger image. As soon as the trigger image is scanned it can be used for example to open up a virtual tour through a museum. Thus, a lot of strides have been made with regard to 21st century learning with new platforms to simplify educational accessibility developing.

Steve Jobs envisioned transforming education and Apple developed the iTunes U platform where lecturers can upload entire courses. This application can accommodate a variety of data, such as lectures, books, assignments and quizzes. It can only be accessed from an iPad, iPhone or iPod touch. Universities such as Yale, Harvard and Stanford have uploader courses for iTunes U; however, there is still much skepticism about this platform since so many institutes are still using their platforms and are hesitant to change. Blackboard Inc. is still one of the main platforms (Cooper 2012:10-11).

The question remains whether iTunes U will be viable since it is only accessible from an iOS device, whereas Blackboard Learn is accessible from either a PC or Apple Mac. Furthermore, the cost of the iPad must also be taken into consideration (Cooper 2012:11).

iTunes U provides course material that is free to download by anyone. There are two objections. Firstly, the fact that material is freely available to anyone, poses the problem of copyright since the lectures are compiled from sources that have copyright. Another matter of concern is the legal implications of privacy, since photographs of students or student feedback forms can be uploaded to iTunes U (Cooper 2012:10).

Ensor (2012:193) worked as an instructional leader with the teachers and students to use effectively in learning. Teachers who wanted to get involved would meet with her on a monthly basis and they would share information via Evernote. She not only noted the collaborative possibilities of the iPad, but also that students would be able to learn independently. Students would have immediate access to information, create their own content and share their experience, thus moving away from the teacher as a source of information and rather discover knowledge. The aforementioned was also observed during the field work of this study. The participants were able to learn collaboratively, but also practicing their skills to become more familiar with their devices.

Although there is a lot of literature available from overseas experiences regarding the implementation of the iPad, South African studies have not been represented thoroughly in literature and therefore another gap was identified that requires further investigation.

2.3 CONSTRUCTIVISM

Slabbert et al. (2009:14-15, 54) argue that education is one of the most important 'service industries' and the approach to education must be revised. The authors take a critical view at the development of multimedia technology within the business world and of the fact that the same strides were not made in education. Thus education has become more individualised and caters for the individual. The high expectations in the business world must be exemplar to education. Furthermore the authors state that learning

is 'radically constructivist'. The assumption is made that knowledge is based on experience.

Herrmann's metaphoric Whole Brain® model introduces the four thinking styles in more specialised quadrants. The upper left mode or A quadrant thinking process characteristics are linked to analytical, fact-based, logical and quantitative thinking. The lower left mode or B thinking process relates to planned, organised, and sequential thinking. The lower right mode or quadrant C describes someone who is emotional, feelings-based, interpersonal and kinaesthetic (De Boer et al. 2013:3-5). These thinking preferences relate to Kolb's experiential learning. The upper right mode or D quadrant is characterised by holistic, integrated, intuitive and synthesised thinking (De Boer et al. 2013:5).

This study is based on the constructivist theory that makes provision for 'different learning strategies' (Gulati 2008:183) The strategies focused on Whole Brain® facilitating learning and Action Research. Gravett (2005:14) argues that professionals have a frame of reference due to life experience and existing knowledge plays a fundamental role in learning. Professionals' existing knowledge forms part of their framework of knowledge and adds to the facilitating of learning; therefore they 'possess an expert body of knowledge, skills, attitudes and values in their field of practice' (Slabbert et al. 2009:129). The workshops were an adaptation of the framework set by Herrmann's (1995:206-234) Applied Creative Thinking Workshop or ACT I. Films, music, individual and collaborative tasks were used during the workshops and in the one-on-one peer mentoring sessions to ensure the promotion of Whole

Brain® facilitating learning. Learning tasks were designed by the professionals to incorporate the use of a Smartboard and iPads, keeping Whole Brain® facilitating of learning in mind to accommodate students who might not share the professional's preferred thinking preference. The content of the workshops was adapted to the four dimensions (See Chapter 3) identified for Wilberforce High School.

Imel (2000) defines four factors for consideration when learning tasks are set. Firstly, the multiple realities of each participant; secondly, the facilitator's understanding of the professionals' experiences; thirdly, the creation of a learning environment where the professionals can feel free to disagree with the mentor. Lastly, consideration of the different dynamics and multiple realities that the professionals bring to the workshops.

Constructivism makes provision for multiple realities (Gulati 2008:183) that are well-suited and combined with Action Research in terms of the repetition of reflection, and transformation within one's teaching practice. Constructivism also adds value to the evaluation of one's teaching practice since it assists with 'problem identification' (Gulati 2008:184). However, as Du Toit (2008) considers 'problem identification' a deficit-based approach, my mentoring practice and the teaching practices of my professionals were investigated following an 'asset-based approach' (Du Toit 2008). This entails identifying an innovative idea such as implementing the principles of Whole Brain® facilitating of learning to promote an innovative learning culture at Wilberforce High School.

Martell (2012:4) deduces that constructivism is a pragmatic approach and that the multiple realities are epistemologically rooted in the constructs of the students (in the case of this study the construct *professionals* is used). By using the constructivist lens I am aware of my own reality and interaction with the professionals. They in part, also have multiple realities in which they will construct their meaning of Whole Brain® facilitating of learning. Each participant constructs his or her knowledge uniquely (Yilmaz 2008:169); therefore the facilitating of professional learning as well as reflecting on the process is important. Each participant's experience is consequential to his or her action within the environment (Sutinen 2008:6). Slabbert et al. (2009:54-55) point out that radical constructivism may lead to all constructions being of equal value. However, the authors suggest that these constructions be tested by the coherence criterion.

Ültanır and Ültanır (2010:8) state that mere rote memorisation does not have the same value as engaging the professionals and encouraging knowledge construction. The experiential approach and collaboration can be described as socio-constructivism. Thus, knowledge from a socio-constructivist point is the result of communication and negotiation (Slabbert et al. 2009:57). Socio-constructivism expresses the idea that knowledge is not an external phenomenon, but rather that a participant constructs knowledge through his or her own interpretation and formation of ideas. Gravett (2005:20) describes constructivism as a process, where meaning is constructed and understanding is transformed in relation to interaction with the environment. The construction of meaning

should not be regarded as an individual process; it also relates to a social process meaning in which professionals share the 'co-construction of meaning' (Gravett 2005:21). 'Social' indicates that the participant not only constructs ideas individually, but within a group (Hubbard 2012:160), for example, through collaboration. Collaboration within a scholarly group forms the basis for developing a scholarship of teaching and learning and communities of practice (Lave & Wenger 2003). The construction of knowledge should be seen in a social context and it is socially and culturally constructed. Therefore language and dialogue (Gravett 2005:21) play a major role in constructing meaning within a community of practice. However, meaning may vary from individual to individual; meaning might be underpinned by emotion. Furthermore, if meaning were to be defined as significant, mutual agreements and consensus in addition to social justification of 'knowledge construction in the form of mutual agreements through consensus' (Slabbert et al. 2009:57).

Constructivism further supplements Whole Brain® professional development through mentoring. The construct *activity* should rather be replaced by *task* as proposed by Slabbert et al. (2009:104) as *task* reflects authentic professional learning by the professionals. The assertion is made that professionals have previous knowledge that they will draw upon to build their skills and reflect (Hubbard 2012:162) on their learning in order to construct meaning. Gravett (2005:20) describes the phenomenon of learning new knowledge as learning through 'existing knowledge structures'. Therefore new knowledge builds upon existing knowledge or 'conceptions are transformed during knowledge construction'

(Gravett 2005:21). Slabbert et al. (2009:57) argue that the construction of meaning is individual and central to human existence.

Cornelius, Gordon and Ackland (2011:381-387) have designed a 'flexible-activity (task) focused model'. In this model they make provision for constructivist learning, learning within a community and the importance of reflection. They claim that this task-focused model makes the learning of content more 'flexible.' They made use of collaboration, assessments, reflective logs and diaries, workshops, face-to-face discussions and tutoring as well as online discussions. The construction of meaning does not relate only to the professionals' individual experiences, but also to context of the culture (Gravett 2005:21) of Wilberforce High School as well as the available tools that were used for learning tasks. Thus the assumption is that by the culture, tools and the context of the professionals' construction of meaning can be placed in a social context (Gravett 2005:21).

For the purpose of my study the workshops and one-on-one peer mentoring sessions were the main method used to introduce flexibility and to challenge the professionals to think outside their most preferred thinking preference. The tools that were used were iPads and we communicated through paper-based letters, email as well as a WhatsApp group that was formed. The needs of the professionals were addressed, questions were posed to the group and answered and knowledge was shared; for example, when a new App was discovered that would contribute to the transformation of learning and Whole Brain® learning support. Thus, from a socio-

constructivist point of view, learning took place for the individual participant, but also within the social context (Gravett 2005:22) and interaction within the mentoring practice.

Mentoring can be regarded as a mutually reciprocal scholarly activity, promoting professional learning for all involved in the professional development programme; in other words, it is enacted in a socio-constructivist context (De Boer et al. 2013:100). Peer mentors should be involved in research on mentorship, promoting a constructivist approach through a 'scholarship of mentoring' (Du Toit, 2012 in De Boer et al. 2013:100) Therefore the professional constructivist approach to mentoring underpins the Whole Brain® thinking lens in the sense that 'professional meaning is created personally at an intrapersonal level' (De Boer et al. 2013:100).

The one-on-one peer mentoring sessions and workshops were therefore 'flexible-task'-based to challenge the professionals. Furthermore, the collaboration between the professionals underpinned constructivist learning. The workshops can be described as a modular creative programme (Herne, Adams, Atkinson, Dash & Jessel 2013:72) where my professional background helped me to create creative tasks that were geared to be subject-specific, but also to challenge the professionals' thinking styles by providing an innovative task that incorporated a certain thinking preference within the learning environment. Professional learning communities can change, implying that collaboration can lead to shared goals, interdependency, participatory decision-making (De Boer et al. 2013:100) and collaboration that promotes professionalism. However, De Boer et al. (2013:100) stipulate that

a professional should still work independently. Professionals were given the opportunity to construct their own meaning and design task that would accommodate other thinking preferences. The extent of Whole Brain® thinking will be evaluated in Chapter 5.

The environment where the workshops and one-on-one peer mentoring sessions took place was set up for that particular workshop's objectives or for the professional who attended the one-on-one peer mentoring session. The professionals were encouraged to use the immediate surroundings as suggested by Herne et al. (2013:72) and their iPads to explore new ways of facilitating learning and to be inspired and challenged in designing Whole Brain® tasks.

2.4 SYNTHESIS

Chapter 2 is an analysis of literature with a view to delineating the constructs of this study and to find the gap for my study. Whole Brain® professional development of primary school teachers was investigated by De Jager (2011); Wolvaardt (2013) and Boshoff's (2014) studies probed professional development at tertiary level as well as De Boer et al.'s (2013) pioneering book regarding *Whole Brain® learning in higher education* added to the body of knowledge of Whole Brain® professional development and learning. Thus I found my gap, professional development of high school teachers using peer mentoring and an Action Research design to introduce Whole Brain® facilitating of learning based on constructivist theory. After the delineation of the A quadrant, I am now moving into the B quadrant to define my research design.

CHAPTER 3
RESEARCH DESIGN

3.1 INTRODUCTION

The research design for this study consists of Action Research using a mixed methods approach. Characteristic of my Action Research process are unpacked by delineating the original planned action and the subsequent cycles that emerged during the field work. My Action Research process also includes the planning and methods used to promote Whole Brain® facilitating of learning at Wilberforce High School. A mixed methods research paradigm was used, analysing qualitative and quantitative data sets to provide a rich understanding of my mentee practice. In order to make sense of the research design I drew on the idea of becoming more flexible and used my secondary thinking preference (HBDI® 2015 result), the B quadrant that can be described as organised and sequential (Herrmann 1995:411).

Quill (played by Kaoru Kobayashi) in *Quill: the life of a guide dog* (Sai 2004), is a seeing-eye dog (a guide dog) that has to learn not only instructions in English (being used to Japanese), but also basic commands that are needed for a seeing-eye dog. Initially he struggles, but eventually he masters these skills and becomes a guide dog for a stubborn journalist, who initially did not want anything to do with a guide dog. In the latter part of Quill's life he becomes a demonstration dog at the seeing-eye dog school and spends the last part of his life back with his puppy walker family. Quill had to extend his thinking style from a predominantly emotional, feeling-based and expressive nature (these are key descriptors for Quadrant C) to that of a controlled, structured, sequential observer of detail, a strictly B quadrant thinking

preference. Therefore, if a dog can adapt to become more of a Whole Brain® thinker, it should be an exemplar for humans to become Whole Brain® thinkers too.

Chapter 3 relates to the B quadrant, showing the detailed planning in order to continue with my Action Research design. The initial vision and preliminary inquiry for Whole Brain® facilitating of learning was probed and four main dimensions for further investigation were identified at Wilberforce High School. A research design by means of a mixed methods approach is delineated, including the research instruments and planned data analysis. Supplementary to the data analysis is the validation of the research, including constructing meaning from new knowledge. Just like Quill (Sai 2004) I had to become flexible, not only in my most preferred quadrants and change my thinking. Figure 6 represents Herrmann's (1995:411) B quadrant with a watch, indicating *tempora mutantur nos et mutamur in illis*, meaning times change and we have to change with them (Latin Phrases 2015).

Figure 6: An adaptation of Herrmann's (1995:411) B quadrant

3.2 ACTION RESEARCH

Action Research has been used for more than 60 years to transform professional learning communities that share the same objective to improve either individual or the community of practice's context (Calhoun 2002:18). McNiff (2002:4-8) traces the origin of Action Research back to the 1940s in the United States of America under Kurt Lewin. Action Research became eminent in the United Kingdom in the 1970s under the influence of Lawrence Stenhouse who promoted meaningful students' experiences and promoted the idea that the teacher should be a researcher. McNiff (2002:4) stipulates that Action Research is particularly effectively applied to teacher professional education. The construct *professional education* will be replaced with *professional learning* for the purpose of this study. Action Research is a probe into past events as well as current phenomena. It constitutes cycles of planning and implementing innovative ideas that are reviewed and renewed planning for further action cycles being taken (Chandler & Torbert 2003:134).

Winter and Munn-Giddings (2001:2) describe Action Research as a process that questions traditional methods of experience by acknowledging and utilising sources of knowledge that other modes of inquiry might have overlooked. McNiff (2002:5) refers to Action Research as being 'practitioner based research,' conducted by the practitioner; she labels it as a 'self-reflective practice' since it is an investigation into one's practice, reflecting on it and instigating change that is practically applied and later reflected on again. Winter and Munn-Giddings (2001:2) argue that Action Research delineates constructs such as power and authority together with services. The construct *services* is replaced with *learning* for the purpose of this study. Winter and Munn-Giddings (2001:19) describe some of the principal characteristics of Action Research as

'collaboration and empowerment' that must be seen on the same level as the inquiry process. The mentor is not autonomous in the Action Research process, but also a participant.

According to Brydon-Miller, Greenwood and Maguire (2003:14) Action Research rejects an objective, value-free approach and instead focuses on a socially and democratically engaged practice. Ebersöhn, Eloff and Ferreira (2013:131) claim that subjectivity is a strength and fundamental in the research process. They stipulate the strengths of Action Research are firstly, that a positive approach is used to solve practical problems; Du Toit (2009) uses the construct *asset-based approach* rather than practical problems. Secondly, Action Research may lead to obtaining rich contextual data from the participants' own perspectives. Thirdly, participatory activities do not require expensive resources and finally the activities are often 'concrete and interesting' (Ebersöhn et al. 2013:135).

There are different constructs that describe Action Research. Constructs such as action learning, meta-learning and self-regulated learning are part of the theoretical framework for Action Research (De Boer et al. 2013:41). McNiff (2002:26) specifies one of the strengths of Action Research as the fact that the researcher generates his or her own theories from experience within his or her teaching practice. I kept a journal, reflecting on experiences within my mentee and teaching practices. Mills (2013: 8, 11) defines Action Research as a systematic inquiry into teaching practice to gather information, develop a reflective practice and to introduce positive changes. Mills relates it to a four-step process. Firstly, that the area of focus must be identified and secondly data collection starts; thirdly the data must be analysed and interpreted and lastly an action plan must be developed. Furthermore he mentions that

practical Action Research emphasises the practical 'how-to' approach. Contrary to Mills, Ebersöhn et al. (2010:131-132) hold a much more expanded view of practical Action Research and the phases are more complex. Firstly the asset-based objective was defined within the context of a community of practice.

The purpose of the research must be demystified through negotiation or consultation. Data collection methods as well as the mode and instruments for recording the data are selected. Data analysis strategies are implemented and the researcher formulates categories and themes to group information. Further negotiation might be needed to expand understanding and exploring individual interpretations and link them to a broader context. Next the data is evaluated and the integrity of the data is insured by the researcher writing a report. Findings may be shared in bulletins or interim reports. The implementation of action plans may include self-development programmes and can integrate existing strategies and structures. An evaluation of the action outcomes is conducted, thus the results of the action taken are assessed and a further period of research is initiated.

The next phase of the Action Research cycle takes place (Ebersöhn et al. 2010:131-133). McNiff (2002:11) divides Action Research into two processes, namely the researcher's systematic actions that are taken and the researcher's own professional learning. Thus the action taken personifies the learning and the learning is conversant through reflection on the action that was taken. McNiff (2002:12) further stipulates that once change has been made after the evaluation process another cycle can start. Similarly Du Toit's (De Boer et al. 2013:88) visionary Action Research model makes provision for a series or cycles to emerge during the Action Research process showing the integrate nature of the Action

Research process as new cycles emerging during different stages of the initial Action Research process.

The assumption is made that the participants determine the nature of the investigation. Davis (2004:6) states that Action Research is not a precise form of inquiry since the researcher knows only where the inquiry originated from, but cannot predict where the study might lead. Thus she stipulates that Action Research is an 'inexact process' and the outcomes cannot be predicted and are changeable (Davis 2004:7). According to Mills (2013:11-12) practical Action Research also assumes that the participants are committed to professional learning and will reflect on their own teaching practices. The final assumption is that the participants will choose their area of focus and plan for innovation and transformation in their teaching practices. Slabbert et al. (2009:142) suggest that Action Research is at the core of evidence-based facilitating of learning in a professional development programme.

Action Research for professional development is a popular approach for research within the educational field (McNiff & Whitehead, 2006:7). Teachers collect data that will provide 'persuasive insights' (Mills 2013:14) into the professional development practice that will take place in the teacher's practice. According to McNiff and Whitehead (2006:7) Action Research is used mostly in education; therefore it was ideal within the Wilberforce High School milieu for promoting professional development and an innovative approach to facilitating learning. Teachers developed a more focused view on their teaching practice and the gathered data provided the basis for, as suggested by Shanks, Miller and Rosendale (2012:26, 29) post-observation reflection.

Calhoun (2002:18) argues that Action Research contributes to the transformation of professional development. She further stipulates

that continual formal learning is expected and supported by the Action Research process. To further promote lifelong learning and transformation within the participants' teaching practices Whole Brain® teaching (Herrmann 1995:419) was introduced. One must realise that potential is a personal process and can only be accessed by the individual. Slabbert et al. (2009:49) point out that learning may be facilitated; however, it is up to the learner to maximise his or her potential. According to Herrmann (1995:211), when one becomes aware of the different modes of thinking, one has a better understanding and new growth is promoted independently or through self-regulated learning. A participant may become more flexible (D quadrant) by using the Whole Brain® learning model. When one becomes more flexible, one is willing to take risks (De Boer et al. 2013:43). A construct that emerged from this view is *flexible learning* that De Boer et al. (2013:43) imply should be used more in higher education.

According to McNiff and Whitehead (2006:12-14), by using Action Research the researcher can improve his or her strategies of facilitating learning by gaining a better understanding of his or her own teaching practice through reflection and inspire participants and members of management to do the same. Calhoun (2002:18) argues that Action Research ensures depth of knowledge. The gathered knowledge generates data for the analysis of the effectiveness of programmes that have been implemented, both for the students as well as professional learning (Calhoun, 2002:18). Former research does, however, warn against Action Research being used for comparisons and 'cause and effect'. The conclusive decision was therefore made to implement Ned Herrmann's (1995; 1996) Herrmann Brain Dominance Instrument (HBDI®).

Action learning and Action Research create the opportunity for professional learners and professional mentors to assess collected knowledge. Action learning usually applies to students or professional learners (the construct *student* is replaced with *professional learner* in terms of this study). Thus, Action Research relates to the actions taken by the lecturer (the construct *lecturer* is replaced with *mentor* for the purpose of this study). Although the same steps are taken the outcome differs. In the case of a professional learner action learning might be reflected in a portfolio or a notebook, whereas for a professional mentor the reflections are kept on record and analysed in order to be published or for the purpose of writing up an investigation (De Boer et al. 2013:41).

Slabbert et al. (2009:143) describe the process of Action Research as firstly to plan what one wants to improve in one's teaching practice. Secondly the action is taken to implement the plan. Thirdly, is to observe the action taken and collect data in this context. Fourthly, one reflects on the data that has been collected and reviews the original plan and modifies it to improve upon one's original plan; lastly one restarts with the revised plan and the next phase (cycle) takes place. Action Research supports professional development in the sense that it encourages a community of practice to be established, focusing on developing and inquiring transforming the school into a community of learning (Calhoun, 2002:19). Winter and Munn-Giddings (2001:7) argue that 'community' forms the basis for Action Research and goes hand in hand with constructs such as *collaboration* and *cooperative learning*.

3.2.1 Applying the principles of Action Research at Wilberforce High School

Using Action Research prompted me to improve my role as peer mentor by being accountable for my mentoring practice and assessing it to implement upon Whole Brain® professional development. As a peer mentor the expectation was that I would develop skills and insights following critical reflection (Mezirow 2003:61). Observations by the professionals and myself were recorded to monitor the effects of the actions taken. Self-assessment was conducted to reflect on Whole Brain® teaching and transformations in my mentoring practice. After the initial evaluation and self-reflection, reflective judgement (Mezirow, 2003:61) helped me to realise my own capabilities and to be more 'critically-reflective of assumptions' and open to and 'disposed to transformative learning'. (Mezirow 2003:61) postulated a better understanding of my mentoring practice and prompted cooperative creative ideas that led to new actions being taken and the whole process was repeated to enhance the mentoring practice (Du Toit 2002:273). Gravett (2005:49) underscores the importance of enthusiasm, respect and appropriate humour in a mentor.

The traditional cycle Action Research models were insufficient for the purpose of my research. There was a need for more defined nuances, therefore I adapted Du Toit's (2011:16) Action Research model for transforming teaching practices (See Chapter 1). It is more complex and refines the Action Research better as a continuous process of innovation and transforming the facilitating of learning. It amplifies Du Toit's (2008) vision of an 'asset-based approach' and it also underpins the multi-dimensional nature of Action Research. In the Wilberforce High School context I envisioned transformation within my own teaching practice by using

Whole Brain® learning. Therefore I facilitated innovative professional learning during mentoring workshop interventions, on which I reflected to improve and enhance my mentoring practice, and also to encourage a Whole Brain® approach to the facilitating of learning at Wilberforce High School. As a result of the multiple outcomes that Action Research lends itself to, there were and will be various opportunities to reflect on and act further on my mentoring practice.

Figure 7 (page 91) represents a concept map that I initially designed to indicate the context and planned intervention through facilitating Action Research and Whole Brain® workshops at Wilberforce High School. This concept map incorporates an adaptation of Du Toit's (2011:16) Action Research for a transformation model. It indicates the professional learning of the professionals and how the timeframe for implementing Whole Brain® teaching within their teaching practices and how Action Research led to continuous transformation. I reflected on my mentorship practice and parallel to this I continued to reflect on my own teaching practice (as I have been doing since 2006) to ensure continuous innovation.

The context for this study is indicated as the initial identification of the four dimensions that was adapted to broaden the scope for this study (See Figure 7 page 91) The next step was the exploratory method, including exploratory and semi-structured interviews as well as observations of my own mentee practice. The next step was to facilitate workshops, (later one-on-one peer mentoring sessions were added) after which the professionals and I would plan for innovation in our teaching practices (indicated by the figures - representing the professionals' 'light bulb' ideas that are formulated and implemented in their own teaching practices. Follow up

interventions continued in the form of one-on-one peer mentoring sessions and two workshops. I conducted observations of the professionals' teaching practices and semi-structured interviews, exploring the needs of support for the professionals as well as to gather data to reflect on my own mentee practice. Thus, two Action Research cycles emerged, one for my mentee practice and another for my own teaching practice. Each of the seven professionals (indicated by the three figures) had their own action learning cycles emerging and either wrote down their reflections or reflected cognitively on the actions taken in their teaching practices (See analysis in Chapter 4).

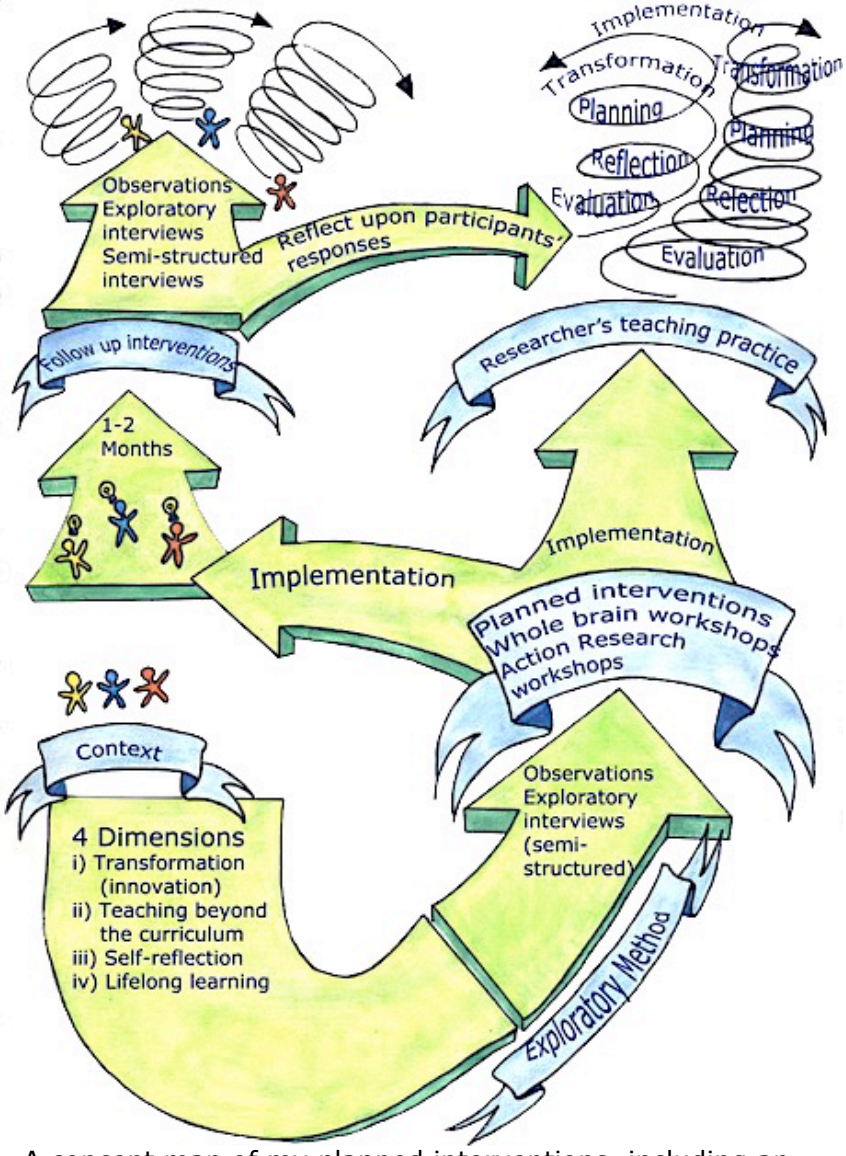


Figure 7: A concept map of my planned interventions, including an adaptation of Du Toit's (2011:16) visionary Action Research model

Since Action Research is a reflective process, I reflected on my own mentoring practice. Mezirow (2003:61) regards critical reflection and self-reflection as fundamental for effective participation in critical-dialectical discourse. This process is a strategy for inquiry and transforming and developing my mentoring practice to make it more effective and to cater for different thinking styles through continuous reflection. I was the mentor of professional learning and I used meta-learning and cooperative learning within my mentoring practice. By using these methods of learning I was able to gain knowledge of the interactions between my mentoring practice and the professionals' response to the Whole Brain® workshops as well as their observations of my facilitating of learning in the workshops.

Action Research is complemented by a mixed method approach since the HBDI® incorporates a quantitative analysis to determine the professionals' thinking preference. The interviews, observations of the mentee practice and professional adhere to a qualitative mode of analysis. All research was transparent; professionals' anonymity was respected at all times as suggested by Ebersöhn et al. (2010:131-132). As prescribed by the Ethics Committee (University of Pretoria 2013) the professionals had the right to ask not to be recorded during the interviews. None of them made that request; thus, the preliminary and semi-structured interviews were recorded and field notes were taken during the interviews.

The initial planning was for workshops where cooperative learning could be explored by using the iPad. Some professionals sat together and collaborated in order to construct meaning from the new knowledge. The ideal would have been to have one-hour sessions; however, due to administration and difficulty to adjust the time table, shorter, one-on-one peer mentoring sessions had to be

planned. The length of the sessions differed, depending on the length of the period. The one-on-one sessions ranged from 30 minutes to an hour. Keeping in mind that 20 to 25 minutes is the optimal attention span as stated by Gravett (2005:36), the facilitating of learning was planned to utilise the 20 to 25 minutes and alternate after that time by, for example, completing a task on the iPad.

The first workshop was an introduction to Herrmann's (1995) Whole Brain® approach. The assumption was that the professionals were not aware of Herrmann's Whole Brain® learning. From the second workshop onwards professionals were introduced to the facilitating of Whole Brain® teaching by incorporating all the thinking styles in their own teaching practices. Each workshop consisted of subject-specific content from the professionals' teaching practices and certain software that was available for the iPad for a particular topic was used. In the more advanced workshops, after the professionals had mastered the basics of the device, the professionals worked collaboratively by making use of practical examples of implementing Whole Brain® learning. Furthermore I as mentor introduced Action Research. The professionals made use of the facilitating learning in practice under the construct of *practice theory* (Slabbert et al. 2009:130). The professionals acquired new knowledge regarding the use of a variety of Apps, the iPad device and Whole Brain® thinking and they applied it in their practices; they reflected on the actions that were taken and this formed part of their own action learning process.

De Boer et al. (2013:37) are of the opinion that one's conception of meaning and constructing new meaning about learning can be divided into a three-dimensional point of view. They stipulate a three-dimensional view, namely the high quality of learning that is

expected from students; secondly what the student expects from the professional facilitator's ability to facilitating learning of a high quality. Lastly, professional facilitators who are involved in staff development (*staff development* as construct is replaced with *professional learning* for the purpose of this study) including peer mentoring to promote professional learning.

Figure 8 represents a more detailed look at the action learning process that was followed by the professionals as they gained new knowledge from the workshops and one-on-one peer mentoring sessions. The professionals constructed their own knowledge within their individual realities by firstly planning for innovation within their teaching practices and acting upon it; then they would critically reflect upon their action and act to innovate and change. The action learning cycles were based on Du Toit's (De Boer et al. 2013:88) visionary Action Research model.

Figure 8: The professionals' action learning cycles

As mentioned earlier, the assumption was made that we would realise that there are multiple realities (Gulati 2008:183) from the way that each individual constructed knowledge. The professionals' constructed knowledge was grounded in their existing knowledge and related to constructivist theory (Gravett 2005:25). These multiple realities had to be taken into consideration while reflecting on the workshops and applications of Whole Brain® learning. Gravett (2005:24-25) emphasises the importance of knowledge construction and the application of information acquisition. Thus, each one-on-one peer mentoring session was reflected on and changed to adapt to the thinking style of the professional. However, in later sessions, when the professionals were more comfortable with their learning, a more challenging task was set to make allowance for the application of Whole Brain® thinking and observing the responses of the professionals during these sessions. Different categories emerged from looking through a grounded theory lens. However, the process was not forced onto the professionals but rather identified during the data analysis (See Chapter 4). Kelle (2012:192-193) suggests that the researcher should reflect on the empirical data using theoretical terms. The social phenomena of the professional's experiences were explored through empirical inquiry (Engward 2013:37). Engward (2013:37) describes grounded theory as 'an inductive approach' from which data can be collected. The researcher collected the data systematically in order to analyse it through coding.

The following table is an adaptation of Hartle, Baviskar and Smith's (2012:32) *Field Guide to Constructivist Teaching and Learning* in which I adapted it to indicate the methods used.

The Four Criteria	Methods and learning tasks at Wilberforce High School
i. Eliciting prior knowledge	Preliminary interviews were conducted; introductory workshop about Herrmann's Whole Brain® teaching
ii. Creating cognitive dissonance	Challenged the professionals' thinking preferences by motivating them to create learning tasks that challenged them beyond their primary thinking preferences
iii. Application of new knowledge with feedback	The professionals had to introduce Whole Brain® facilitating learning within their own practices; semi-structured interviews were conducted to construct content
iv. Metacognition	The professionals had to reflect on their own teaching practices; I reflected on my own role as a peer mentor and my mentoring practice

Table 5: Constructivist professional learning at Wilberforce High School

The following facilitating of learning, learning task design, authentic learning, meta-learning, cooperative learning (Slabbert et al. 2009:102-118) were used to facilitate the professional learning of the professionals and to design Whole Brain® workshops to promote professional learning to encourage Action Research. The facilitating of the workshops included the professionals' own meta-learning, evaluating of and reflection on the facilitating of learning and cooperative learning in the workshops and smaller learning opportunities between the professionals and also between me and the professionals. Cooperative learning was conducted in collaboration with Herrmann Whole Brain® thinking. Cooperative learning included explorations of the iPad, using evaluating subject specific Apps in the one-on-one peer mentoring sessions, but also general Apps, for example, *ExplainEverything* that is a presentation App and could be applied to all the learning areas. Professionals would collaborate with one another or myself to explore to what

extent these Apps would be useful for their learning areas and whether they can be used to facilitating Whole Brain® learning.

All of the one-on-one peer mentoring sessions and workshops were structured around the Whole Brain® model that applied to the content, delivery, learning group (community of practice) and the environment (Herrmann 1995:218-119) as well as creating a cooperative learning climate (Gravett 2005:44) by clearly delineating the objectives of the professional development as well as finding out the needs of the professionals. The professionals were able to construct their own meaning based on previous experience through professional self-regulated learning as defined by Du Toit (2012:1220) for example, if they were already familiar with programs used on the SmartBoard. I found the ExplainEverything presentation App (as mentioned earlier) related to some of the Notebook software. It had enhanced features that could be utilised for Whole Brain® facilitating of learning. Thus, learning was a 'negotiation of meaning' (Gravett 2005:23) where the professional constructed meaning based on previous knowledge.

I considered each professional's learning individually, taking into account possible impediments to learning. Thus, the design of the facilitating of learning was to accommodate the needs of each professional after conducting preliminary interviews to probe and determine the needs of each professional. This construction of meaning can also be described as a 'negotiation of meaning' (Gravett 2005:23). The reflection on the professionals' responses created a dialogue where I could comprehend their beliefs, feelings and values as prescribed by Mezirow (2003:59) and it was regarded as an intrapersonal process in which the professionals would evaluate their own teaching practices. Professionals at Wilberforce High School were encouraged to provide feedback in the form of

'constructive peer feedback' and thereby promoting 'collaborative scholarship' (De Boer et al. 2013:89).

Cooperative learning and collaboration led to the development of learning tasks that accommodated Whole Brain® facilitating of learning. De Boer et al. (2013:223-231) refer to how collaboration underpins the design and development of learning material in the Department of Information Science. Below is a figure representing the types of smartness (Herrmann 1996:60) superimposed onto the Herrmann Whole Brain® model.

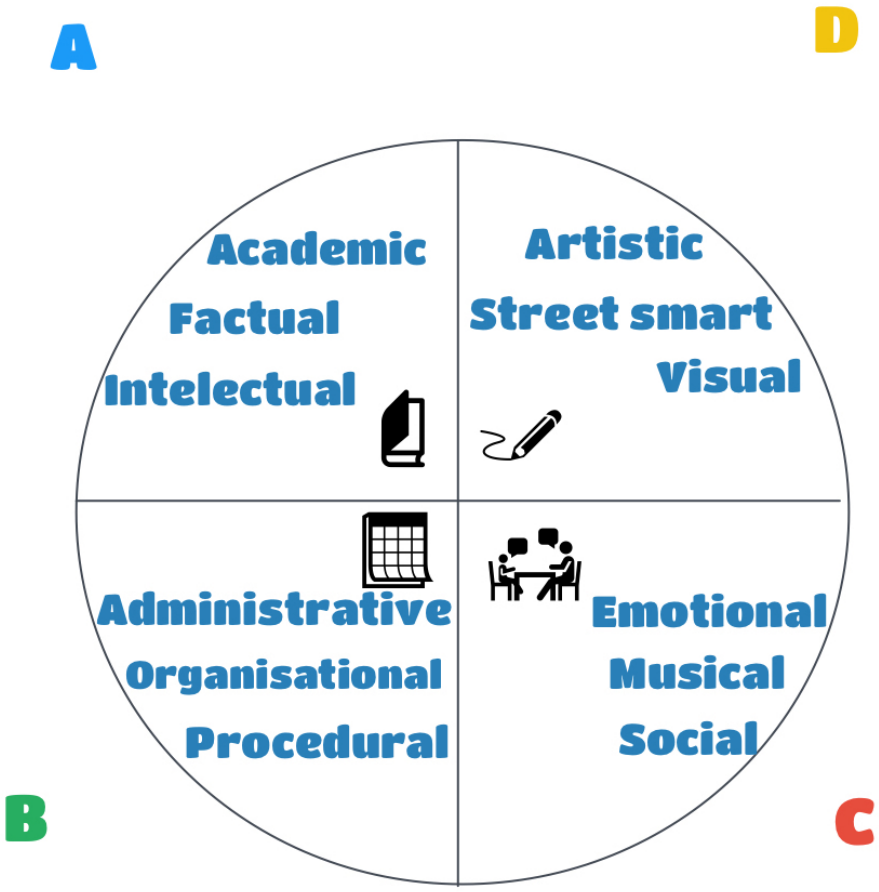


Figure 9: An adaptation of Herrmann's (1996:60) types of smartness

Most of the professional development opportunities were presented in my classroom that had resources such as a SmartBoard and projector to which I could connect my iPad to show examples of the learning tasks before we commenced with their practical application.

Gravett (2005:45) suggests that the physical environment should have adequate lighting, and the environment should encourage cooperation and dialogue. The environment should also be quiet; this was not always possible, since there were interruptions during some of the one-on-one professional development opportunities, for example, if a learner came into the classroom to ask something or when the bell rang and learners were moving to their classes. Gravett (2005:46) also highlights the importance of an 'affective-social climate,' thus implying that the facilitator should promote cooperation and the professional learner should feel at ease to interact and experience. Winter and Munn-Giddings (2001:19) are of the opinion that all the professionals in an Action Research study become facilitators of professional learning in the sense that they collaborate and support one another.

When I had to facilitate the learning of Apple's Pages at a workshop that included the volunteer professionals in my study as well as professionals in the ICT professional development program I decided to do so in a systematic fashion (B quadrant); therefore I followed steps to explain the software and to encourage collaboration among the professionals by giving them learning tasks after each step had explained, for example how to add a table or photographs. According to Gravett (2005:46) the sequencing of activities can establish self-confidence and provide a sense of safety. Furthermore I deemed it necessary to use the B quadrant for the aforementioned workshop and then allowing the professionals to explore the possibilities (D quadrant) through cooperation (C quadrant). Gravett (2005:53) suggests that collaboration has the advantage of a feeling of safety (linked to Herrmann's C quadrant) and the professionals could reflect on alternative possibilities and becoming part of a community. The complexity of the task becomes more manageable, through cooperative learning, the professionals

support one another through cooperative learning and assist in facilitating learning by engaging and analysing new knowledge. Here I again adhered to the prescription of Gravett (2005:47-50) to encourage, and to provide affirmation to the professionals. Professionals could apply the knowledge within their teaching practice, for example in making use of an App to explain moving molecules. Chandler and Torbert (2003:142-143) describe this type of interaction as 'second-person practice' and it is defined as two or more professionals that interact either through dialogue or for example via WhatsApp about the professional learning. They further suggest that second-person research should be documented, for example by audio recording. I recorded the interviews and I made observations of the interaction between professionals during the workshops and on the occasions where I saw two professionals at the same time. The WhatsApp messages have been recorded on my iPhone and can be easily accessed to obtain a better understanding of the professionals' needs. The analysis of the aforementioned data sets is discussed in Chapter 4.

It is important to provide affirmation and facilitating (Herrmann 1996: 277) learning to promote creativity. A mentor should ask the professional learners what their needs are and ideally the professional learners should be accountable for their own learning. Thus professional learners can determine their own needs (Gravett 2005:11). One must, however, guard against stereotyping professional learners, by for example assuming that they have a strong thinking preference in the A and B quadrant if they facilitate Physical Science; an example was Lana, who did not fit the aforementioned mold at all, but is passionate about Physical Science. Lana's teaching practice is discussed in more detail in Chapter 4. The mentor must also consider the professional development outcomes of each professional by asking what they envision for

their teaching practice. An example is the goal to accommodate visual learners more as in the case of Kypris and Brynhildr's teaching practices (See Chapter 4). Lastly, the mentor should relate the professionals' learning to the objective of implementing the use of the iPad at Wilberforce High School.

A critical-dialectical discourse (Mezirow 2003:58) approach was used when I would be empathetic to the needs of the professional learner. Gravett (2005:40) states that dialogue is not merely the exchange of ideas or conversing, but also a deferential relationship of inquiring, thinking and reasoning together. The objective was to find out where I could support the professional learner in his or her own personal development and to seek, as Mezirow (2003:58) states, 'common ground'. Gravett (2005:12) points out that one must distinguish between *wants* and *needs*. She distinguishes between *felt needs* that she defines as the personal requirements a professional learner has. Secondly Gravett (2005:12) describes *prescribed needs* as the requirements of other professionals as well as of the employer. She suggests that both felt needs and prescribed needs (See Table 6 page 108) should be considered when planning facilitating of learning. Winter and Munn-Giddings (2001:17) describe a facilitator as someone who brings in an outsider perspective, provides emotional support, practical assistance and is able to provide resources. I have found that for the research process to continue, I had to provide much emotional support and motivation for professional learners who had inhibitions or who were frustrated with the slow pace of implementing iPads and Wi-Fi. Due to some of these barriers that arose I bought an iPad on which I could download Apps to continue with the training. Later I also bought mobile Wi-Fi as a backup if the school Wi-Fi was not working. Winter and Munn-Giddings (2001:17) warn that the facilitator's role might become counterproductive if the professional

learners rely too much on the facilitator and the learning becomes authoritative. I was aware of this fact, thus I encouraged the professionals to continue exploring new possibilities for development in their teaching practice. Shortly after I had purchased the iPad for training, most of the professionals bought their own. Thus the professionals were determined to take charge of their own professional development as self-regulated learners.

The following table is an adaptation of Gravett's (2005:13, 24) needs analysis to determine the needs of professionals at Wilberforce High School.

Needs analysis	Professionals at Wilberforce High School
Identifying the desired state	Modelling the facilitating of learning according to the needs of the professionals
Identifying the existing state	The professionals' approximate confidence regarding the iPad varied
Assessing the gaps	Scaffolding a diversity of ability levels and use of the iPad
Prioritising the gaps	More time was allocated to technical coaching and use of the iPad as a tool for facilitating Whole Brain® learning
Gradually decreasing assistance	My role as facilitator faded as the professionals took up the role of their own learning and constructing Whole Brain® learning tasks

Table 6: An adaptation of Gravett's (2005:13, 24) needs analysis in correlation with mediation relating to the needs at Wilberforce High School

3.3 INITIATING THE PROCESS FOR THE APPLICATION OF WHOLE BRAIN® THINKING

Herrmann's *The creative brain* (1995) was the principal source used for implementing Whole Brain® facilitating learning for Wilberforce High School professionals. Herrmann's concept of using creativity to enhance Whole Brain® thinking skills was applied during the multi-dimensional Action Research process. It was termed multi-dimensional as I investigated my own mentorship practice, while the mentee teachers or professionals investigated their teaching practices. Furthermore, Whole Brain® thinking and reflection on Action Research was utilised to reflect on professional learning and I critically evaluated my professional development. Seven professionals volunteered and were willing to take up the exploration of their own professional learning and were motivated to obtain new knowledge, contributing to their lifelong learning. As mentioned in Chapter 2, the mentor is also a co-learner, thus it was a 'dialogue of equals' (McNiff 2002:23). The Whole Brain® vision was that the professionals would transform their teaching practices by applying Whole Brain® thinking and learning in order to, as noted by Slabbert et al. (2009:48-49) maximise the students' potential.

Herrmann (1995:57) observed that one of the drawbacks of groups with similar thinking preferences is that there is a lack of variety, simply because they are not divergent enough in their thinking styles. The professionals at Wilberforce High School have different thinking styles and they are representatives of different learning areas. The initial objective was to conduct workshops; however, due to time constraints, administration and afternoon duties six workshops were presented that were not attended by all the

members. In part this could be regarded as problematic; however, since my thinking preference (See Chapter 4) differs completely from most of the professionals' we used Herrmann's (1996:129) process storming (as discussed in Chapter 2) during the one-on-one peer mentoring sessions to elicit innovative ideas together and weigh the attributes of these ideas for use in the professionals' teaching practice.

Herrmann states that if a group of people with similar thinking styles work together, they will come to an agreement quite quickly (Herrmann 1996:40). However, when a group comprises individuals with varying thinking preferences within the same department that have to make decision, agreement might not be reached so quickly. Interestingly at Wilberforce High School two professionals were from the Physical Science Department. Their thinking preferences were divergent. Coincidently the initiative, before Lana and Helena joined this study, was that Lana, with her creative and holistic view (D quadrant) would capitalise on her thinking preference to design creative learning tasks and opportunities to extend her into these quadrants and Helena focused on developing the more structured and detailed (B quadrant) study material.

A composite (See Chapter 4) of our (the seven professionals and my own) thinking preferences indicates that we represent a Whole Brain® community of practice who will continue to apply the characteristics of Whole Brain® facilitating learning, reflection and innovation within our teaching practices and take responsibility for our learning, leading us to develop strategies for 'self-regulated professional learning' (a construct used by Du Toit (2012:1218)) and initialise the process of becoming lifelong learners. Lifelong learning is one of the objectives of Wilberforce High School and it was identified as one of the four dimensions that would scaffold

Whole Brain® facilitating of learning.

Four dimensions were identified (Wilberforce High School 2012:1-3) that were used to design the workshops and one-on-one peer mentoring sessions to promote transformation in the professionals' teaching practices and develop my own mentee practice and teaching practice. The mode of intervention was an asset-based approach as defined by Du Toit (2008).

The first dimension, linked to Action Research, is to promote innovation and creativity. The second dimension is to transform teaching practice and facilitate learning beyond the curriculum. Thirdly, self-reflection that is part of an Action Research design, was promoted and lastly lifelong learning, with a specific focus on professional development, was encouraged through the reflective process of action learning. I took up my role as a mentor in the interest of the professionals to motivate transformation in their teaching practices underpinned by the four dimensions.

Five main aims were identified. Firstly, the principles of Whole Brain® thinking were used to inspire facilitating learning beyond the curriculum. Secondly, the introduction of Whole Brain® thinking challenged the professionals to be creative and innovative to plan for Whole Brain® facilitating learning. Thirdly, the professional development of the professionals, as well as my own, was observed through self-reflection, which forms an integral part of Action Research. Fourthly, the aim was to foster an atmosphere of eagerness to learn, not only for professionals but also for the students. Professional development with the objective to encourage lifelong learning and the promotion of professional self-regulated learning (Du Toit 2012:1220) were used to motivate the professionals to employ action learning in their teaching practices.

The professionals were encouraged to work collaboratively (Robinson, Lloyd & Rowe, 2008:639) to explore the four dimensions, i) to promote innovation, ii) to teach beyond the curriculum, iii) to promote self-reflection and iv) to encourage lifelong learning, and this ultimately led to the establishment of a community of practice (Lave & Wenger 2003) that subscribed to the vision of creating a Whole Brain® culture at Wilberforce High School.

Figure 10 is a Whole Brain® adaptation of the four dimensions that were identified. Instead of focusing on 'innovation' only, the professionals were challenged to see how they would plan for Whole Brain® facilitating learning within their own teaching practices.

Figure 10: The four dimensions that were identified at Wilberforce High School

Herrmann (1996:210) describes innovation as 'building on existing, already-created concepts, ideas, processes, and devices.' I used 'older' ideas to elaborate or build upon and adapted or changed these ideas to be more innovative and to transform my teaching practice, using some of these ideas and sharing them with the professionals. Learning tasks can be set to cater for individual learning styles and to encourage motivation and learning (Boström & Lassen 2006:181). However, by using Herrmann's Whole Brain® model, professionals with different thinking preferences were presented with the challenge to set Whole Brain® learning tasks for their students, that they were both comfortable with and that challenged their thinking preferences (see Chapter 4). Thus the objective was to encourage professionals to become Whole Brain® thinkers so that they would be able to transform their teaching practices to introduce Whole Brain® facilitating of learning to their students.

3.4 INITIATING A WHOLE BRAIN® COMMUNITY OF PRACTICE AT WILBERFORCE HIGH SCHOOL

A community of practice shares common objectives with the assumption that the members will learn together. Participation in learning tasks took place within this community of practice, specifically making use of the iPad and exploring Apps. The assumption was made that engaging in this mentee practice formed a fundamental part of the professional learning that took place. The professionals were 'elected,' similarly to what Herne et al. (2013:73-74) suggested, being part of a team implementing ICT and they had to accept the responsibility for their own professional self-regulated learning, supported by the mentee practice.

The community of practice consisted of the voluntary professionals who formed part of this study, but it also included professionals who did not form part of this study. From the preliminary interviews and informal discussions during the one-on-one peer mentoring sessions and workshops the professionals formed a community of learning (Bleach 2013:253-254) by establishing a WhatsApp group where information was shared. The community of practice consisted of professionals who were at different confidence levels of using the iPad within their own teaching practice. Herne et al. (2013:70) recommend that the mentor needs to be technologically inclined, have a personal enthusiasm for learning as well as creative. The professionals were encouraged to make use of interaction design and explore, in other words, to use diverse devices for example their iPads, other mobile devices such as their smart phones and a variety of software applications. There was collaboration between the mentor and the professionals as well as among the professionals leading to cooperative learning.

The professionals would evaluate (cooperatively or self-directed) Apps to plan for facilitating Whole Brain® facilitating of learning within their teaching practices. By engaging students to use different forms of ICT learning such as the iPad in their teaching practices, is described by Herne et al. (2013:71) as more personalised and through creating virtual learning environments the students will develop 'e-maturity' and this forms part of transforming teaching and engaging students who have different thinking styles.

Within this community of learning we collectively inquired and critically reflected on our teaching practices. Our objective was to become collaborators and this led to new knowledge and 'professional dialogue' (Burke et al. 2012:115-116).

3.5 METHODOLOGY: A MIXED METHODS APPROACH

Data was gathered by using quantitative and qualitative methods. I agree with Du Toit (2012 in De Boer et al. 2013:109) that a mixed methods approach complements Action Research. Du Toit (De Boer et al. 2013:109) adds that the HBDI® can serve as a 'baseline study' for professional development. Therefore I completed the HBDI® for a second time to see if there were any significant changes in my thinking preference. A more in-depth analysis is presented in Chapter 4. Knowing what my thinking preference is helped me to facilitate learning, promoting a Whole Brain® thinking and learning approach for the professionals.

Bergman (2010:171) describes a concept (or construct) as a link between theory and empirical research. The writer states that quantitative and qualitative do not prescribe a particular analysis technique; thus research questions can be addressed by using different theories and analysis techniques as well as a variety of data sets.

Despite some limitations of a mixed methods approach as identified by Bergman (2012:284), such as that multiple perspectives do not necessarily lead to an objective research result and that, theoretically, the research questions cannot be fully answered due to the complexity of the data, the writer does list advantages. Individual findings can be validated. Due to the multi-faceted nature of mixed methods design the researcher is at the centre of the research premises (Berman 2012:274-275).

The mixed method design followed sequential exploratory design procedures. Figure 11 represents the exploratory design of this study. The HBDI® is both qualitative and quantitative.

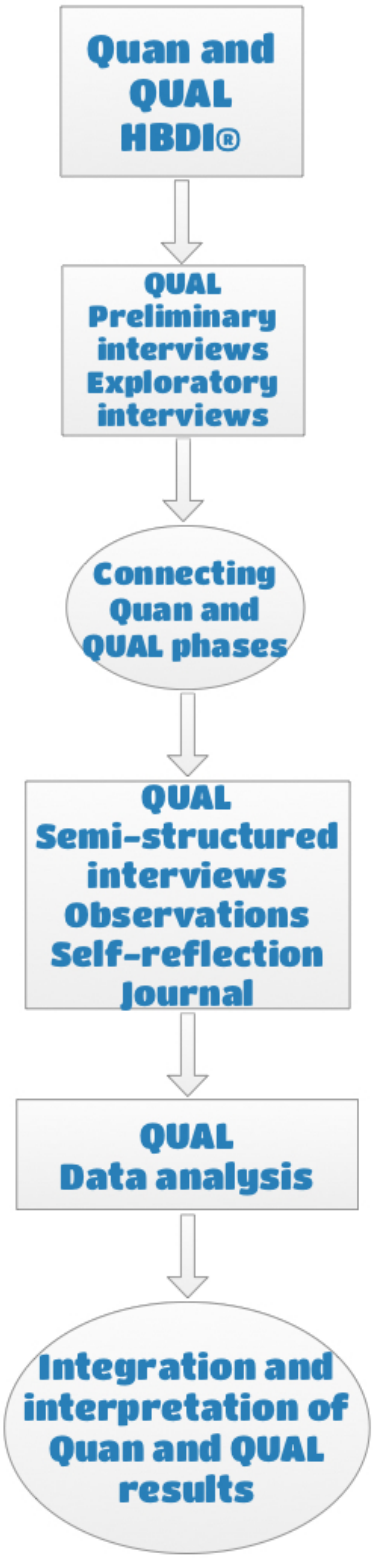


Figure 11: An adaptation of Ivankova, Creswell and Stick's (2006:16) sequential exploratory design procedures

3.5.1 Quantitative mode of inquiry

The Herrmann Brain Dominance Instrument® (HBDI®) is a scientifically validated instrument that quantifies the degree of thinking preferences for the specific quadrants within the Whole Brain® model. The questionnaire consists of 120 items that quantify the thinking preference within each quadrant. The results are then visually plotted (De Boer et al. 2013:5) within the Whole Brain® model, providing a holistic view and it synthesises the profile score in a visual representation (part of qualitative data), accommodating the D quadrant preference of the participants' thinking preference within each quadrant (See Figure 4 page 30).

A data summary sheet is included and provides a quantitative breakdown of items that were selected by the participant. The profile score relates to the total scores within each quadrant, based on the responses of the individual participant. The codes categorises the profiles and may be used to identify similar profiles (De Boer et al. 2013:5-6). The data summary applies to the A quadrant thinking preference and the codes are related to the quantity of items that the participant responded to in the questionnaire. A booklet is included with further detailed explanation about each quadrant. The booklet is preferable for B and C dominant quadrants since both are readers. The booklet is also preferable to the A quadrant thinker, since it provides reasoning and factual evidence. Table 7 shows the codes used in the analysis of the HBDI.®

Code	Numerical value
1	67 - 99 equal a strong preference
2	34 - 66 equal an intermediate preference
3	33 and below equal a low preference

Table 7: An adaptation of De Boer et al.'s (2013:6) explanation of the HBDI® preference code

The adjective pair data forces a participant to choose between adjective pairs and this section helps to determine the participant's intermediate preferred thinking style. There are 24 points distributed between the four quadrants and the maximum score is 12, which will reveal a participant's thinking preference when he or she is under stress (De Boer et al. 2013:6).

Herrmann's HBDI® (1995; 1996) was used to determine the thinking styles of the participants. As a long-term goal they were encouraged to participate in developing a 'Whole Brain® culture' at Wilberforce High School. One objective of the one-on-one peer mentoring sessions and workshops was to offer the professionals opportunities for professional development to be able to facilitate Whole Brain® learning within their own teaching practice as Whole Brain® thinkers. In other words, knowing their own thinking preference made them aware of their own dominant quadrant and their least dominant quadrant. The professionals were able to reflect on their actions and transform their teaching practice by incorporating their least preferred thinking styles into facilitating of learning.

The teaching practice observation sheets that were designed for this study incorporated quantitative data in which I could indicate on a Likert scale to what extent Whole Brain® facilitating learning was

applied. Below is the key that was used for the rating scale.

To what extent has whole brain learning been applied?

1) Whole brain learning has not been used.
2) One/two thinking styles were used.
3) Three thinking styles were used.
4) Whole brain learning was used throughout facilitating learning.

1	2	3	~~4~~

3.5.2 Qualitative mode of inquiry

The HBDI® includes qualitative data that was analysed to determine the participants' thinking styles. The HBDI® is a metaphor to provide insight into the participants' thinking preferences. The participant might have more than one quadrant that has a high score, indicating that the participant is comfortable in more than one quadrant. Usually there is one quadrant that is primary. Analysing the thinking preference of a participant provides insight into, for example, the activities that the participant favours (Herrmann 1995:77-79).

Herrmann (1996:282-283) deduced from the HBDI® that people who have a strong A quadrant thinking preference and deal with factual evidence become rational in decision-making. People with a predominantly B quadrant thinking preference want to analyse the details and they are careful to make a decision. A person who has a predominantly C quadrant thinking preference prefers to make an intuitive decision to analysing or referring to factual evidence. A person with a D quadrant thinking preference is more spontaneous and daring in the decision making process. These short descriptions of the four quadrants are just a basic analysis of thinking

preferences. It can, however, become more complex, especially if one or two quadrants are the preferred thinking preference of a person.

The Herrmann Whole Brain® approach with the learning considerations for Whole Brain® teaching as prescribed is represented graphically. Within each quadrant are descriptive words to describe the relevant preferences.

3.5.3 Research instruments

3.5.3.1 Data

Preliminary and exploratory interviews were conducted with the professionals to obtain an idea of areas where there was a need for improvement. The preliminary interviews focused on aspects like values, attitude towards the learning environment or certain topics within the curriculum and opinions as suggested by Maree and Pietersen (2010:155-158) and Nieuwenhuis (2010:87). The preliminary interviews were conducted face-to-face and the answers were audio-recorded with the permission of the professionals. While the interviews were conducted initial thoughts on analysis were written in square brackets (Martell 2012:54) in the shorthand notes. Interviews were conducted at Wilberforce High School. With this background information a better idea was formed as to what needs were to be addressed in the workshops. The information from the interviews was analysed in relation to the HBDI® thinking style profiles.

The professionals were asked to complete the HBDI® by responding to the questionnaire via email. They were able to answer the questionnaire in their own time with the option of logging off and accessing the HBDI® again to complete it at a later stage. A

thinking preference should not be regarded as right or wrong, but as a mode of knowing one's own thinking preference and mode of thought. Thus the HBDI® measures the participant's preference for a mental activity to obtain a better understanding of whether or not the participant shows an inclination for completing a certain task. Learning can be linked to the professionals' thinking preference, personal views and language (Gravett 2005:24). Profiles tend to remain constant; however, some people might change their preference if they choose or if, for example, they are required to do so. The change of profile should not be regarded as a drawback, but rather as positive since it shows that a participant is able to move beyond his or her own thinking preference (Herrmann 1995:76-77).

Further semi-structured interviews were conducted with professionals after the completion of the workshops and the implementation of Whole Brain® learning within their own teaching practices started. These interviews were more detailed to obtain a better idea of where the professionals felt there were gaps. The questions were based on the outcomes after the interventions took place via the workshops (Maree & Pietersen 2010:158; Nieuwenhuis 2010:87; 90). These interviews focused on determining if the workshops helped the professionals to be innovative facilitators of learning and to what extent self-reflection had helped them to transform their style of facilitating learning. These interviews led to in-depth discussions that provided rich information. Chandler and Torbert (2003:142) describe this mode of inquiry as a 'first-person practice' where I made use of feedback from 'second persons' or the professionals that took part in the study.

Direct observations of the teaching practices were made with the permission of the professionals. The value of these direct observations was that I had the opportunity to collect data from

real-life facilitating of learning within the professionals' teaching practices.

Observation sheets were developed for the professionals to monitor how they responded to the workshops. They also had self-reflection sheets for use in their own teaching practices and to determine to what extent Whole Brain® learning had been implemented. These observation sheets were of low sensitivity and intrusion (University of Pretoria 2013) since the main focus was on the analysis and personal views of the professionals and how they reflected on their own teaching practice. A separate observation sheet was developed to provide critical feedback on my facilitating of learning.

For a more in-depth narrative I wrote my observations and reflection of the facilitating of learning within my mentoring practice in a journal that served as a running record. I made observations of the professional learning tasks and workshops to obtain a greater understanding of the respondents' reaction towards facilitating of professional learning. I also used observation sheets to monitor the outcomes of the workshops in the professionals' teaching practices. Two forms of observation were used, namely observer as professional where the focus was on my role as observer and secondly as a participant observer where I was part of the process to develop strategies to improve my mentoring practice (Nieuwenhuis 2010:83-85). Lempert (2012:245) suggests that memoranda should be kept since it would 'conceptualise' the data and capture it in narrative form. Furthermore it could be seen as narrated records of analytical conversations about the research data.

The following is an adaptation of Mills's (2013:99) Action Research data collection techniques, the three E's in the context of Wilberforce High School.

The tree E's Action Research data collection techniques		
Experiencing	**Enquiring**	**Examining**
Own observations	Exploratory and Preliminary interviews	Audio-recordings Field notes Transcripts
Professionals' observations	My mentee practice	One-on-one peer mentoring and workshop observation sheets
Observing professionals	Professionals' teaching practices	Teaching practice observation sheets
Mentee practice	Critical reflection	My observations and reflections in my journal
Professionals' reflections	Semi-structured interviews Observations during one-on-one peer mentoring sessions	Audio-recordings Field notes Transcripts

Table 8: An adaptation of Mills's (2013:99) Three E's in the context of Wilberforce High School

Professional development was fostered through facilitating Whole Brain® professional learning. I had a clear perception of my own professional identity as well as integrity. Firstly, I designed professional learning tasks according to the aims of my mentoring practice. These tasks were conducted in the one-on-one peer mentoring sessions and workshops and then I made a critical assessment and reflected upon the learning tasks in my journal. Secondly, there was room for innovation to improve the learning task (Slabbert et al. 2009:134). A second learning task was monitored and critically assessed by the professionals and myself. The course content was linked to the professionals' own knowledge – a constructivist approach.

It is important that existing knowledge form a basis for problem-solving (Gravett 2005:25) and the professionals were encouraged

to utilise their own knowledge during the one-on-one sessions and explore to what extent certain topics could be facilitated through Whole Brain® learning. Gravett (2005:12) suggests that content should always be relevant and should be linked to previous knowledge. Continuous reflections led to a process of Action Research to continue to develop my own role as mentor for professional learning (Du Toit 2011:16). Gravett (2005:23) describes learning as *mediation*, implying that a facilitator of learning *mediates* the learning of the professionals. However, the facilitator also learns since the professionals are co-mediators, and the facilitator re-learns (Gravett 2005:24) while facilitating of learning takes place.

As prescribed by the Department of Education and the University of Pretoria (2013) all the data collection tools that were used were submitted together with my application for ethical clearance before fieldwork could commence.

3.5.3.2 Analysis

The data collection took place in four phases, similar to the data analysis as used by Martel (2012:9). Phase one consisted of the preliminary interviews and planning the one-on-one peer mentoring sessions and workshops. Observations were made when attending some lessons of the professionals to observe their teaching methods. In Phase two the professionals attended the workshops and they provided me with feedback. Their thinking preferences were challenged; they were also presented with tasks that complemented their specific thinking preferences. Phase three was the implementation period of Herrmann's Whole Brain® teaching. This lasted for three months during which the professionals made use of Action learning to reflect on their professional development.

Phase four consisted of semi-structured interviews to obtain an understanding of the professionals' experiences to introduce Whole Brain® teaching and Action learning into their teaching practices.

Each professional was interviewed twice (exploratory, preliminary interview, and semi-structured) using voice recording and making shorthand notes while the interview was conducted. Each interview took place on the school premises. During Phase three I observed the professionals within their teaching practices in order to observe to what extent they were able to use Whole Brain® teaching within their teaching practice. Detailed field notes were taken during these observations.

Figure 12 (page 120) is a visual representation of the inductive stages of data analysis superimposed on Du Toit's (2009) visionary Action Research model. Firstly I conceptualised the idea for professional development underpinned by introducing Herrmann's Whole Brain® model. Second was the implementation phase through workshops and one-on-one peer mentoring sessions. During the field work data was gathered and I had to read through the data systematically to identify patterns and links. The findings were reviewed and are explained in Chapter 4.

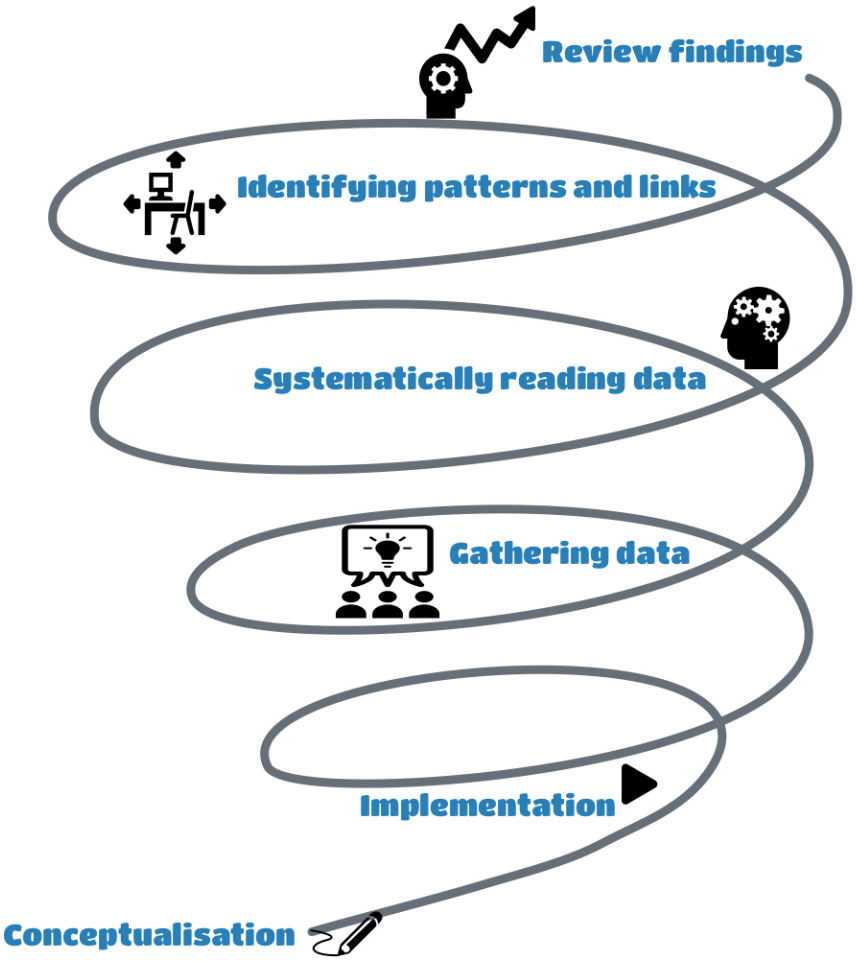


Figure 12: An adaptation of Du Toit's (2009) visionary Action Research model to indicate the inductive stages of data analysis for this study

Due to the nature of mixed methods research I kept field notes and a personal journal of the research, to complement the written records that I took during the professional learning one-on-one peer mentoring sessions and workshops. In order to adhere to ethical considerations, permission was obtained from the professionals before any audio-recordings were done. There were codebooks[5] for documenting the various data sets. Records of the questionnaires, observation sheets and the responses of the professionals as prescribed by Mouton (2004:107) were also kept and analysed for validation.

[5] The codebooks contain transcriptions of the interviews. The frequency of the four dimensions (See page 86) was documented as analysed from the databases. As the research progressed more themes were identified and coded.

The preliminary interviews and more detailed follow-up interviews were audio recorded while I made shorthand memos while conducting the interviews. The shorthand memos were simultaneously transcribed while listening to the audio-recordings and reworked into write-ups for better editing and analysis (Welman, Kruger & Mitchell 2011:211).

Inductive data analysis was used to determine the findings during Action Research (Maree & Van der Westhuizen 2010:37). Since the outcome can lead to more than one answer or 'multiple meanings' inductive analysis was the preferred mode of inquiry. This is an interpretive paradigm, assuming that there are different realities leading to a holistic view of the various realities (Maree & Van Der Westhuizen 2009:28; Mouton 2004:108). According to Thomas (2003:3) the inductive method should be used to reduce extensive information into more manageable parts and to be able to identify clear links between various components of the research. In order to identify links and determine codes a matrix diagram based on Herrmann's management style matrix was used.

The matrix diagram (See page 122) was used to list research categories chronologically and to determine possible codes that contributed to the outcomes of reflections on my own mentoring practice as well as those of my professionals to obtain a better understanding of each professional's thinking preference.

Thinking style matrix

A-quadrant style	A/D-quadrant style	D-quadrant style
Single A-quadrant style is typically academic analytical authoritative critical directive factual logical problem solving quantitative rational results-driven statistical technical theoretical	The A/D cerebral style combines preferences for experimental thinking and technical thinking.	The D-quadrant style is adventurous conceptual experimental holistic imaginative integrative metaphoric risk-orientated simultaneous spatial visual
A/B left-mode style	**Multi-dominant style**	**C/D right-mode style**
A/B-quadrant, left mode common sense practical realistic well-defined concrete	Multi-dominant style enables a teacher to respond to a diverse set of learning issues in a creative and natural way, fact-based, open minded, controlled and feelings.	The C/D-quadrant right-mode style is experiential flexible idealistic intuitive kinaesthetic open-minded
B quadrant style	**B/C quadrant style**	**C quadrant**
Single B-quadrant style is typically administrative consistent conservative controlled detailed organising planning regulatory risk avoiding sequential structural supervisory task driven traditional	B/C limbic style combines stability of tradition with an instinctual, caring responsiveness.	The single C-quadrant style is emotional expressive feeling-driven humanistic interactive interpersonal intuitive personable

Table 9: An adaptation of Herrmann's (1996:113, 115, 118) management style matrix

The research that was documented was reduced into more manageable components in the form of codes. The written memos assisted in finding patterns among the codes (Engward 2013:39). Certain constructs were used to tag and categorise parts of the information that assisted in making sense of the various outcomes of Action Research. I categorised codes in the following parts of my research: personal reflection, professionals' response and professionals' reflection, to name but a few. Marginal remarks were used to explore my ideas about the outcomes of the research, for example reflection on my mentoring practice or feedback from the professionals. The coding system helped to rework the information into visual representations and tables. The visuals are a quick reference to summarise the results as suggested by Welman et al. (2011:213-218) and Mouton (2004:124). The visual references and themes that were identified led to a comprehensive and easily 'accessible working theory' (Engward 2013:41). By using the lens of grounded theory to identify core categories the presented data could be catalogued according to these themes (Åge 2011:1600).

The following two tables are examples of the coding that was used. Table 10 (page 124) defines the coding into the Herrmann Whole Brain® thinking styles. Ideally provision must be made for Whole Brain® thinking; however, for the research analysis the variety of tasks were divided into a specific thinking preference. The codes are based on the four dimensions that were identified at Wilberforce High School. Table 11 (page 124) represents the four quadrants and was used to determine how the professionals capitalised on their preferred thinking preferences and where they were challenged in their least preferred thinking preference.

Four dimensions	Code
1. Innovative	I
2. Beyond Curriculum	II
3. Self-reflection	III
4. Lifelong learning	IV

Table 10: Coding used to identify the four dimensions in the data

Thinking style preference	Code
A quadrant	
B quadrant	
C quadrant	
D quadrant	

Table 11: Coding used to identify the thinking preferences

The main outcomes of the research were classified into patterns and reflected on in the initial research questions and other research questions that arose during the data gathering and research process to test my hypothesis. The main outcomes were interpreted and the positive and negative outcomes were reflected on. Due to the nature of Action Research the study actually continued after the results had been discussed because it is a continuous process to transform my professional practice as well as professional development (Mouton 2004:124) at Wilberforce High School. Robinson, Lloyd and Rowe (2008:639-640) suggest that meta-analysis can be used to determine the impact of transformational leadership. Therefore I included meta-analysis in the last chapter.

The following list is an adaptation of Lempert (2012:249) in the context of Wilberforce High School. Firstly, I envisioned engaging in the research of professional development. Secondly I set a few codes to define the sets of data and keeping in mind to keep an 'analytical distance' and to probe the data to see if any other codes

emerged. A record was kept of the research and analytical process in codebooks as well as separate documents on my iPad. During the analysis and coding process new codes emerged and main codes and minor codes were delineated in table form to note the frequency of each code. The initial analytical ideas and the identification of patterns and properties formed part of the raw data that was used to analyse and conclude this study.

Below is a list of the different stages of data analysis that was followed during the course of this study:

- Researcher engage
- Clarify explaining and defining
- Analytical distance
- Record of research and analytical progress
- Differentiate between major codes and minor codes
- Store analytical ideas
- Identify patterns and properties (Adapted from Lempert 2012:249)

3.6 VALIDITY OF THE RESEARCH

3.6.1 Internal and external validity in mixed methods

Internal validity is when a qualitative study might be questioned if some professionals are not available during a learning task or the result of some outcomes might change due to the timeframe. However, within the perimeters of Action Research this should not be problematic, since it is a continued reflective process. The surveys and questionnaires that were used were given to an expert to moderate and the Ethics Committee approved them before they could be used with the professionals (Maree & Van der Westhuizen 2009:29; Maree & Van der Westhuizen 2010:37; University of Pretoria: 2013). McNiff (2002:10) refers to accountability as

forming part of a professional practice. She stipulates that in Action Research one gives an account of oneself, thereby implying that one is responsible and that one can justify one's actions. Thus Action Research underpins the justification of one's actions on a continuous basis.

Ebersöhn et al. (2013:133-134) stipulate the following criteria to determine rigour and ensure credibility:

- Prolonged engagement in one's field
- Participant research
- Persistent observation
- Multiple perspectives for collecting and contemplating data
- Action Research report collaboratively developed
- Hypothesis and reformulation
- Member validation

Table 12 is and adaptation of the afore-mentioned criteria by Ebersöhn et al. (2013:133-134) to determine rigour at Wilberforce High School.

Criteria to determine rigour	Wilberforce High School
i. Prolonged engagement in one's field	The fieldwork lasted from 18 April 2014 to 25 August 2015
ii. Participant research	Volunteer professionals formed the Whole Brain® community of practice, taking responsibility for their own action learning
iii. Persistent observation	Workshop observation One-on-one peer mentorship observations Teacher practice observation Professional observation feedback

Criteria to determine rigour		Wilberforce High School
iv.	Multiple perspectives for collecting and contemplating data	Whole Brain® learning Whole Brain® facilitating learning Constructivist theory Multiple realities Meta-learning Lifelong learning
v.	Action Research report collaboratively developed	Professionals were invited to read the field notes, observations and final write up
vi.	Hypothesis and reformulation	New cycles emerged from the original hypothesis, for example the use of the iPad to facilitate Whole Brain® learning and collaboration with peers from another private school
vii.	Member validation	To promote transparency and adhere to the stipulations of the Ethics Committee the professionals were given the option to read the field notes and observations during the course of the study and they were invited to read the final write up The raw data and initial analysis of the interviews were sent to each professional to comment on

Table 12: Criteria to determine rigour at Wilberforce High School

I am aware that in order to obtain a better understanding of the expectations from the professionals I had to have a greater understanding of their personal teaching practices (Riveros 2012:610). McNiff (2002:10) describes it as a form of self-evaluation within the context of 'critical conversations' with professionals, professionals and facilitator meeting and learning as equals. The interviews that were conducted were to provide a greater understanding of the rich narrative and experiences within their teaching practices.

Coupled with the observations was obtaining a greater understanding of the dynamics within the teaching practice and the professionals' attitude towards professional learning. I was aware of my personal involvement in the study, since I am an employee at Wilberforce High School and the validity of the research might be questioned since I might not be perceived as taking a 'neutral stance' (Winter & Munn-Giddings 2001:8). I was aware of this fact.

Riveros (2012: 610) warns that professional learning communities might not necessarily address professional learning and explains why a community of practice would be the best way to encourage professional learning. Thus it was important to give proper structured guidance to the professionals in terms of peer mentoring by presenting Whole Brain® learning and Action learning to transform their teaching practices. Collaboration was used for certain tasks that were presented at the workshops.

3.6.2 Quantitative validity

The professionals completed the HBDI® of 120 items (Herrmann, 1996:29) to determine their thinking preferences. The results of the HBDI® were related to the preliminary and exploratory interviews to

gain insight into the deficit of their teaching practices.

The HBDI® was designed to avoid bias from professionals by firstly providing five possible answers using a Likert scale. Secondly, a number of questions were blind-phrased so that professionals would not be able to guess a particular outcome. Thirdly, there was an internal validation section with which cross-reference could be made to each of the four quadrants (Herrmann 1995:67-68).

The strength of HBDI® is in the key areas that are questioned and these sections consist of blind questions. The six main categories are the following (Herrmann 1995:68-69):

- Educational focus
- Work
- Discretionary time
- Inner self
- Values
- Inner/outer self

Herrmann (1995:69) wanted to eliminate bias and test anxiety by ensuring that professionals clearly understood that it was not a test and might want to look for the 'right' answer instead of reflecting on their mode of thinking. The HBDI® measures the thinking style that a person prefers within a certain situation. The participant must be made aware that the HBDI® is not a 'test' and that the result would be used to promote growth and to become more aware of the thinking preference that scored lower in one's HBDI® result. Herrmann warns that the questions must be answered honestly. However, the instrument itself has been modified in such a way that it would be difficult for a participant to fake honesty (Herrmann 1995:340).

In order to avoid the misunderstanding of terminology the HBDI®

cross-references a participant's thinking preference by using adjectives pairs and forces a participant to make a choice. An explanation of the terms is also included in the HBDI® (Herrmann, 1995:70).

The HBDI® uses a propriety scoring protocol to validate the instrument. A trained professional in brain dominance technology provided feedback to the professionals (Herrmann 1995:70).

The following table indicates the numerical codes presenting the thinking preference for a specific quadrant (Herrmann 1995:70) used to identify the thinking preference in each quadrant.

Code	Score	Explanation
1	67 points or more	Primary or strong preference
2	34 - 66	Secondary preference
3	0 - 33	Tertiary preference

Table 13: Herrmann's numerical codes presenting thinking preferences

The result is displayed on a four-quadrant grid that is colour-coded and indicates the preferred thinking styles. The blue and green or A and B quadrants are commonly referred to as the left brain, whereas the red and yellow or C and D quadrants are commonly referred to as right brain thinking. The Herrmann instrument goes further than a 'right and left' brain mode of thinking. The blue and yellow or A and D quadrants are referred to as cerebral north, and the green and red or B and C quadrants are referred to as limbic south. The HBDI® represents thinking preferences and not aptitudes (Herrmann 1996:29-30).

Within the Herrmann Group a sample of professionals were taken and retested to test the reliability of the HBDI®. Coffield et al. (2004:80) point out that there is still a need to do an independent study on the reliability of the HBDI® method, since some crucial information, such as how long the time lapse was between the first test and the retest as well as no feedback from the professionals after the first test is mentioned in the dissertation that it is used for. This was investigated as a gap while conducting my study to ensure that a careful record was kept when the professionals completed the instrument as well as when they were interviewed about the results of the instrument.

Coffield et al. (2004:80) further state that the HBDI® instrument provides a good impression and validity; however, few studies have been conducted in education to test its validity.

3.6.3 Qualitative validity

In order to gain greater insight and to validate the research outcomes they should be available for external critique. Especially in the sense of introducing Whole Brain® learning at Wilberforce High School the opinions of critical professionals were invaluable to the process. A validation group that consisted of the professionals was set up. Regular meetings were held after intervention workshops were presented and the research was made available to the group to provide critical feedback (McNiff & Whitehead 2006:157-159; McNiff & Whitehead 2002:105).

To ensure a form of quality control I kept a clear record of my fieldwork. Dates of preliminary and exploratory interviews, semi-structured interviews, observation sheets, self-reflection sheets and learning tasks were kept. A detailed personal journal with the

reflection and actions taken to transform my teaching practice was also kept. The reflections were twofold, because they reflected on my personal teaching practice as a peer mentor, but also on the facilitating of learning during the intervention workshops. Detailed information about the professionals was kept for my own records; however, their anonymity will be respected. Part of Action Research is to document problems that were encountered; therefore extraneous variables, for example problems with the instrument that might have influenced the observation sheet were carefully noted.

The following list is an adaptation, in the context of Wilberforce High School, of Mezirow's methods that were adhered to as far as possible in discourse to reduce distortion (Gravett 2005:29):

- Access to the research and data to ensure informed participation.
- The study was free from coercion and distorting self-deception.
- I am aware that I had to weigh the evidence and assess the arguments objectively.
- I was aware of other points of view and empathetic towards the needs of the professionals.
- I had to reflect critically on my initial assumptions and not the effects thereof.
- I had equal opportunity to participate and explore during the one-on-one peer mentoring sessions.
- I am willing to accept an informed consensus to validate the study.

The conclusion drawn from the research must be meaningful to the researcher and the professionals (Maree & Van Der Westhuizen 2010:38). Therefore I focused not only on my own professional

development but also on professional development at Wilberforce High School and ultimately developed a 'Whole Brain® culture'.

To ensure academic validation of the study, the internal methodology had to be consistent. Winter (McNiff & Whitehead 2002:107) suggests six principles to validate Action Research. Table 14 is an adaptation of the six principles of Winter, including questions that arose from my study regarding my own professional development.

The Six principles of Winter	
Principles	**Possible questions pertaining to the research**
Reflective critique	How will I use the principles of Action Research to reform my mentee practice?
Dialectical critique	How will I use dialectical critique to recognise transformation within my personal development?
Collaborative learning	How will I use collaboration to promote the use of an iPad?
Accepted risk	How will I do risk assessment?
Multiple viewpoints	How will Action Research lead to a variety of answers?
Relationship: theory and practice	How will I continue to monitor and transform my professional development?

Table 14: The six principles set out by Winter

By using grounded theory I avoided making assumptions and asserted a more objective view of the outcomes of this Action Research process. Openness (Engward 2013:37) was encouraged with a view to having a greater in-depth understanding of the experiences of the professionals. The voice recordings complemented the memo-writing and as stated by Stocker and Close (2013:1-2) a better formulation of the data was made possible due to the voice recordings.

Altrichter, Posh and Somekh (2003:25) argue that the validity testing of Action Research is more effective in the sense that it tests the knowledge of actions that are taken and the professionals are the ones for whom the research inquiry started.

Ensuring authenticity as prescribed by Gravett (2005:48) I determined the facilitating of learning in conjunction with the needs of the professionals. I was consistent in the facilitating of learning and empathetic to the needs of the professionals. I was open to criticism and I was prepared to learn from the professionals as well, thus adhering to a *learner-centred* approach (Gravett 2005:41).

3.7 ETHICAL PROCEDURES

With regard to the study and the ethical factors thereof, I conducted my study with seven participant teachers. The professionals volunteered and they were informed in detail what the research was about. The professionals had ample time to decide whether or not to participate. I presented an introduction to my research at a staff meeting and teachers who were interested came to see me afterwards. The professionals had to give informed consent and enter the study out of their own free will. This reduced the likelihood of exploitation of the professionals (Mills 2013:32).

There was minimum risk (University of Pretoria 2013) involved for the professionals. The only risk might be to keep the professionals' identities anonymous within Wilberforce High School; consequently they were identified by means of a pseudonym for the purpose of the research being conducted and the final write up. To ensure confidentiality the pseudonyms were also given to the professionals to protect their identities. Further access to data was and will be

limited (Mills 2013:32-33) to my promoter and myself. As researcher I know who the professionals are, but I will maintain confidentiality.

Permission to conduct the study was granted by the principal and informed consent was obtained from the professionals. Transparency was a key factor in this investigation for the professionals (Maree & Van Der Westhuizen 2010:42). Information was shared with the professionals and they were not deceived in any way. The professionals who were involved in the research were able to withdraw at any time during the research process. Their anonymity was respected at all times.

3.8 SYNTHESIS

Chapter 3 delineates the research design (B quadrant) for this study. Just like *Quill* (Sia 2004) had to become flexible from his C quadrant thinking preference and be structured and ordered, I had to expand my thinking preference and become more flexible in the B quadrant to design instruments and codes to organise and structure the data into more manageable chunks. Preliminary interviews, semi-structured interviews, teaching practice observations, workshops and one-on-one peer mentoring observations together with field notes and a professional observation feedback sheet were designed to probe and explore the qualitative nature of my mentee practice. The HBDI® that includes quantitative and qualitative characteristics was implemented. Thus this study explores a mixed methods design that led to a rich set of data that was analysed as part of the empirical study in Chapter 4.

CHAPTER 4
EMPIRICAL STUDY

4.1 INTRODUCTION

Amicitia aequalitas (Friendship quotes 2015) or *Friendship is equality* underpins the peer mentoring practice, where we are co-learners with different thinking preferences. From the commencement of the fieldwork we experienced challenges; however, in these times we stood together and supported one another just as in *Friends* (Crane & Kauffman 1994-2004). *Friends* was a very popular sit-com and it reminded me of the objective for this study: to be able to establish a community of practice and more specifically a Whole Brain® community of practice. Thus, in the sense that *Friends* came together in difficult situations, the professionals and I came together during dilemmas and we supported one another.

During the times of technical difficulty, increased workloads and general dissatisfaction I remembered the theme song of *Friends*, 'I'll be there for you' (The Rembrandts 1995); it is synonymous with how we dealt with the dilemmas or challenges at Wilberforce High School. It can be related to the C quadrant of emotional and feeling-based characteristics and also harmonising, listening and sharing ideas with one another. Figure 13 (page 137) represents an adaptation of Herrmann's C quadrant (1995:411) with a picture indicating the collaboration during the workshops and one-on-one peer mentoring sessions leading to innovative ideas for the teaching practices of the professionals.

Figure 13: An adaptation of Herrmann's C quadrant

Ipsa scientia potestas est (*Knowledge itself is power*) (Latin Phrases, 2005) is a driving force (A quadrant) for me to become more aware not only of self-knowledge (C quadrant) constructs but also the knowledge constructs of the professionals' life experiences (C quadrant) and new knowledge as well as their multiple realities that underpin constructivist theory. I am a professional self-regulated and lifelong learner and I wanted to motivate my professionals to become lifelong learners as well. However, very little motivation was needed since they were already passionate to enrich themselves and take responsibility for their own professional development. One of the major dilemmas that we, faced was time constraints.

Calhoun (2002:24) stipulates that barriers such as time allocation for professional development may jeopardise Action Research; finding volunteers to take up the role as a professional learner was another barrier. Some of these barriers, for example policy change and an increase in administration were experienced in this study and the key was how to overcome these challenges and maintain an

asset-based approach, realising the dynamics of Action Research to go back to the drawing board continuously and think of innovative ways to overcome these barriers. However, as stipulated by McNiff (2002:6) the final write up of this study shows the process that I have gone through in order to construct understanding of the professional learning phenomena within my own teaching and mentee practice as well as the knowledge constructs of the professionals that formed part of this study.

Since I am an employee in my research premises, it might have led to bias; however, with my pre-graduate and post-graduate experience of working with people and, specifically gathering oral evidence by interviewing participants, I am familiar with the proper decorum and I applied my experience from Anthropological and Cultural Historical inquiry to this study that formed part of, as stated by McNiff and Whitehead (2009:141), my living theory practice. Thus, my subjectivity underpinned the narrative that follows. I agree with Ebersöhn et al. (2013:131) postulating that subjectivity would strengthen the Action Research process.

4.2 PRESENTATION OF THE DATA

McNiff (2002:20) refers to the construct *critical friend* as someone whose opinion the researcher values. Critique is fundamental in assessing the quality of the research. I asked my colleagues to complete an observation sheet, providing me with critical feedback regarding my mentoring practice. The observation sheet (See Appendix I) included a rating scale (mentioned in Chapter 3) in which the professionals also had to provide a reason for their rating of my peer mentoring practice. A further inquiry rating to what extent each quadrant was used during the facilitating of learning was asked and is complemented by Herrmann's (1995:415-1417)

Whole Brain® teaching model. The construct *teaching* instead of *facilitating learning* was used for the observation sheet because it is currently used in the context of Wilberforce High School. The professionals were then asked to list the actions taken in each quadrant during the facilitating of learning. Two questions probed what the professionals found challenging and interesting.

McNiff (2002:23) suggests setting up a validation group. A validation group was included in my original planning; however, due to time constraints and an influx of responsibilities, including administration, the group members were not able to meet. As a way to bridge this gap I started a WhatsApp group to share information and asked professionals to provide feedback. The feedback is discussed later.

4.2.1 Testing hypothesis

I realised that Action Research is open-ended, although I did start off with a fixed hypothesis. McNiff (2002:6) describes Action Research as a 'developmental process' where one starts with a fixed hypothesis, but with the realisation that Action Research is open-ended and suggests that hypotheses may be developed and changed. Thus it can be seen as a process of critical reflection, constantly reflecting on the innovative ideas that were acted upon, evaluating the steps that were taken and suggesting new ideas that will be reflected upon again as the next cycle starts.

McNiff (2002:20) describes two forms of criteria that a researcher must adhere to. Firstly, the relation to one's own research, and secondly, the relation to the writing up of the research report. Therefore criteria were set that underpin the values (McNiff, 2002:21) of the teaching and mentoring practice. Altrichter et al.

(2005:121) stipulate that during the critical stage of data analysis the researcher constructs meaning and simultaneously critically examines the analytical process.

Herrmann (1995:313) states that 'all quadrants are necessary, so nobody's profile is undesirable in the right setting'. This is true for the research context and process. He further postulates that 'Diversity in thinking can be the basis of creative thinking'. Herrmann's (1996:127) Action Research is exactly that: a creative process that needs a diversity of thinking, making a Whole Brain® thinking approach to action research inevitable (Du Toit 2012:1230-1231).

Firstly the assumption was made that the HBDI® would provide the professionals with better introspection or self-knowledge as well as a better understanding of their peers and learners' thinking preferences. 'To learn about one's own brain profile and to understand how that profile compares to that of other people' is the belief of Herrmann (1995:341) for increased productivity and communication. Herrmann (1995:341) is confident that a Whole Brain® approach will improve communication and the professional will be able to predict how different thinking preferences might influence communication. My Action Research included the establishing of scholarly communities of practice communication, specifically Whole Brain® communication.

The second assumption was that the professionals' knowledge of their thinking preference would assist them to be innovative in designing Whole Brain® learning tasks. Herrmann (1995:341) suggests that the HBDI® will 'enhance and improve the effectiveness of learning and teaching'. Furthermore the assumption is made that learning and teaching will be more enjoyable.

Improving the quality of learning (Slabbert et al. 2009:129) in class as well as the professional learning of the participants was one of the aims of the study.

A third assumption was that the HBDI® would encourage better cooperative professional learning and help establish a community of practice at Wilberforce High School. Herrmann (1995:341) is of the opinion that Whole Brain® thinking will promote productivity through 'teamwork' (the constructs *cooperative* and *collaboration* are used in this study) and due to the cooperation there will be a better interpersonal understanding of peers.

Lastly, the assumption was that Whole Brain® thinking would lead to more innovative and creative ways of learning. According to Herrmann (1995:341) inhibitors to creativity can be identified and there will be a sense of authenticity that will result in a positive and productive working environment.

An adaptation from Herrmann's (1996:231-232) steps to establish a 'pool of creative process champions' and Whole Brain® problem-solving teams was planned as part of the Action Research design for this study. Firstly, the principal had to give consent for the commencement of the study, after which I called for volunteers to participate in the study. The exploratory and preliminary interviews were to probe the needs of the professionals after which the professional development programme commenced. The professionals completed the HBDI® survey that was analysed by a professional who explained the results. I gained insight into the professionals' existing creative processes from the teacher practice observations, interviews as well as observations during the facilitating of learning, and the HBDI®. During the semi-structured interviews I probed to what extent the professionals' preferences

were aligned with their creative process and to what extent they capitalised on their preferred thinking preference.

During the one-on-one peer mentoring sessions we would brainstorm or as Herrmann calls it, process storm ideas for creative innovation within the teaching practices (discussed in more detail later in this chapter). Ultimately the group of professionals would not only be the 'ICT champions' of the school, but they would also form part of the creative process champions leading to the creation of a Whole Brain® community of practice. The next step is one that I envision for Wilberforce High School, a space where there are iPads, Apple TV, SmartBoard and so forth to create an environment (See Chapter 5) to stimulate creativity. Lastly I established effective communication by keeping regular contact. For the purpose of my mentee practice I created a WhatsApp facility that proved to be the most effective form of communication between the professionals and myself that is discussed in further detail later in this chapter. The following summarises the steps that were taken:

- Sponsorship from the principal.
- Identify voluntary professionals.
- Preliminary probe of the needs of the professionals.
- Initialising the professional development programme.
- Administer the HBDI®.
- Identify the professionals' existing creative process.
- Determine the degree of alignment between the mental preference and the creative process of each professional.
- Brainstorming 'creative sessions'.
- Semi-structured interviews.
- Creative process champions to be involved creating a Whole Brain® community of practice.
- Provide a room for experimentation and creative models.
- Mode of communication.

4.2.2 Data collection

Nieuwenhuis (2010:113) suggests that multiple sets of data should be used that might collaborate to achieving the same conclusions. Thus I made use of individual interviews, observations, self-reflection and journal writing to construct understanding of my mentee and teaching practices.

Although I did construct codes according to my own theoretical knowledge I realised that the deductive method would not be optimal for developing categories. Thus I decided to use an inductive method (See Chapter 3) where I created codes while scrutinising the sets of data. Altrichter, Posh and Somekh (2005:122) suggest that the researcher should use both deductive and inductive methods to capitalise fully on existing knowledge and to be aware that the data might contain more than initially anticipated.

With regard to the qualitative data I made use of inter-coder reliability (Nieuwenhuis 2010:114) since the HBDI® is an internationally recognised and tested instrument to determine a person's thinking preference. Nieuwenhuis (2010:114) points out that qualitative research is justifiable when multiple coders are used and when high inter-coder and intra-coder (consistency of a single coder) reliability is obtained. The HBDI® is conducted by a trained specialist who provides feedback to the professional.

During the data collection I made theoretical notes. Theoretical notes can be defined as a method to move beyond the detail of an action that was taken to a conceptual level, thus developing theories, for example identifying relationships and underpinning the

significance of information that was gathered (Altrichter et al. 2005:124).

4.2.3 Understanding the data

Metaphors can be construed as shaping meaning and transferring the meaning from one field of study to another. Metaphors can generate meaning and can transfer learning in a similar way as recording pictures (Altrichter et al. 2005:125-126). Altrichter et al. (2005:126) refer to the 'imprinting' of meaning and 'construction' of meaning. Imprinting of meaning is related to similar images that are superimposed onto each other. I literally superimposed the HBDI® profiles in order to construct meaning. The process of data analysis is to 'construct new knowledge, using the experience and knowledge' (Altrichter et al. 2005:126) that I already had.

I am also aware of dilemma analysis as coined by Winter (Altrichter et al. 2005:143). While reviewing the transcripts of the interviews I observed a few instances of dilemmas faced by the professionals. Some professionals shared the same dilemma, for example time constraints to engage learners effectively in participating in Whole Brain® tasks, and secondly the drawbacks of iPad implementation.

4.3 INTERPRETATION OF THE DATA

The interpretation of the interview transcripts and journal notes was done in a methodical way, known as content analysis. Nieuwenhuis (2010:101) describes content analysis as an 'inductive and iterative process' where the researcher looks for comparisons and variations in the data, either to substantiate or question the theory.

4.3.1 Introduction of the professionals

The professionals were selected by means of volunteering. They were initially selected for ICT training to implement the use of iPads at Wilberforce High School. Their ages varied from 20 to 55 years of age. For the ICT group I presented my research topic at a staff meeting and asked for volunteers. The initial group of volunteers changed due to a variety of reasons. Firstly the process of obtaining ethical clearance for this study took a few months, after which many changes occurred at Wilberforce High School – an increase in workload, administration and also a change in policy occurred that pressurised a large number of the professionals and they felt that they were in a dilemma. Secondly, there was the uncertainty regarding the iPads that were allocated to some staff members. Initially the iPads were given to selected members of staff who were under the impression that they now owned the iPad; however, this was not the case. The iPads still belonged to the company and had to be handed in at the end of 2014. This frustrated some of the initial professionals and they were no longer willing to continue participating in this study, since they were not willing to buy their own iPads. One of the staff members, Lana, was not willing to continue with the iPad training, but she wanted to continue with the project on Whole Brain® facilitating learning.

Thus the final group of professionals consisted of the original teachers who showed an interest in Whole Brain® learning and new members who were not initially selected for the ICT training but wanted to continue with professional development. Octavia joined later and she caught up with the rest of the professionals since she was a professional self-regulated learner.

Altogether a group of seven professionals were part of this study. Six of the professionals were from the second group of volunteers and the seventh member joined later. One professional who initially wanted to join faced several dilemmas, mostly due to increased workload; therefore she did not form part of the fieldwork.

- Kypris is a female teacher in her fifties. She studied B.Ed. and she has twenty-three years' teaching experience; her learning area is Mathematics.
- Alexander is a male teacher in his twenties with two years teaching experience. He studied B.Ed. and he specialised in History, English and Life Orientation.
- Heidi is a female teacher in her fifties with twenty-two years' teaching experience. She studied B.Ed. and her learning area is German.
- Octavia is a female teacher in her fifties. She studied B.Sc., B.Sc. (Hons.) and M.Sc. in Natural and Agricultural Sciences. She decided to complete a PGCE and has fifteen years' teaching experience. Her learning area is Life Sciences and Natural Sciences.
- Lana is a female teacher in her thirties with eleven years' teaching experience. She studied B.Sc. Human Genetics, but later decided to teach for one to two years and completed her PGCE. Her learning area is Physical Science.
- Helena is a female teacher in her fifties. She studied B.Sc. Metallurgy and obtained an Honours degree. She later decided to complete a PGCE to become a teacher. She has ten years' experience and her learning area is Physical Science.
- Brynhildr is a female teacher in her fifties who studied B.Ed. and obtained an Honours degree in Mathematics. She has twenty-eight years teaching' experience and her learning area is Mathematics.

4.3.2 Analysing the exploratory interview

The exploratory and preliminary interviews were all conducted at Wilberforce High School by appointment with the interviewee (professional) and formed part of my qualitative data sets. The interview schedule included welcoming the interviewee and thanking him or her for taking part in this study, motivating him or her to provide a narrative. I explained that the study was transparent and that the interviewee was welcome to read through my notes and the interview transcript to ensure authenticity. Furthermore I stated that if at any point the interviewee did not want to be part of this study anymore, he or she could withdraw without any repercussions and the gathered data pertaining to the interviewee would not be used in the final write up of this study.

During the exploratory interview I wanted to elicit a narrative to obtain rich background of qualitative data on why the professional became a teacher and on his or her perception of teaching. Therefore I posed the question: 'Why did you become a teacher?' I was able to find a pattern and could code most of the professionals' responses and group them together.

4.3.2.1 What inspired the professionals to become teachers?

The responses were coded into six categories. If a professional indicated that he or she always wanted to be a teacher or always played the role of a teacher I coded it as a 'life ambition.' Four of the professionals who always wanted to pursue a career in teaching were identified. Three professionals studied B.Sc. and became teachers at a later stage. Lana decided to earn money after her studies and teach for one to two years. She discovered that she

loved teaching and continued her teaching career. Helena indicated that she always wanted to be a teacher and although she studied B.Sc. decided to obtain a PGCE and become a teacher. Octavia also initially saw teaching as something temporary, but realised that she loved teaching. Thus, as seen in the table below, six professionals regarded teaching as a calling or a passion.

Three professionals received bursaries to study B.Ed. For Alexander and Heidi it was a life ambition. Brynhildr explained that she studied B.Ed. because she received a bursary and she loved Mathematics. Both Brynhildr and Kypris said that due to social constraints and perceptions regarding the role of the female they regarded teaching as a 'safe option' due to the expectations or 'conservative background' that they came from. Interestingly enough, although Kypris felt that there were limited options for females she did state that she always had a passion for teaching. One professional, Lana, explained how her negative experience in the Science class actually motivated her not to follow in the footsteps of her Science teacher who did not understand her thinking preference. One can observe this in her approach to facilitating learning. She involves all the learners in a lesson and ensures that they understand the content.

Response / Names	Life ambition	Safe option	Bursary	Calling or passion	Temporary career	PGCE	Negative experience
Kypris	☑	☑		☑			
Alexander	☑		☑	☑			
Heidi	☑		☑	☑			
Octavia				☑	☑	☑	

Response / Names	Life ambition	Safe option	Bursary	Calling or passion	Temporary career	PGCE	Negative experience
Lana				☑	☑	☑	☑
Helena	☑			☑		☑	
Brynhildr		☑	☑				

Table 15: The six codes that were identified during and after the exploratory interviews

4.3.3 Analysing the preliminary interviews and teaching practice observations of the professionals

The preliminary interview was an extension of the exploratory interview. The first question pertained to the professionals' teaching practice to gain a better understanding of how the interviewee saw his or her teaching practice. I used the teaching practice observations data set together with the interview narrative in order to implement the existing codes (See Chapter 3) as well as to identify new codes that became apparent during the analysis of the qualitative data.

During the preliminary interviews the following question was asked:

- 'How would you describe your teaching practice?'

The purpose of the question was to obtain greater insight into how the professionals described their own teaching practice to create a better understanding of their thinking preference and approach to facilitating learning. I include the teaching practice observation

analysis in this section. All of the professionals agreed and allowed me to observe one of their classes during the fieldwork for this study. From these observations I could deduce what their thinking preference was and what their comfort zones were in order to facilitate learning in their individual learning areas.

From the responses and teaching practice observations I could construct seven codes determining to what extent Whole Brain® facilitating of learning took place as well as make preliminary deductions regarding the professionals' thinking preferences. Six of the professionals regarded their teaching practice as teacher-centred. Four of the professionals incorporated learner-centred facilitating of learning and interestingly enough the three professionals, Alexander, Octavia and Lana as well as I had made the assumption that they had a strong C quadrant thinking preference. This was confirmed when I conducted the teaching practice observations. Three of the professionals – Kypris, Heidi and Helena – used the phrase 'chalk and talk'. I observed Brynhildr's facilitating of teaching as 'chalk and talk'. Three of the professionals focused on A quadrant learning; Kypris and Brynhildr are both Mathematic teachers and Helena is a Physical Science teacher. All of the professionals catered for B quadrant learning mainly through being sequential, structured and detailed.

Lana wanted to simplify information, thus explaining the 'basics' as she described it. Five of the professionals catered for C quadrant learning to a greater or lesser degree. Alexander and Heidi both frequently incorporated C quadrant learning through discussions, group interactions, experiential opportunities, listening and sharing and through emotional involvement that is underscored by Herrmann (1995:419). Octavia made use of sensory movement, and group interactions and people-oriented case discussions to

cater for C quadrant learning. Kypris and Lana's facilitating of learning was done by discussions and interaction; however, the discussions tended to be technical, which falls under the A quadrant. Three professionals made use of D quadrant learning. Kypris linked topics to construct concepts, whereas Lana synthesised the content to provide a holistic view of the content by drawing, for example, a mind map or making use of a flowchart, incorporating simplified pictures. Heidi wanted to incorporate creativity in facilitating German and she would instruct her learners to make drawings, but her facilitating related to the C quadrant also since learners were encouraged to share ideas.

Response / Names	Teacher-centred	Learner-centred	Chalk and talk	A quadrant learning	B quadrant learning	C quadrant learning	D quadrant learning
Kypris	☑		☑	☑	☑	☑	☑
Alexander	☑	☑			☑	☑	
Heidi	☑	☑	☑		☑	☑	☑
Octavia		☑			☑	☑	
Lana	☑	☑			☑	☑	☑
Helena	☑		☑	☑	☑		
Brynhildr	☑		☑	☑	☑		

Table 16: The codes describing the teaching practices

The following two questions were posed during the preliminary interview:

- 'What learning tasks do the learners find interesting?'

- 'What learning tasks do the learners dislike or find challenging?'

The objectives of these questions were to gain a better understanding of the structure of the learning tasks and of the extent to which the professional utilised his or her thinking preference to construct these tasks.

I could deduce after the analysis of the responses to the two questions that many the formal assessment assignments were predominantly constructed for A quadrant and B quadrant thinking preferences. To a lesser degree there were assignments that incorporated the C quadrant in the form of stories and group work. According to Brynhildr some learners do like to take part in Olympiads and competitions[6]. Most of the professionals stipulated that formal assessment assignments, for example examinations and cyclic tests challenge the learners. Octavia and Heidi noted that learners found oral assessment and application of theory difficult. Helena stated that learners were not able to apply the theory that they had learned. Alexander emphasised that he found that learners were reluctant to read and Octavia underscored this assumption by stating that learners did not fully comprehend or read the instructions thoroughly, thus they lost marks for not being able to apply their knowledge. The table below indicates the eight codes that I identified during the data analysis process.

Four of the professionals were concerned about time constraints, putting an obstacle in their learning practice to engage learners in more experiential or enriching tasks. Kypris and Brynhildr both

[6] The strategies that the professionals implemented are described in the past tense. References to teaching practice that are generally true are done in the present tense. To facilitate reading the profiles of the professionals are often outlined in the present tense.

stated that Mathematics puts pressure on the learners to perform. Lana and Helena noted that Physical Science puts pressure on the learners to do well so that they will be able to obtain admission to study in fields such as Medicine and Engineering. Lana further analysed the reasons as internal pressure from the learner as well as external pressure from the parents wanting the learner to perform well in Physical Science so that they might pursue a degree that their parents think will ensure a prosperous future.

Five of the professionals noted that the formal assessment assignments were the most challenging for learners. Six of the professionals speaking from experience in their particular learning area, indicated that the learners found practical work, for example in Physical Science, challenging. Octavia mentioned that learners in Natural Sciences found practical and group work interesting. Heidi stated that her learners also liked group work and they responded well when she read stories to them.

Response / Names	Time constraints	Subject pressure	Challenging: Examinations, tests, orals, reading, application	Interesting: Practical work, group work, stories, competitions	A quadrant assignment	B quadrant assignment	C quadrant assignment	D quadrant assignment
Kypris	☑	☑	☑		☑	☑	☑	
Alexander			☑	☑	☑	☑	☑	
Heidi		☑	☑	☑	☑	☑	☑	
Octavia			☑	☑	☑	☑	☑	
Lana	☑	☑		☑	☑	☑	☑	
Helena	☑		☑	☑	☑	☑		
Brynhildr	☑	☑		☑	☑	☑	☑	

Table 17: The codes describing responses to learning tasks

The following question was asked regarding the professionals' favourite section:

- 'What is your favourite section to teach? Explain.'

The reason for asking this question was to determine how the professionals capitalised on their preferred mode of thinking to facilitate learning. Eight codes were identified. Four emerged during the analysis of the data, for example interaction and discourse with the learners, and four codes relating to Herrmann's Whole Brain® facilitating of learning.

One candidate indicated that she preferred teaching in the FET phase. Lana felt that the more 'energetic' the learners were, the more 'energetic' her lessons (the construct *lesson* was used by Lana; however, the construct *facilitating learning* is used for this study) would be. This is a typical C quadrant approach; however, depending on the content of the discussion, it might also relate to the A quadrant technical case discussion or B quadrant case discussions (Herrmann 1995:419).

Five professionals noted that they liked to interact with the learners; four of the five participants indicated that they preferred to have discourse with the learners. In Physics Helena showed a preference for 'explaining Newton's laws' and she stated that she was grateful when the learners showed understanding of the theory. Helena's preferred facilitating of learning falls in the A and B quadrant. In Life Orientation Alexander wanted to motivate the learners to be patriotic and he observed how negative South African learners were to the country. He challenged the learners by giving them an assignment of writing a letter to President Zuma. Alexander's approach is mainly from the C quadrant; however, he does facilitate structured learning that relates to the B quadrant.

Heidi enjoys reading stories to her learners. The stories lead to discussions and even if the learners cannot express themselves in German, they may do so in English. Heidi felt that this gave her a better understanding of the learner. She showed a preference for her C quadrant mode of thinking regarding feelings. Heidi has a strong preference for facilitating learning using the B quadrant, as observed during the teaching practice observation. She is sequential and organised (B quadrant) but also promotes people-oriented case discussions and group interaction (C quadrant). Brynhildr's approach to facilitating learning is more in accordance with the A quadrant; she does, however, to improve her own understanding of the theory of Additional Mathematics, want to have a holistic view, which relates to the D quadrant. The aforementioned professionals showed an inclination to use mostly two quadrants when facilitating learning. Two candidates, Helena and Brynhildr capitalised on their preferred thinking preferences when they facilitated learning. Alexander and Heidi both have triple dominant profiles (See 4.3.4 for an in-depth description of each professional's profile). Hence they made primary use of their B and C quadrant thinking preferences when facilitating learning. Kypris has a triple dominant profile, but focuses mainly on the A quadrant when facilitating learning.

Two candidates, Octavia and Lana extended their thinking preferences when facilitating learning. Octavia has a lower double dominant profile, but she became flexible in thinking and extended her thinking preference to the A and D quadrants to accommodate the learners. Octavia accommodates all the thinking preferences in her teaching practice. Lana has an upper double dominant profile, but extends her thinking preference to the B quadrant to accommodate the learners who respond to the sequencing and ordering of content.

Response / Names	Prefer FET learners	Interaction with learners	Discourse with learners	Used mostly two quadrants when facilitating learning	A quadrant facilitating of learning	B quadrant facilitating of learning	C quadrant facilitating of learning	D quadrant facilitating of learning
Kypris					☑			
Alexander		☑	☑	☑		☑	☑	
Heidi		☑	☑	☑		☑	☑	
Octavia		☑	☑		☑	☑	☑	☑
Lana	☑	☑	☑		☑	☑	☑	
Helena		☑		☑	☑	☑		
Brynhildr				☑	☑			☑

Table 18: The codes used to identify professionals' favourite part of facilitating learning

The next question in the preliminary interview was asked about the learning environment:

- 'What do you think is important within the learning environment?'

The purpose of this question was to investigate the professionals' perspective regarding the safekeeping self and to what extent it could be related to the C quadrant, and also to see if the environment might have a creative atmosphere to cater for the D quadrant and to see to what extent the A quadrant and B quadrant were catered for in the classroom environment; thus, to what extent the classroom environment would promote Whole Brain® thinking. Some of the codes are based on Herrmann's (1995:417) expanded Whole Brain® teaching and learning model as well as the adaptation of Herrmann's (1996:113) Management Matrix (See Table 9, Chapter 3 page 122).

Table 19 (page 160) represents the codes that I identified from the responses to the question. Initially I found it difficult to analyse this question and obtain an idea of the thinking preference that the professionals thought was important in the learning environment. I decided to incorporate the teaching practice observation of the professionals' classroom to complement the narrative. It succeeded, otherwise I would not have been able to identify the C quadrant and especially the D quadrant learning environment. All of the professionals had one or more Whiteboards. Six of the professionals had SmartBoards, with the exception of Alexander who had a digital projector. Five of the professionals focused on creating an A quadrant facilitating of learning environment and four professionals made provision for B quadrant facilitating of learning.

Three of the aforementioned professionals made use of A quadrant and B quadrant facilitating of learning. Six of the professionals, with the exception of Kypris, either insinuated or I could observe from the classroom that they catered for C quadrant facilitating of learning. Two professionals, Octavia and Lana made use of an A quadrant, B quadrant and C quadrant learning environment, but not all were facilitated equally effectively. Both professionals focused on motivating their learners to achieve and utilise the Whiteboard extensively. Both professionals focused on a task-driven and sequential learning environment. Octavia postulated that the learners should be self-regulated learners and make their own discoveries, prescribing that learning should be 'fun' and a 'process of discovery' that indicated accommodating a D quadrant thinking preference. Thus Octavia utilised all four thinking preferences in the learning environment underpinning her Whole Brain® facilitating of learning as seen in the previous section.

Helena insinuated and from the teaching practice I observed an A quadrant, B quadrant and C quadrant learning environment; however, these quadrants were not equally weighted. Her main focus in her learning environment related to her left double dominant profile, thus she capitalised mostly on her A and B quadrant thinking preferences. She stipulated that she wanted the learners to feel comfortable to ask questions and promote discussions. The discussions related to technical case discussions (A quadrant) or organisational case discussions (B quadrant). One professional showed initiative in all four quadrants; however, further investigation and analysis were needed to determine whether or not all the quadrants were equally utilised during learning.

Kypris and Brynhildr were similar in their preferences, creating mainly an A quadrant learning environment, with the exception that Brynhildr incorporated aspects from the C quadrant when she stated that her classroom must be a 'friendly classroom' and that learners must be able to see properly. There were only three posters indicating that it was a Mathematics classroom. Firstly she had a printout of Pi above the Whiteboard and in the back of her classroom she had an A3 poster of a calculator. Close to her working desk was an A4 poster of Pythagoras. She had a smaller Whiteboard in the back of her classroom to display the homework (B quadrant) and she asked that one part of the wall should be painted with chalk paint so that it could be used by the learners to practise sums or just to express themselves by writing a quote or drawing a picture. She received a positive response from the learners and there was always text, drawings or quotes on the painted blackboard. Brynhildr was a register teacher and on the one wall the learners chose a picture to represent them with their birthday on. These pictures were placed in chronological order. On

the back wall there were laminated photographs of former learners. From Brynhildr's classroom environment it was evident that she had become more flexible in the C quadrant and there was a marked difference between her classroom and all the other Mathematics classrooms.

Four professionals indicated that it was important that the learners should feel safe and comfortable and four underscored the importance of learners engaging in discussions. Three professionals made use of visual and conceptual elements in the learning environment, which relates to the D quadrant. Alexander's learning environment included motivational phrases, learners' assignments and posters that were related mostly to History. Every day he wrote a quotation on the Whiteboard to motivate the learners and to start a discussion, leading to facilitating learning. This strategy underscores Alexander's capitalisation on his C quadrant thinking preference, but also shows his flexibility in his secondary D thinking preference.

Heidi's classroom was very visual (D quadrant preference), with images and posters from Germany, including people and landscapes. The posters were not organised in any specific order. Differing slightly from the aforementioned two professionals Octavia's classroom displayed many pictures of cats, horses and some personal photographs (C and D quadrants). There were models of molecules and the rest of the classroom reflected that of a traditional laboratory set up.

Response / Names	A quadrant learning environment	Achievement-driven: fact based	Whiteboard	B quadrant learning environment	Task-driven: back to basics	C quadrant learning environment	Engaging in discussions	Safe and comfortable	D quadrant learning environment	Visual and conceptual
Kypris	☑	☑	☑							
Alexander			☑			☑	☑	☑	☑	☑
Heidi			☑	☑	☑	☑		☑	☑	☑
Octavia	☑	☑	☑	☑	☑	☑	☑		☑	☑
Lana	☑	☑	☑	☑	☑	☑	☑	☑		
Helena	☑	☑	☑	☑	☑	☑	☑	☑		
Brynhildr	☑	☑	☑			☑				

Table 19: The codes used to describe the learning environment

The final question in the preliminary interview related to the thinking styles that the professionals incorporated in their teaching practice. The question was:

- 'Do you make provision for all the thinking styles in your teaching practice?'

The purpose of this question was to probe to what extent the professionals were aware of different thinking preferences.

Two professionals, Lana and Brynhildr indicated that they did not incorporate all the thinking preferences. Kypris and Alexander were not sure if they were making provision for different thinking styles. Both felt that they were confined to conventional ways of teaching. Alexander indicated that he promoted experiential learning (C quadrant) to break away from conventional modes of learning, by,

for example, giving the learners the assignment to write a letter to Jacob Zuma, focusing on how they (the learners) would be able to contribute positively to South Africa. The objective was to instil a form of patriotism into the learners after he had observed their negativity as opposed to the non-South African learners who were more positive about current South African affairs. Alexander found it challenging to reflect and determine the effectiveness of learning tasks and facilitating learning. Helena remarked that she found it difficult to incorporate all the thinking styles; however, she was eager to 'learn' more about it in order to plan better (B quadrant). Helena, Kypris and Octavia stated that they were not aware of different thinking preferences; Kypris underscored this by stating that she had not been taught about thinking preferences when she studied B.Ed.

Heidi, Octavia and Helena indicated that they tried to incorporate different thinking preferences when facilitating learning (See Table 34). Heidi made use of experiential learning (C and D quadrant) by challenging the learners to play, for example, *Simon Says* and also encouraging kinaesthetic mode of learning; she also implemented the C quadrant of movement. Another example would be for learners to visit a German bakery where they had to order in German. Octavia also incorporated experiential learning by creating innovate learning tasks; for example, she showed the learners a YouTube rap song and instructed them to compose their own rap song (C quadrant) about the functions and components of a cell. She stated that the whole class enjoyed the learning task and the one group was very inventive and created a 'Pita wrap'. They filled the pita while they were rapping. The pita presented the cell membrane and the mayonnaise was the cytoplasm. Afterwards they enjoyed eating the pita. Octavia was an innovative facilitator of

learning and she used the D quadrant and especially the C quadrant to facilitate learning.

Response / Names	Does not incorporate all	Not sure	Try to	Not aware of thinking preferences	Convention	Experiential learning	Challenging
Kypris		☑		☑	☑		
Alexander		☑			☑	☑	☑
Heidi			☑			☑	
Octavia			☑	☑		☑	
Lana	☑						
Helena			☑	☑			☑
Brynhildr	☑						

Table 20: The codes used to determine Whole Brain® facilitating learning

4.3.4 Analysis of the HBDI®

Du Toit (De Boer et al. 2013:109) postulates the importance of using the HBDI® as a 'baseline study and point of departure' for professional development. I completed the HBDI® for the second time (previously I completed the HBDI® in 2005). According to Herrmann (1995:350) a professional's scores may change over time; however, the general pattern remains the same (See Chapter 2 and Chapter 3 for an explanation of the reference code, adjective pairs and profile score. The HBDI® analysis forms part of the qualitative and quantitative data sets).

4.3.4.1 My HBDI® analysis

According to the HBDI® 2005 result my thinking preference was triple dominant, 2111 which, according to De Boer et al. (2013:7) is one of the most frequent profiles seen in the triple dominant Herrmann database. Eighty-one per cent of the 34% triple dominant profiles are most frequently 2111, 1121 and 1112.

	A quadrant	B quadrant	C quadrant	D quadrant
Profile Scores	**42**	**69**	**75**	**119**
Reference code	**2**	**1**	**1**	**1**
Adjective pairs	**5**	**5**	**5**	**9**

Table 21: An adaptation of my 2005 HBDI® profile summary

In the narrative report my most preferred thinking preference was the D quadrant with a value of 119 and the key descriptors that I chose were *imaginative*, *artistic*, *intuitive* and *holistic*. I selected *imaginative* as my Key descriptor. My next preferred thinking preference was the C quadrant and I selected *spiritual*, *symbolic* and *intuitive* and *writing* as descriptors. My next preferred quadrant by a slight margin from the C quadrant was the B quadrant. The descriptors that I chose were *detailed* and *planning*. My preference code was 2111 (See Figure 14 that forms part of the qualitative data analysis). When I completed the HBDI® again this year there was a slight change of preference code to 1211 (See Figure 15); however, I concluded it had to do with focusing more on my work environment and this study when I answered the survey questions.

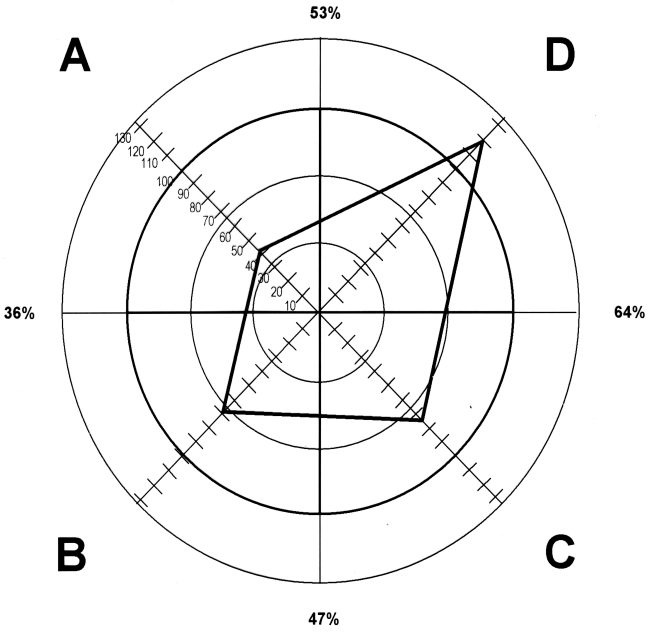


Figure 14: My 2005 HBDI® profile

My 2015 HBDI® profile preference code is 1211, a triple dominant profile. The advantage of a triple dominant profile (See Chapter 2) is that it allows the professional to 'process and be able to access the associated language across the three quadrants more easily' (De Boer et al. 2013:8). The primary thinking style quadrant is the D quadrant with a quantitative value of 104. Then the two secondary thinking quadrants are the C quadrant with a quantitative value of 77 and the A quadrant with a quantitative value of 68 (See table below).

	A quadrant	B quadrant	C quadrant	D quadrant
Profile Scores	**68**	**42**	**77**	**104**
Reference code	**1**	**2**	**1**	**1**
Adjective pairs	**5**	**5**	**5**	**9**

Table 22: An adaptation of my 2015 HBDI® profile summary

In the HBDI® narrative provided with the analysis of my thinking preference, *holistic* and *intuitive* were selected as descriptors of my

mental preference in day-to-day circumstances. What describes me best, or the Key descriptor is *artistic*. My mental preference at work includes *integration*, *conceptualisation*, *creative* and *innovating*. From this analysis I could comprehend my mode of thinking regarding how I respond in certain situations. For example, in order to make sense of this study, I first had to obtain a holistic view of the chapters, thus I outlined the chapters and through integration of the sources I was able to construct meaning from the data gathered. While doing the final write up for this study I conceptualised different ways of representing the data in a more creative way by using, for example, the Grafio App on my iPad.

The secondary identified preferred mode of thinking is the C quadrant with *spiritual* and *intuitive* as descriptors. One can see this in my day-to-day life; I am very spiritual regarding my religion. However, I have the utmost respect for other religious orientations as well. My spirituality extends to my teaching practice, since I have learners from different cultures and different religious orientations. The latter is probably one of the aspects that I love most of my working environment, since I developed a passion for Anthropology in my pre-graduate years and from specialising in Cultural History as post-graduate student. I also have an intuitive mind set and can read people and especially my learners quite well. I am also interpersonal and I interact with the learners and my professionals not only on an academic level, but also on a personal level.

Another secondary preferred quadrant is the A quadrant with *logical*, *critical*, *rational* and *factual* as descriptors. These descriptors indicate how I became more flexible with regard to the A quadrant. In 2005 the B quadrant was a secondary preferred quadrant; however, since then I have changed schools and the environment has changed radically. According to Herrmann (1996:283), if a

professional shows a preference for the B and D quadrant, it may lead to a 'decision-making dilemma'. On the one hand the D quadrant is about risk-taking and being daring, whereas the B quadrant is cautious. There is a sense of dualism at work here and I am reminded of Pablo Picasso's years of dualism in his *Minotaur* works. I have often experienced these conflicts, both in my art as well as within a work situation. Therefore I found it interesting to see the slight shift in my thinking preference with the A quadrant that expanded and the B quadrant that receded. The expectations at Wilberforce High School are for academic excellence, thus I had to become more logical in thought, critical when reflecting on my teaching practice but also with a rational approach, which contradicts my intuitive side. My domain knowledge, History, is factual; therefore I have to relay the factual evidence in a constructive, but also holistic and innovative way through the use of key words and a variety of study methods, for example mind maps and associations.

The adjective pairs indicated that when I am under pressure my thinking preference is altered; however, it is not radically out of alignment. The shift indicates that I become more flexible in my less preferred B quadrant and more so in my dominant D quadrant. The A quadrant and C quadrant preferences recede when I am under pressure. The aforementioned analysis was relevant in the final write up of the study. I isolated myself and had to plan in order to allocate time for the final write up. It was a challenge, since time constraints, personal and increased work pressure influenced me considerably. Figure 15 (page 167) indicates my 2015 HBDI® profile.

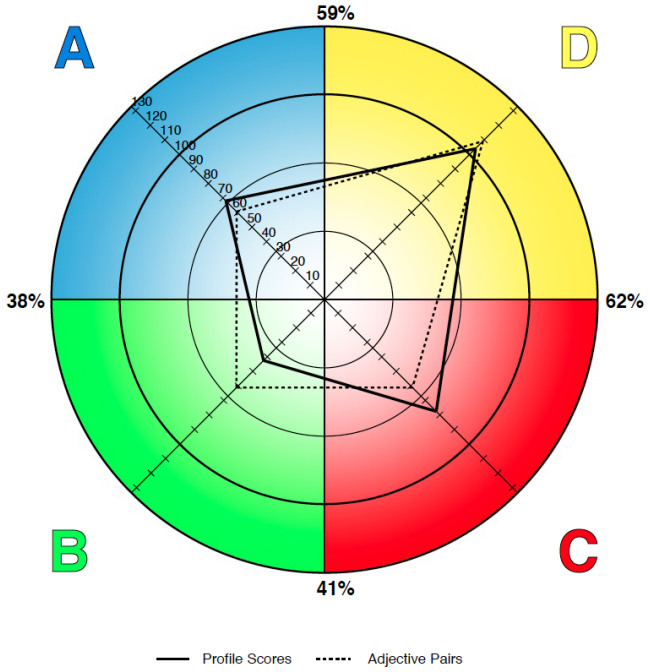


Figure 15: My 2015 HBDI® profile

If a preference is predominantly in the right and limbic mode, the assumption can be made that the triple dominant person is less competitive and focuses on competing with him- or herself (Herrmann 1996:46). As an example I recall my own thinking preference in the C quadrant and I agree on above statement. In my case, I aim to better myself and challenge myself to do better.

As mentioned earlier, one's scores might change over a period of time; however, the main pattern stays the same. Figure 16 (page 168) is a composite of the 2005 and 2015 HBDI® profile overlays. The shift in thinking preference is clear. The B quadrant was one of my secondary quadrants in 2005, but has receded whereas the A quadrant was extended. In both the C and D quadrants I scored high with a slight decrease of the D quadrant in the 2015 HBDI® analysis. In the 2005 HBDI® survey I chose my key descriptor as *imaginative* and in 2015 I selected *artistic*; both descriptors underpin my primary D quadrant thinking preference.

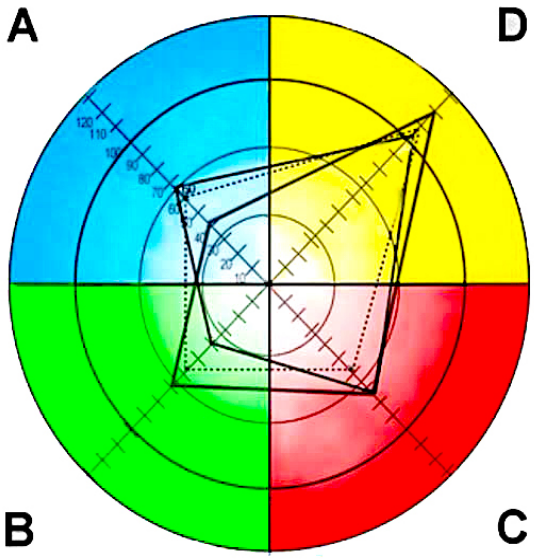


Figure 16: A composite of my 2005 and 2015 HBDI® profiles

4.3.4.2 Kypris's HBDI® analysis and comparison with my HBDI®

Kypris's HBDI® profile preference code is 1211, a triple dominant profile (De Boer et al. 2013:7). The primary thinking style quadrant is the A quadrant with a quantitative value of 89. The two secondary thinking quadrants are the C quadrant with a quantitative value of 84 and the D quadrant with a quantitative value of 77 (See table below).

	A quadrant	B quadrant	C quadrant	D quadrant
Profile Scores	**89**	**53**	**84**	**77**
Reference code	**1**	**2**	**1**	**1**
Adjective pairs	**7**	**4**	**10**	**3**

Table 23: An adaptation of Kypris's HBDI® profile summary

Kypris's mental preferences for day-to-day life are *logical*, *rational*, *mathematical* and *factual* in the A quadrant. These descriptors became evident during the one-on-one sessions and workshops. Kypris worked in a logical manner and she responded positively to a formulised facilitating of learning, including technical discussions about how Apps can be integrated and applied in her learning area. With regard to her work descriptors she selected *analytical* and *problem solving*, both relating to her learning area, Mathematics. During the teaching practice observation I could clearly perceive her preference for facilitating learning by utilising her A quadrant thinking preference.

Kypris's secondary thinking preference by a slight margin is the C quadrant with *talker* and *spiritual* as descriptors and *intuitive* as a Key descriptor. These descriptors are reflected in her daily actions, her being a very social person with strong beliefs. She utilises her intuition and can read the learners and colleagues very well. As a Form Leader she had the responsibility to monitor and be supportive of learners and the challenges that they might face at home or at school. During the one-on-one sessions and workshops I observed that she was a keen listener and she shared her ideas and experiences. She also looked for experiential opportunities and she enjoys group interactions.

Another secondary thinking preference is the D quadrant with descriptors *holistic* and *intuitive* Key descriptor. Kypris's holistic view became clear when she volunteered to be part of this study. She took up the role of taking responsibility for her own learning and self-discovery by challenging herself to make more use of technology in her teaching practice. Descriptors that were identified as associated with her work are *integration* and *conceptualisation*. These thinking preferences became evident in her self-regulated

learning, taking responsibility and acknowledging that she wanted to 'keep up' with the technological trends and explore the possibilities of transforming her teaching practice. I deduced that she conceptualised this strategy as part of her journey as lifelong learner.

With regard to the adjective pairs analysis Kypris's is markedly different from her profile. Thus she responded quite differently when under pressure and her profile became more like the adjective pairs increasing significantly into the C quadrant and the A quadrant. She therefore capitalised on her rational thought and talked through the dilemmas that she faced. It was clear from her management of the Form Groups that she used these modes to solve challenges that were experienced. Figure 17 displays Kypris's thinking preference.

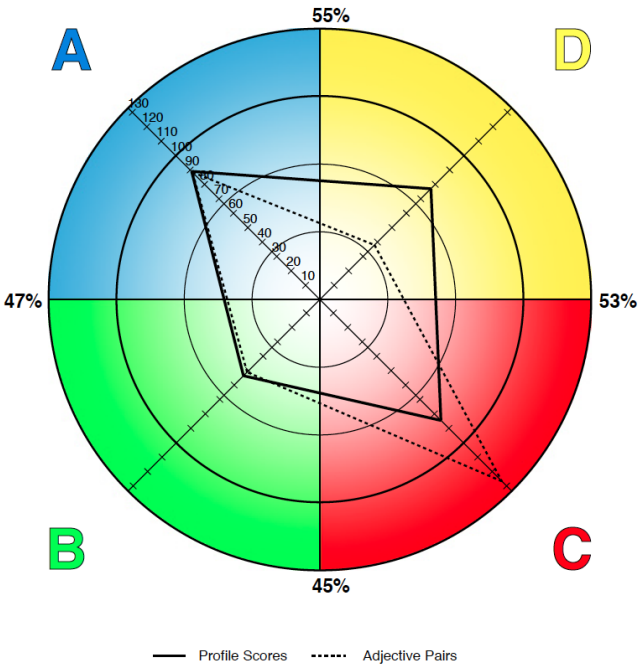


Figure 17: Kypris's HBDI® profile

A composite (See Figure 18 of Kypris's HBDI® and my HBDI®) indicates that we shared thinking preferences in the D quadrant and C quadrant; thus I was comfortable facilitating learning within these

two preferences and she responded positively to listening and sharing ideas, integrating experiences. We also had people-oriented as well as future-oriented case discussions with reference to how she could become more flexible to develop into a Whole Brain® facilitator of learning. Together we were able to explore possibilities and innovative ways to facilitate Mathematics in a more flexible thinking style way.

The challenge for me was to be more flexible in the A and B quadrant. Kypris's thinking preference in both these quadrants was higher than mine; however, I had already made the assumption after the preliminary interview, teaching practice observation and initial fieldwork started. Thus I was aware before we completed the HBDI® that I had to adapt my facilitating of learning to become more dominant in the A quadrant and B quadrant by thinking through ideas, having thorough knowledge of the iPad and Applications for the iPad. One of our one-on-one sessions lasted longer than one hour where we explored the possibilities of ExplainEverything through practice. Thus, together we both could construct knowledge during the learning and also complement each other's knowledge through collaboration. I was able to extend my flexibility into my least preferred B quadrant and Kypris was able to take up the role of her own learning and explore new ways of facilitating Mathematics. A more in-depth analysis of our explorations is discussed later in this chapter in 4.3.7.

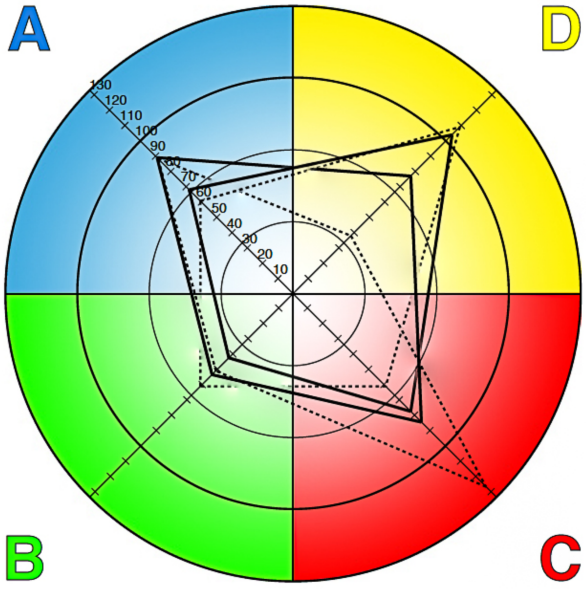


Figure 18: A composite of Kypris's and my HBDI® profiles

4.3.4.3 Alexander's HBDI® analysis and comparison with my HBDI®

Alexander's HBDI® profile preference code is 2111, a triple dominant profile (De Boer et al. 2013:7). The primary thinking style quadrant is the C quadrant with a quantitative value of 101. Then the two secondary thinking quadrants are the B quadrant with a quantitative value of 83 and the D quadrant with a quantitative value of 68 (See table below).

	A quadrant	B quadrant	C quadrant	D quadrant
Profile Scores	**65**	**83**	**101**	**68**
Reference code	**2**	**1**	**1**	**1**
Adjective pairs	**4**	**6**	**7**	**7**

Table 24: An adaptation of Alexander's HBDI® profile summary

Talker and *spiritual* were selected as descriptors in the C quadrant and Alexander's Key descriptor is *reader*. He was very spiritual and a dedicated follower of his religion with strong moral values. He was also very respectful of other religions and it was evident in his teaching practice that he was a listener and showed great interpersonal skills. From the preliminary interview and the teaching practice observation it became evident that he was concerned about the learners' interests and they should feel comfortable to speak to him about their concerns. He also motivated his learners to read more and liked to facilitate discussions and debates. Furthermore he was the choirmaster and librarian of Wilberforce High School, clearly displaying his love of music and reading. The descriptors that he chose regarding work are *teaching*, *writing*, *expressing* and *interpersonal.* The aforementioned descriptors also underscored the deductions that were made during the preliminary interview and teaching practice observation. Alexander had a life ambition to follow in his father's footsteps and become a teacher. Since high school he took up the role of being a mentor for his peers and he continued mentoring young adults to prepare them for job interviews.

Alexander selected *speaker*, *conservative* and *reader* (Key descriptor) in his secondary preference, the B quadrant. As part of work elements he identified with *planning*. The aforementioned descriptors are evident in his teaching practice, but also in his day-to-day actions. He is very vocal and self-motivated, not scared to speak his mind. However, he is respectful and understanding of others' opinions and concerns. His conservative approach underpins his religious orientation and moral values. He is an avid reader is also quite evident, since he never sits idle and you will always find him reading in his free time, which of course, makes him an excellent librarian. The Media Centre monitors also prospered

significantly since he became the librarian, signifying that he motivates the learners to read more. During the first few one-on-one sessions and workshops Alexander listened more and in later one-on-one sessions he interacted and expressed himself more. He was more comfortable to share his ideas in the one-on-one sessions than during the workshops.

Alexander's next preferred quadrant is the D quadrant and he selected *integration* and *creative* as work elements. These constructs were evident during one of the class observations when he simplified the diaspora of the southern African cultural groups in the form of a concept map. By making use of this concept map he simplified a very difficult topic, but also showed how there is interconnectedness among the southern African cultural groups and how cause and effect changed their social and political structures.

The adjective pairs result indicated that although when under pressure Alexander's thinking preference is not perfectly aligned with his preferred preference, it is also not radically different. When under pressure Alexander becomes more flexible in his secondary D quadrant that becomes more dominant and slightly recedes in the B and C quadrant. I have observed that when Alexander is under pressure, he conceptualises and formulates a strategy to bridge the dilemma that he is facing. Figure 19 (page 175) indicates Alexander's thinking preference.

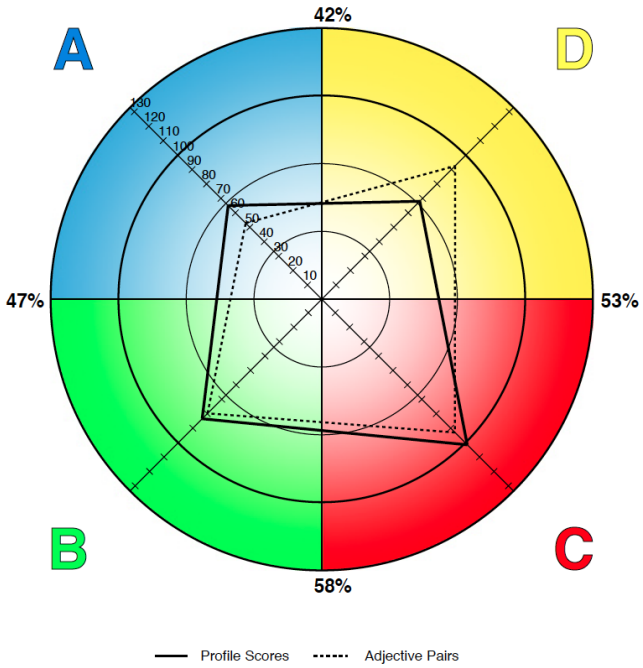


Figure 19: Alexander's HBDI® profile

According to the composite of Alexander's HBDI® and my HBDI® (See Figure 20 page 176) our thinking styles differ quite considerably in the sense that Alexander's secondary thinking preference is the B quadrant and the B quadrant is my least preferred one. In the A quadrant we are quite similar in thinking preference and in the D quadrant my thinking preference is more dominant and in the C quadrant Alexander's thinking preference is more dominant. During the one-on-one sessions I capitalised on my D quadrant and C quadrant preferences and Alexander's thinking D quadrant and C quadrant styles were catered for in these sessions. We would share ideas and we integrated experiences to add to our construction of knowledge in the context of our teaching practices. Alexander was led on a road of self-discovery and of all the professionals he was the most diligent to give me timely feedback regarding proposed dates for professional development, content as well as feedback on my mentoring practice. Alexander's diligence clearly underpins his B quadrant thinking preference of organisation and administration.

The challenge for me was to be flexible and cater more for Alexander's B quadrant and the challenge for both of us was to be more flexible and incorporate A quadrant thinking preference more in our professional learning programme.

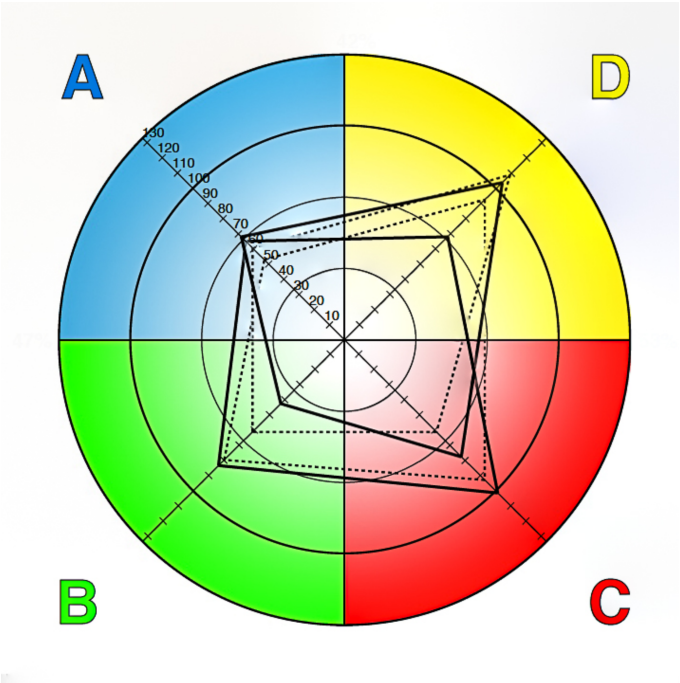


Figure 20: A composite of Alexander's and my HBDI® profiles

4.3.4.4 Heidi's HBDI® analysis and comparison with my HBDI®

Heidi's HBDI® profile preference code is 2111, a triple dominant profile (De Boer et al. 2013:7). The primary thinking style quadrant is the D quadrant with a quantitative value of 87. Then the two secondary thinking quadrants are the C quadrant with a quantitative value of 83 and the B quadrant with a quantitative value of 83 (See Table 25 page 177).

	A quadrant	B quadrant	C quadrant	D quadrant
Profile Scores	**51**	**83**	**83**	**87**
Reference code	**2**	**1**	**1**	**1**
Adjective pairs	**2**	**7**	**8**	**7**

Table 25: An adaptation of Heidi's HBDI® profile summary

Heidi selected *imaginative*, *holistic* and *intuitive* as descriptors for her primary D quadrant thinking preference. Her mental preference at work is *conceptualisation*. From the exploratory, preliminary interviews and the teaching practice observations I could clearly notice her imaginative approach in her teaching practice. She uses creative concepts such as drawing to facilitate learning and she capitalises on her C quadrant thinking preference by telling stories and facilitating games.

The descriptors that Heidi selected for the C quadrant are *spiritual*, *intuitive* and *reader*. With regard to work elements she identified *teaching*, *expressing* and *interpersonal*. Heidi is very spiritual with strong moral values; she respects other peoples' religious orientation. She capitalises on her intuition and during the preliminary interview emphasised that she wants the learners to be comfortable and feel safe. For her it is more important that the learner speaks about his or her concerns (be it school matters or matters at home) and when the learner is 'comfortable' she believes that a better understanding and comprehension of learning German will take place. I have also observed that Heidi makes extensive use of discussions and experiential opportunities during the facilitating of learning.

In the B quadrant the chosen descriptors were *controlled* and *reader*. Heidi identified *organisation*, *planning* and *implementation*

as work elements. These observed during the preliminary interview as well as during the teaching practice observation. She is, like Alexander, an avid reader. The learning environment, although humanistic and interpersonal (C quadrant) displays a balance with control (B quadrant) and a structured organisation; for example, a section on her Whiteboard is dedicated to writing homework and assignments so that the learners can plan their time management.

Although the A quadrant is Heidi's least preferred quadrant her Key descriptor is *rational*. Another descriptor that she selected from the A quadrant is *logical*. I have observed that she is flexible in her thinking style to the extent that she incorporates a logical approach to facilitating learning by making use of worksheets and textbooks but also by motivating her learners to think through ideas.

Regarding the selection of adjective pairs, during times of pressure Heidi's thinking style is not perfectly aligned with her dominant thinking preference; however, it is not radically out of alignment either. Her thinking style shift into the C quadrant becomes more dominant and there is a slight increase in the B quadrant thinking style and a very slight increase in the D quadrant. There is a significant receding of the A quadrant when Heidi is under pressure. Heidi remains calm and rational when she is under pressure or faced with dilemmas. She is very open about her feelings and concerns; she has a methodological approach to assess the situation and to react. Figure 21 (page 179) indicates Heidi's thinking preference.

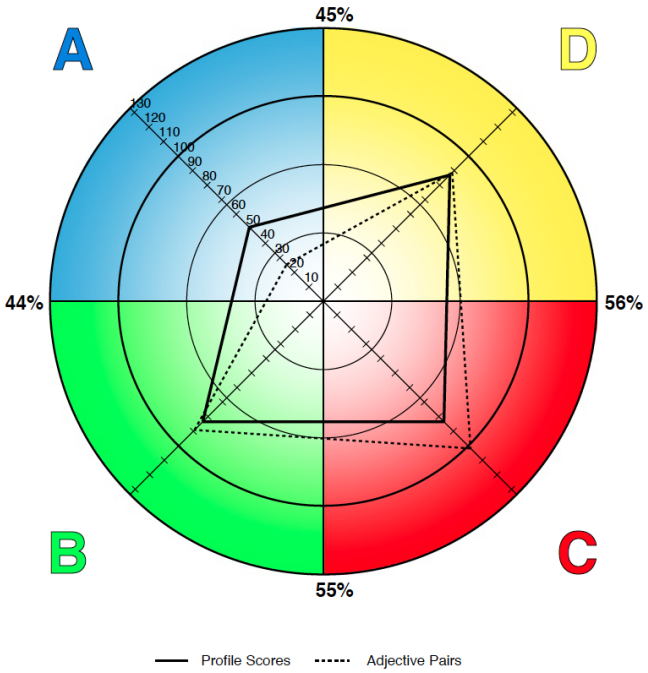


Figure 21: Heidi's HBDI® profile

According to the composite of Heidi's HBDI® and my HBDI® (See Figure 2 page 180) our thinking styles differ, especially in the B quadrant with Heidi's being more dominant than mine. In the A and D quadrant I have a slightly higher dominance than Heidi and in the C quadrant Heidi has a slightly higher dominance; however, it increases when she is under pressure.

During our one-on-one peer mentoring sessions I capitalised on my C quadrant thinking preference and we had many people-oriented case discussions; I extended it to future-oriented case discussions regarding the implementation of the iPad as a source of Whole Brain® facilitating of learning. During one of the one-on-one sessions, where I planned to extend my thinking preference into the B quadrant, I had to switch to facilitate the learning in the C quadrant mode due to the dilemmas that became apparent just after the field work started. There was a need for Heidi to talk through the dilemmas; instead of implementing the course content and acquiring skills through practice, we opted for listening and

sharing ideas on how to overcome the dilemmas that were presented and harmonising with the content that I initially prepared from a B quadrant thinking preference.

Although my thinking preference in the A quadrant is more dominant than Heidi's, I was able to add to my knowledge with regard to a more formalised application of logic. Heidi has more years of experience and she, although very people-oriented, is flexible in accommodating the A quadrant thinking style in a formal fact-based way. What I have learned is that a foreign language is not intimidating and that it can be presented in a way to accommodate, for example, my thinking preference. I have had inhibitions regarding my foreign language skills since high school due to a specific teacher. However, observing Heidi's teaching practice, the care and support that she offers her learners and her belief that each and every candidate can do well in her subject, motivated me to take on a foreign language again after the completion of this study.

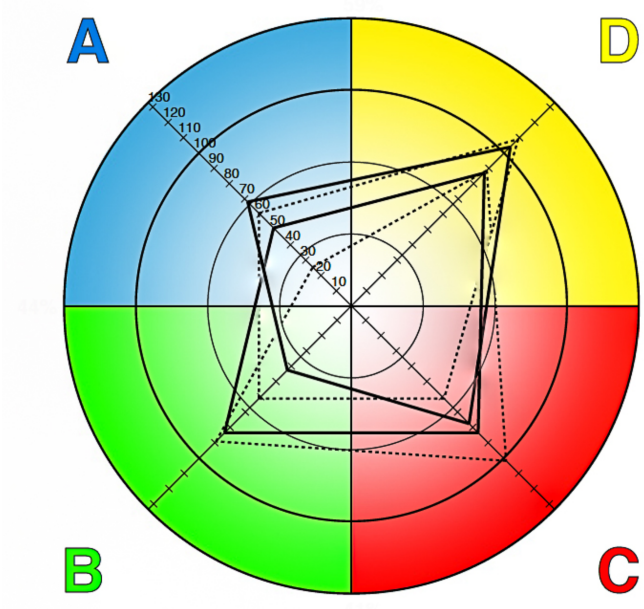


Figure 22: A composite of Heidi's and my HBDI® profiles

4.3.4.5 Octavia's HBDI® analysis and comparison with my HBDI®

Octavia's HBDI® profile preference code is 2112, a double dominant profile (See Chapter 2). The lower 2112 double dominant profile has the advantage that the two quadrants reinforce each other; however, the two primaries in the same mode imply that the professional might access the other modes less frequently (De Boer et al. 2013:7). The primary thinking style quadrant is the C quadrant with a quantitative value of 92. Her secondary thinking quadrant is the B quadrant with a quantitative value of 83 (See table below).

	A quadrant	B quadrant	C quadrant	D quadrant
Profile Scores	**63**	**83**	**92**	**66**
Reference code	**2**	**1**	**1**	**2**
Adjective pairs	**5**	**10**	**6**	**3**

Table 26: An adaptation of Octavia's HBDI® profile summary

Octavia selected *spiritual*, *intuitive* and *reader* as descriptors in the C quadrant of her mental preferences in day-to-day life. With regard to work elements she strongly related to *teaching*, *writing* and *interpersonal*. In the preliminary interview and teaching practice observation as well as my mentee practice the above-mentioned descriptors became apparent. Octavia is spiritual and has a profound respect for and love of nature and animals. She capitalises on her C quadrant when facilitating learning and motivates the learners through experiential opportunities, discussions and group interaction. During a teaching practice observation she made use of movement and interaction when the learners had to measure their own and one another's heart rate. They then had to run a distance and take the measurements again.

She is also very intuitive, able to read her peers and the learners' emotions. She is supportive and a good listener. During the one-on-one lessons she listened and contributed equally during the facilitating of learning. She responds positively to spontaneity and a more 'free flow' approach.

Octavia's secondary preferred quadrant is the B quadrant. She selected *detailed* and *reader* as descriptors. She also selected *organisation*, *planning*, *administrative* and *implementation* that relate to her work ethics. Deductions that were made from the preliminary interview and teaching practice observation underpinned Octavia's planning and organisational skills. She has books for each class that she facilitates and she completes the assignments in these books before assigning them to the learners. She also uses them as part of her own professional development and she reflects on the learning outcomes of the assignments to determine how effective they were and they form part of her action learning. Although Octavia asked to be part of this study at a late stage of the fieldwork, she took up her role as professional learner and constructed her own meaning from the mentee practice.

Octavia's next preferred quadrant is the D quadrant with a quantitative value of 66. She chose *imaginative* and *intuitive* as descriptive of her day-to-day thinking and with regard to her work elements she selected *creative*. During the preliminary interview I discovered how she utilises her imagination and becomes more flexible and moves more into the D quadrant. I also observed that she responded well to learning by self-discovery during the one-on-one sessions and there was playfulness in the leaning.

In Octavia's least preferred A quadrant she selected *rational* and *factual* as descriptive and *logical* as Key descriptor. From informal

discussions I could deduce Octavia's rational and factual approach in formalising the facilitating of learning by introducing theories and factual evidence. Although to a lesser degree as postulated by the analysis of the preliminary interview and teaching practice observation, Octavia does sometimes extend her thinking preference and becomes more flexible in the A quadrant.

However, from her profile most of the learning is based on a humanistic and participative C quadrant facilitating of learning with elements of discovery and conceptualisation. When Octavia is under pressure she becomes more flexible and her B quadrant thinking preference increases considerably, giving her the highest quantitative value in our community of practice. The A quadrant stays the same; however her C and D quadrant recede when she is under pressure. Figure 23 shows Octavia's thinking preference.

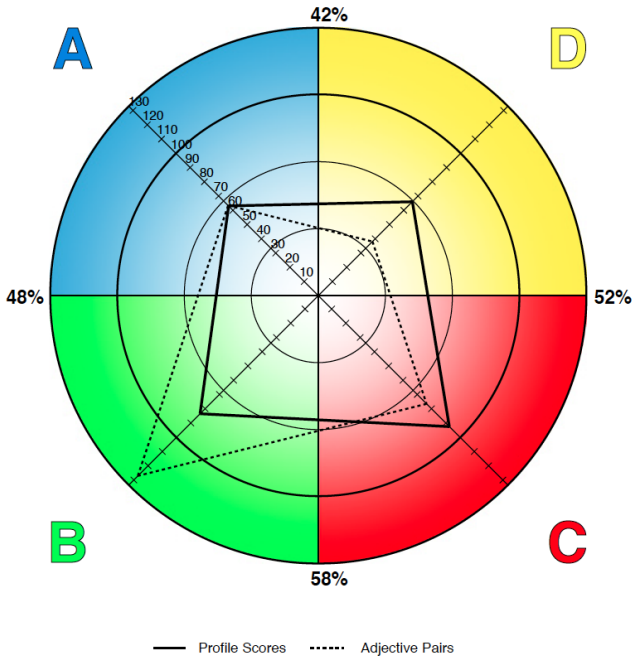


Figure 23: Octavia's HBDI® profile

If one looks at the composite of Octavia's HBDI® and my HBDI® (See Figure 24 page 185) our thinking styles differ quite considerably in the sense that Octavia's thinking preference is very

dominant in the B quadrant and contrary to hers, my primary thinking preference is very dominant in the D quadrant. The challenge was that I should extend my thinking preference to the B quadrant to accommodate Octavia and the challenge for her was to extend her D quadrant thinking preference during our professional development programme. Our A quadrant thinking preferences are similar and Octavia's C quadrant is her primary thinking preference and therefore more dominant than mine.

Thus, my challenge was to extend my C quadrant thinking preference to accommodate Octavia during the one-on-one training sessions. Octavia joined the professional development programme after my fieldwork commenced. She was a new teacher at Wilberforce High School and was thus not initially selected for the ICT program. Octavia capitalises on her C quadrant and she is very social and easy to talk to; therefore, when we started talking we realised that we had much in common and when I told her about my study and what was planned regarding the implementation of the iPads, she wanted to join the ICT professional development program and she also wanted to participate in this study because she found the idea of Whole Brain® facilitating learning fascinating. Octavia clearly wanted to take up the role of her own professional learning and it is an indication that she is a lifelong learner.

Once again I was challenged to extend my thinking preference and become more flexible in the B quadrant to accommodate Octavia since it is her secondary thinking preference. Therefore I focused on a more structured content presentation and we also had organisational case discussions on how to integrate the iPad in the facilitating of learning. Simultaneously I catered for experiential opportunities and encouraged Octavia to explore the possibilities of some of the available Apps. On one occasion I had to change my

original facilitating of learning, because I was unaware that she had a class. For her it was not a problem and before I knew it, I was basically taking part in the assignment that was given to the learners and we relocated from the classroom set up to the field where the learners were instructed to run. I found myself encouraging the learners whom I did not know to run since they were feeling self-conscious because there were seniors on the field. I had previously taught seniors and convinced the younger learners that I knew all the seniors and they should not mind them. This experience was quite liberating for me; although the C quadrant is one of my secondary preferred thinking styles, I am not an athlete. However, Octavia's facilitating of the lesson was so interesting that I actually wanted to run with the learners. The change of venue also led to a change in the facilitating of the content that I originally prepared. Thus, under a tree, keeping an eye on the runners and my seniors Octavia and I explored the possibilities of ExplainEverything.

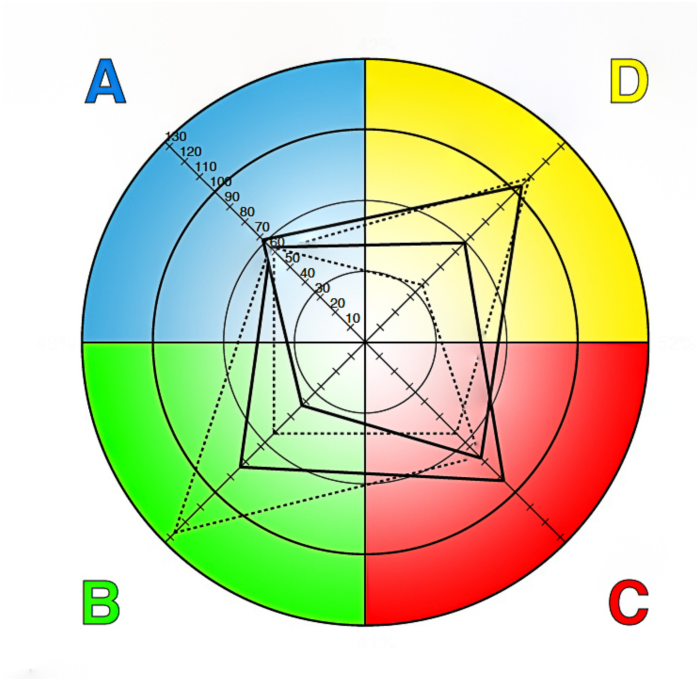


Figure 24: A composite of Octavia's and my HBDI® profiles

4.3.4.6 Lana's HBDI® analysis and comparison with my HBDI®

Lana's HBDI® profile preference code is 1221, an upper double dominant profile (De Boer et al. 2013:7). Like Octavia's, Lana's two quadrants reinforce each other. The primary thinking style quadrant is the D quadrant with a quantitative value of 87. Her secondary thinking quadrant is the A quadrant with a quantitative value of 69 (See table below).

	A quadrant	B quadrant	C quadrant	D quadrant
Profile Scores	**69**	**59**	**59**	**87**
Reference code	**1**	**2**	**2**	**1**
Adjective pairs	**6**	**6**	**4**	**8**

Table 27: An adaptation of Lana's HBDI® profile summary

Imaginative, *artistic* and *intuitive* are the descriptors representing Lana's general day-to-day mental preference in the D quadrant. She related to *integration* and *creative* for her work environment. The aforementioned descriptors underpin Lana's facilitating of learning. She uses mainly mind maps or conceptualises and amplifies the content, and as she stated during the preliminary interview she goes back to the 'basics' and 'breaks them down' for the learners. Although her learning environment reflects her A quadrant preference, she creates and integrates information on the Whiteboard for each class for which she facilitates learning.

Lana selected *analytical* and *critical* as descriptive of her A quadrant thinking style. With regard to her work elements she identified *analytical* and *problem solving*. I observed these descriptors in both the preliminary interviews as well as during the teaching practice

observation. Lana's interview transcripts are the most narrative of all the interviewees'. It was interesting to note that while she answers a question she actually analyses her answer during the process, reflects and criticises a statement she has just made and looks at it from another angle. An example would be her rationale for whether or not technology would change the learning experience. All of her answers, although rich in narrative, were broken down and structured into meaningful constructs that made the analysis and coding of her responses considerably easier. She expresses herself clearly and to the point and fully capitalises on her double dominant thinking preference.

For the B quadrant Lana selected the descriptors *detailed* and *controlled* as a Key descriptor. Lana selected *emotional* and *intuitive* as characteristics in the C quadrant. As observed in her teaching practice, Lana is controlled and systematic in her teaching practice. She capitalises on her A quadrant secondary preference, applying analysis and logic when facilitating learning. She utilises constructing concepts and synthesising in her preferred D quadrant but also organises and structures the content (Herrmann 1995:419) information (B quadrant) during the facilitating of learning.

The Adjective pairs analysis indicated that Lana's distribution is not perfectly aligned with her profile; however, it is also not radically out of alignment either. If Lana is under pressure her primary thinking preference, the D quadrant, extends and the B quadrant is postulated as more dominant. Lana's A quadrant stays the same; however, her secondary C quadrant recedes. Figure 25 (page 188) shows Lana's thinking preference.

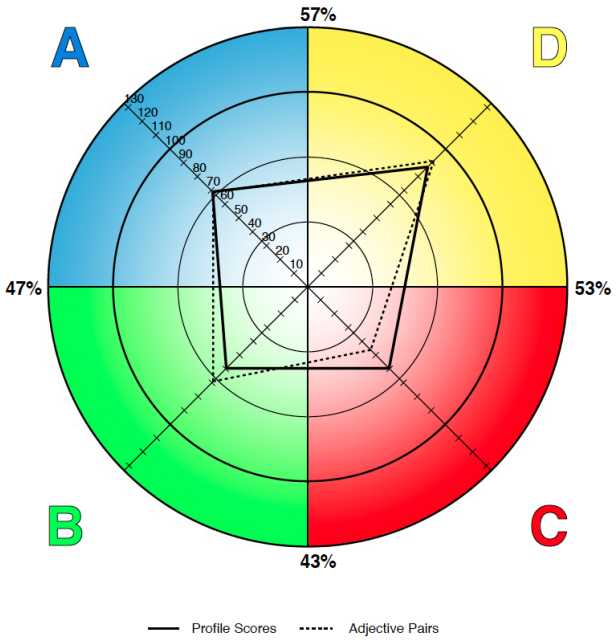


Figure 25: Lana's HBDI® profile

At first glance the composite of Lana's HBDI® and my HBDI® (See Figure 26 page 189) profiles is very similar. During the preliminary interview and teaching practice observation I assumed that we were very similar in thought and method of facilitating learning; however, after the completion of the fieldwork and the analysis I concluded that, although similar in thought and some aspects of facilitating learning, we were actually quite different in our general approach to facilitating learning as well as our outlook regarding the use of technology. Lana was initially in the ICT professional development program; however, she became discontented and I anticipated this already after I had conducted the preliminary interviews. Fortunately, despite her view about the facilitating of learning by using only a Whiteboard and Whiteboard marker, I was relieved that she wanted to stay part of this study and we continued with the professional development; I even challenged her by bringing my iPad and the one that I bought for training and we explored ExplainEveryting and its possibilities. Lana found this App very

useful and stated that it was 'finally' something that she would be able to use in her teaching practice.

Regarding the HBDI® composite profiles, Lana's B quadrant is more dominant than mine and my C and D quadrant are more dominant than Lana's. With regard to the A quadrant our measurements are identical and we can both be more flexible to expand our thinking style into this quadrant. Our one-on-one sessions were comfortable and we both listened and shared ideas, capitalising on our C quadrant thinking preference. I provided a challenge of experiential opportunities, for example working with an iPad, although I also had to be flexible to accommodate Lana and her point of view regarding the iPad. Thus I investigated similar Apps that she would be able to use on another device that she felt more comfortable with. For me it was an important part of learning in my own mentoring practice, since Lana challenged assumptions regarding technology that I had formulated. During the semi-structured interviews I came to an astounding discovery with regard to Lana's facilitating of learning in another context. I will discuss the aforementioned discovery later in this chapter under 4.3.6.

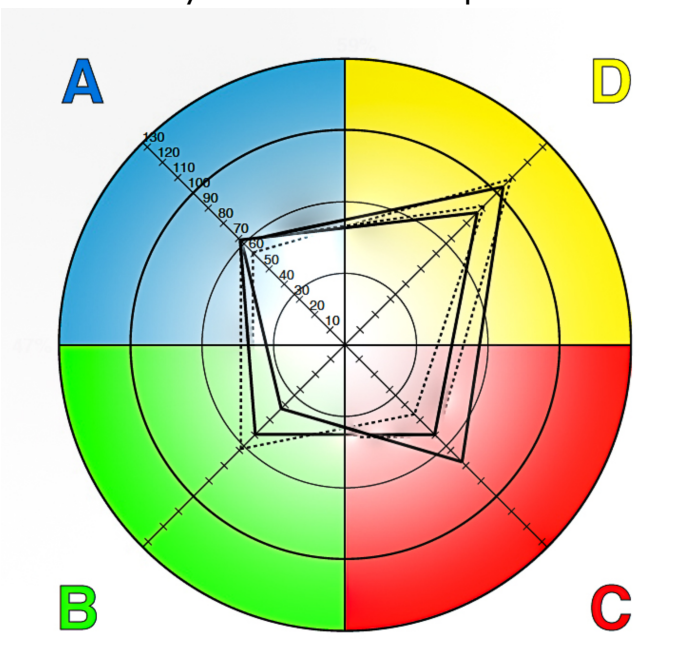


Figure 26: A composite of Lana's and my HBDI® profiles

4.3.4.7 Helena's HBDI® analysis and comparison with my HBDI®

Helena's HBDI® profile preference code is 1122, a left double dominant profile (De Boer et al. 2013:7). The primary thinking style quadrant is the A quadrant with a quantitative value of 116. Her secondary thinking quadrant is the B quadrant with a quantitative value of 77 (See table below).

	A quadrant	B quadrant	C quadrant	D quadrant
Profile Scores	**116**	**77**	**48**	**45**
Reference code	**1**	**1**	**2**	**2**
Adjective pairs	**9**	**8**	**5**	**2**

Table 28: An adaptation of Helena's HBDI® profile summary

According to Herrmann (1996:283) the double dominant A/B quadrant thinking style is the most typical thinking style. Both thinking styles focus on factual evidence and detail. This mode of thinking promotes logic and systematic analysis. Helena's thinking style preference based on the responses to the HBDI® Survey is the A quadrant and the descriptors that she selected are *logical*, *analytical*, *quantitative* and *factual*. She selected *rational* as her Key descriptor. These descriptors relate to her mental preference in day-to-day life and I concur with these findings, from what I observed in the preliminary interview as well as during the teaching practice observation. With regard to work elements Helena strongly relates to *analytical*, *technical* and *problem solving*. From the teaching practice observation the facilitating of learning is formalised and data-based. She 'built a case' to explain Newton's law. She also facilitated a technical case discussion and supplied factual evidence regarding Newton's law.

Helena's secondary preference is the B quadrant and she selected *sequential*, *detailed* and *reader* as descriptors of her thinking style. The work elements that Helena selected were *organisation*, *planning* and *administrative*. Deducing from the preliminary interviews and teaching practice observation I could identify sequencing of the content, thorough planning, structure and the emphasis on acquiring skills through practice during Helena's facilitating of learning that underpin her thinking preference descriptors in the B quadrant.

In the C quadrant Helena selected *reader* and for work elements she identified *teaching*. Her least preferred quadrant is the D quadrant and there were no descriptors in this quadrant. Especially during the one-on-one sessions I observed that, although Helena took up the role of her learning to become more acquainted with the iPad, she expressed a clear dislike of anything creative or spontaneous. Although initially I thought that this outspoken dislike of recognising new possibilities might become a barrier for Helena to become more flexible in her thinking preference, it became clear in the latter one-on-one sessions that she needed to be encouraged to become flexible and think in a holistic, creative manner. After the completion of the HBDI® survey and the feedback session we had a one-on-one contact session, discussing the thinking preferences and Helena was enthused by the results and she was also excited to come to a better understanding of the modes of thinking, especially with the booklet that is included in her HBDI® profile.

The adjective pairs result is not perfectly aligned; however, it is not radically out of alignment either. If Helena is under pressure her thinking style shifts and the B quadrant becomes more dominant, with a slight receding of the A quadrant and more so of the D quadrant. The C quadrant becomes more dominant when Helena is

under stress. I have observed that especially when Helena feels that she is challenged by time constraints she does become more flexible and extends her thinking preference to be more organised and planned. Figure 27 displays Helena's thinking preference.

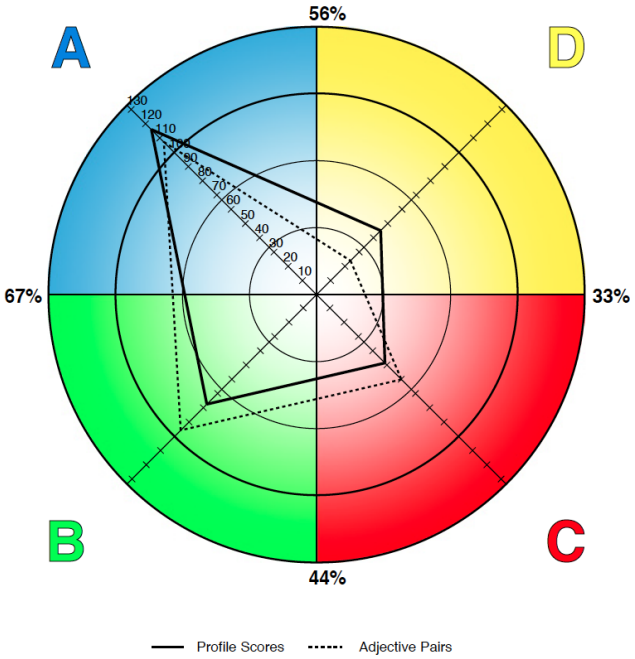


Figure 27: Helena's HBDI® profile

The composite of Helena's HBDI® and my HBDI® (See Figure 28 page 193) profiles shows that our thinking styles are basically mirror images. Helena's primary preference is the A quadrant and my primary preference is the D quadrant. Helena's B quadrant thinking preference is more dominant than mine, whereas my C quadrant is more dominant than hers. We have had interesting interaction during our professional development programme. I had to be more flexible in order to accommodate Helena's thinking preference. I also had to use my intuition (C quadrant) to see when Helena felt overwhelmed and when I should not challenge her to think in one of her non-preferred thinking styles. I had to plan carefully to be more flexible in the B quadrant and clearly formalised the content through logical means (A quadrant) to facilitate learning in our one-on-one peer mentoring sessions. I also

had to be much more reserved with regard to spontaneity and exploring possibilities. I did promote people-oriented as well as future-oriented discussions regarding Helena's professional development and how she proposes it would be transformed by a Whole Brain® facilitating of learning and the implementation of iPads. I realised that the facilitating of professional development for Helena would take another character than that of the other professionals. I had to ensure that I facilitated and motivated Helena to explore possibilities in her own time.

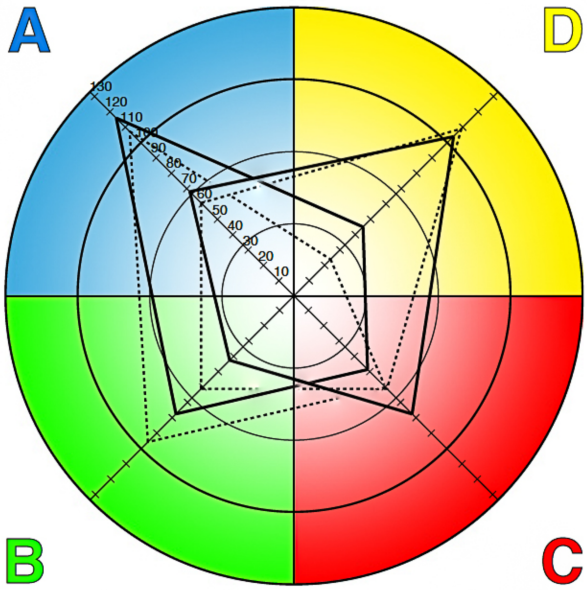


Figure 28: A composite of Helena's and my HBDI® profiles

4.3.4.8 Brynhildr's HBDI® analysis and comparison with my HBDI®

Brynhildr's HBDI® profile preference code is 1221, an upper double dominant profile (De Boer et al. 2013:7). Her primary thinking preference is the A quadrant with a quantitative value of 116. Her secondary thinking quadrant is the D quadrant with a quantitative value of 69 (See Table 29). Her preference is similar to Lana's and Brynhildr also has a double dominant A/D quadrant thinking

preference. The difference is that Brynhildr's A quadrant thinking preference is high and by quite a margin the D quadrant is the secondary preferred quadrant. Lana's most preferred quadrant is the D quadrant.

	A quadrant	B quadrant	C quadrant	D quadrant
Profile Scores	**116**	**54**	**42**	**69**
Reference code	**1**	**2**	**2**	**1**
Adjective pairs	**9**	**5**	**4**	**6**

Table 29: An adaptation of Brynhildr's HBDI® profile summary

Brynhildr selected *analytical*, *critical*, *rational* and *mathematical* as descriptors and *logical* as her Key descriptor. These descriptors represent Brynhildr's general thinking preferences in day-to-day life. In terms of work elements she relates to *analytical*, *problem solving* and *financial*. From the preliminary interview and teaching practice observation I deduced that it supported Brynhildr's HBDI® qualitative analysis and specifically the descriptors of her A quadrant primary thinking preference. She fully capitalises on the A quadrant thinking preference and it is visible in her classroom's minimalistic decor and although the desks are not in evenly distributed rows, they are thus arranged in a logical fashion to be able to seat more learners. During the teaching practice observation I noticed that although the desks are grouped together, the learners did not take advantage of talking to one another or fidget; they focused solely on Brynhildr who was busy explaining a sum on the Whiteboard. She also noted that the learners had to listen to her due to the emphasis placed on the importance of Mathematics in South Africa.

Brynhildr's secondary preference is the D quadrant and she selected *holistic* as a descriptive of herself. With regard to work elements she identified *integration* and *conceptualisation*. Both the afore-mentioned are needed in terms of linking Algebra and Graphs and she capitalised on the D quadrant to simplify Algebra. I came to this realisation during the semi-structured interview when she facilitated an impromptu Algebra explanation for me. As soon as she showed me how X and Y relate to the graph and how the graph actually changes, I had a *Eureka* moment. She used a program on the SmartBoard to show how the graph changes (See Appendix II) and related it to the Algebraic examples that she wrote on the board.

In the B quadrant Brynhildr selected *speaker* and *dominant* as descriptors and she identified *implementation* as one of her work elements. Once again I observed that she is well spoken, and she combines it with her rational thought. Regarding the policy change at Wilberforce High School, she was one of the few teachers who did not show concern or perceive it as a dilemma, for her 'Maths is Maths' as she stated in the semi-structured interview. Brynhildr's least preferred quadrant is the C quadrant and she selected *talker* as a characteristic of herself. I have observed that she is not only a good speaker, but she loves to talk and she has an excellent sense of humour. However, she often does not socialise during breaks and would rather sit in her classroom working on a memorandum or setting an assignment. The fact that Brynhildr does have photographs of former learners and a birthday poster for each learner in her class indicates that she is flexible in her thinking, showing emotional involvement.

Brynhildr was the only professional (including myself) whose adjective pair results were consistent with her profile. Thus, when under pressure, her A quadrant recedes slightly and she becomes

slightly more flexible in the B and C quadrant. Figure 29 shows Brynhildr's thinking preference.

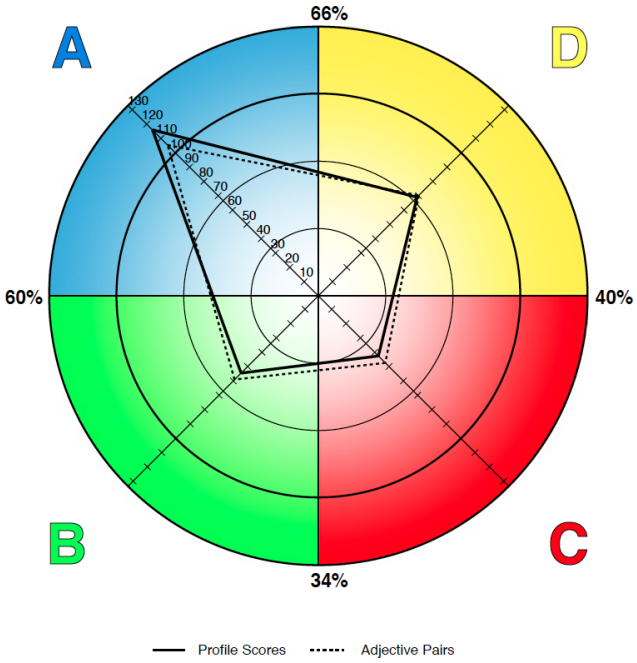


Figure 29: Brynhildr's HBDI® profile

Similar to Helena and my composite of the HBDI®, Brynhildr's HBDI® and my HBDI® (See Figure 30 page 197) profiles also look like mirror images of each other. Brynhildr's primary A quadrant score is very high, and in fact, the highest of the group of professionals. My primary D quadrant is more dominant than Brynhildr's; however, from the one-on-one mentoring sessions and the semi-structured interview I could deduce that she does apply flexibility and move into the D quadrant to provide a more holistic view. She also stipulated that in order to accommodate the different thinking preferences she needed to become more visual. This flexibility is a big step for Brynhildr and it will pave the way for her to become more aware of other thinking preferences and how she can accommodate them.

Brynhildr's B quadrant thinking preference is also more dominant than my less preferred B quadrant. In comparison to our C

quadrants, mine is more dominant. I capitalised on the use of my C quadrant and during our one-on-one mentoring sessions I made use of experiential opportunities that also provided Brynhildr with the challenge to become more flexible. She enjoyed the 'hands-on' sessions and especially when she could explore (D quadrant) something new on the iPad. One of our first one-one-one peer mentoring sessions was conducted before school. I had to be more flexible and expand my thinking preference to prepare the facilitating of learning that would accommodate Brynhildr's thinking preference and at the same time challenge her. I downloaded quite a few Mathematical Apps including an Advanced Mathematics Quiz App that gives the learner a limited time to calculate and answer the questions. Brynhildr had a look at some of the Apps and initially stated that they might be useful for a specific grade. I then decided to show her the Advanced Mathematics quiz App. She was immediately engaged and started to do the calculations and was astonished when she realised that she actually had limited time to complete each task. She started to work faster and in the end we had such a good session that the bell rang and we were both extremely late for our morning meeting.

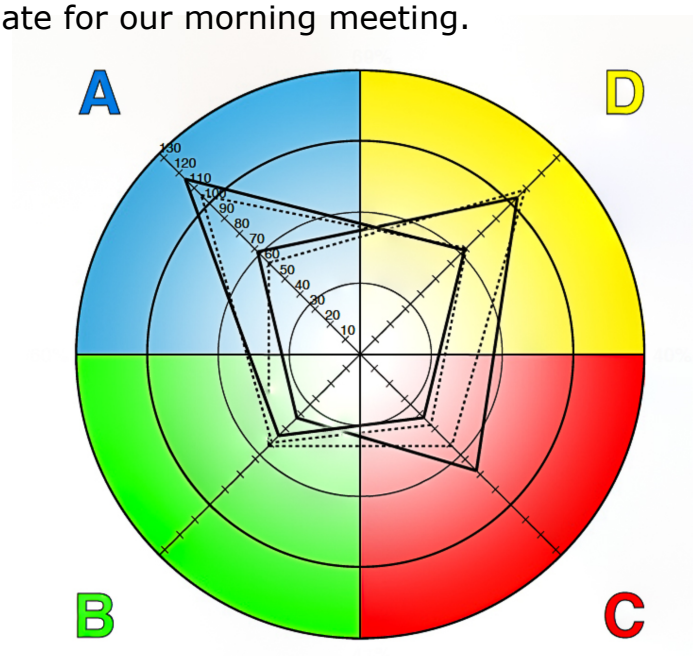


Figure 30: A composite of Brynhildr's and my HBDI® profiles

4.3.5 'Friends' or forming a Whole Brain® community of practice

Du Toit (De Boer et al. 2013:112) compiled a composite of a few profiles to indicate what a Whole Brain® Thinking group would look like. Du Toit stipulates that he was challenged to become more flexible with regard to the facilitating of learning in order to accommodate students and colleagues who did not necessarily share his thinking preference. I include a composite of my professionals' (including myself) thinking preferences (See Figure 31 page 199).

Wilberforce High School's composite indicates that we form a Whole Brain® community of practice and if we were to get more teachers involved to be part of our community of practice there would, for example, be someone who does have a primary thinking preference in the B quadrant. As noted from the composite, the incidence of the B quadrant is the lowest; however, two professionals, Octavia and Helena become more flexible when they are under pressure and the B quadrant becomes a more dominant preference for both of them. Two professionals, Helena and Brynhildr's A quadrant dominance is the highest of the group. Lana and I have the highest D quadrant dominance. Alexander and Octavia have the highest C quadrant dominance; however, depending on the types of dilemma faced or pressure that the professionals are placed under, their thinking styles may recede or expand depending on their individual HBDI® analysis.

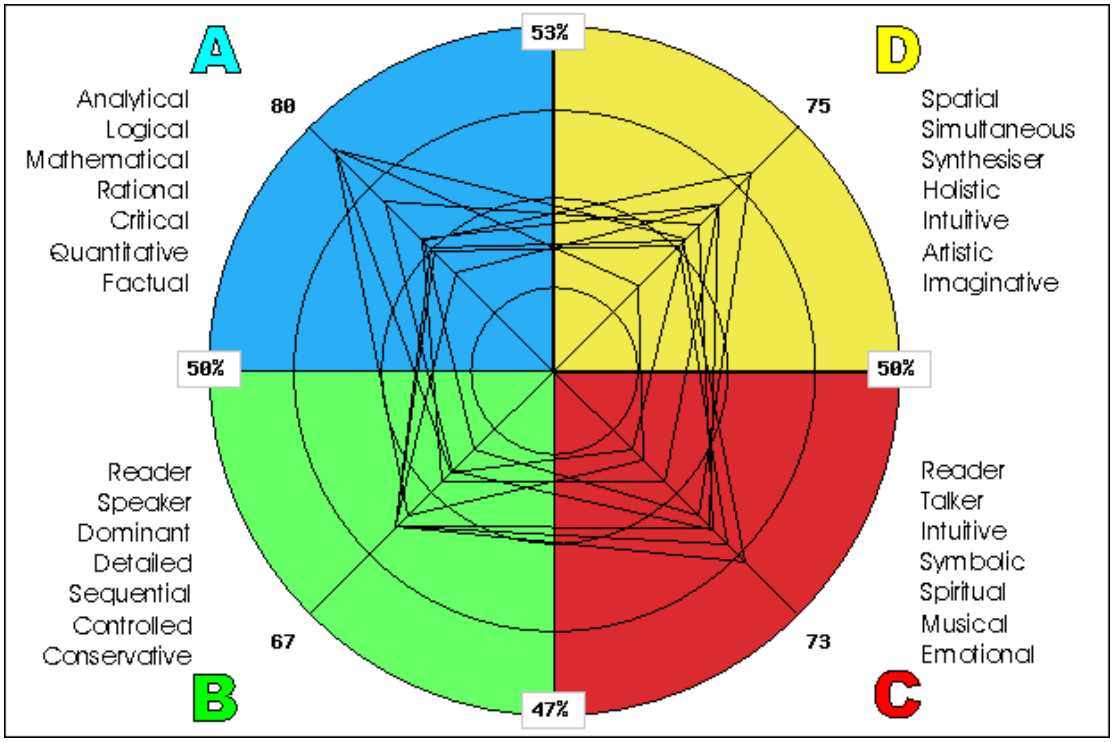


Figure 31: A composite of the HBDI® thinking preferences of the community of practice at Wilberforce High School

The objective of doing the HBDI® survey is to become aware of one's thinking preference and to have an understanding of how to become flexible to become a Whole Brain® teacher to facilitate Whole Brain® learning. One must, however, not think that by becoming a Whole Brain® teacher, expanding one's thinking preference, that one will lose one's own preferred thinking preference. Herrmann (1995:256) states that one must rather regard it as 'adding to the existing preferences'; therefore it is a 'shift' rather than a loss.

The workshops included formalised (A quadrant) facilitating of learning, applying logic and motivating the professionals to think through ideas and take part in technical discussions (A quadrant). The content was structured and I progressed sequentially through the steps (B quadrant), providing time for the professionals to

practise the skills (B quadrant) and explore possibilities (D quadrant). The workshops also promoted collaboration (C quadrant) and experiential learning (C and D quadrant) where the professionals were given the opportunity to apply (A quadrant) their new knowledge and practise the skills (B quadrant), supporting one another and sharing an integrated experience (C quadrant). The one-on-one peer mentoring sessions were planned to accommodate the individual professional and it also motivated me to extend my thinking preference further to accommodate and to challenge the professionals so that they would be able to think outside their preferred thinking preference. I reflected on every workshop and one-on-one peer mentoring session as part of my Action Research process to monitor my mentee practice as well as my own professional development and these reflections or field notes also form part of my qualitative data base.

Three professionals have triple dominant profiles as do I. Kypris's primary thinking preference is the A quadrant and her secondary thinking preferences are the C and D quadrants. With regard to my mentee practice, we shared the same thinking preference in the A, C and D quadrants. Our challenge was to become more flexible and extend our thinking to the B quadrant. We had to plan systematically and go through each step of an App in a sequential way. During the one-on-one peer mentoring sessions I organised (B quadrant) and structured the App or software content in a logical (A quadrant) way. I encouraged Kypris to practise the skills (B quadrant) that she observed during the facilitating of learning, she agreed to the need to be more organised and plan thoroughly (B quadrant) and showed that she was flexible in her thinking preference to accommodate the B quadrant. We had three one-one-one mentoring sessions (two lasted longer than an hour each) where we focused on ExplainEverything and its different functions.

One session was purely a practical session (See Appendix III) where Kypris had to sequence content and practise the skills (B quadrant) that we had looked at earlier. Further explorations of ExplainEverything are discussed in 4.3.7 to see how it can be used to facilitate Whole Brain® learning.

Alexander and Heidi's triple dominant thinking preferences, fall in the B, C and D quadrants. Thus we were comfortable working in the C and D quadrants, but I had to become more flexible in the B quadrant, as with Kypris, and sequence the content to implement the App course content. We would frequently spend a short time discussing how to organise and implement the iPad at Wilberforce High School (B quadrant), which was comfortable for Alexander and Heidi. To challenge them I had to incorporate more A quadrant thinking by applying logic when facilitating learning regarding the iPad Apps and Mac programs. I focused on technical factors, applying analysis and logic creating a formalised learning opportunity (A quadrant), but also simplified it into more tangible content, synthesising (D quadrant) information and capitalising on my D quadrant, which Kypris, Alexander and Heidi were comfortable with. The last five one-on-one peer mentoring sessions were geared at implementing the course content of their individual learning areas by using an iPad (B quadrant) and sharing ideas (C quadrant) and exploring new ways (D quadrant) to accommodate learners who had different thinking preferences and how to accommodate them during the facilitating of learning. Heidi and Alexander felt comfortable to discuss their concerns about the learners (C quadrant) and their objectives to get them more involved. They had to investigate some of the Apps on their own and provide feedback by taking part in technical discussions (A quadrant). The rest of the participants were challenged to expand their thinking preference to two of their least preferred quadrants.

Octavia, Lana, Helena and Brynhildr are all double dominant in their thinking preferences. The challenge for me was to become more flexible in my B quadrant that is my less preferred thinking preference in order to accommodate Helena and Brynhildr. They motivated me to be very well prepared in organising the facilitating of learning. I also had to ensure that I was familiar with the technical requirements of the Apps since Helena and Brynhildr usually wanted to talk about the technical advances (A quadrant) for their learning areas as well as with evaluating and testing (B quadrant) the capabilities of the App. One of Brynhildr's first concerns was whether there was a way to type a Mathematics tests with the necessary mathematical symbols on the iPad. I soon discovered that there were mathematical and scientific keyboard Apps and I downloaded a few through which Brynhildr could work to evaluate (B quadrant) if they could be applied; two Apps were found suitable, namely Math Keyboard and SciKey. With these Apps Brynhildr and Kypris were able to type their Mathematics assignments on their iPads. Thus, the latter formed part of our community of practice and we shared our knowledge via WhatsApp communication; Helena could explore the possibilities of the SciKey App in Physical Science.

The challenge during the one-on-one peer mentoring sessions was to motivate both Helena and Brynhildr to become more flexible in the C and D quadrants. I focused on creating experiential opportunities (C and D quadrant), exploring hidden possibilities (D quadrant) regarding the features of some of the Apps that we explored as well as promoting a more visual (D quadrant) approach for both to utilise in their teaching practices. Brynhildr responded especially well to the visual challenge and thought of ways in which she could use more visual examples in Mathematics. Helena found the latter more challenging; in the beginning she was hesitant to

explore these possibilities and to such an extent that even creating a mind map was a bit too overwhelming for her. After continuous motivation and not taking bold strides, Helena produced a holistic synthesis for acids and bases in a mind map that she made while reflecting on that particular section that she facilitated. There is a more detailed reference to Helena's flexibility in the D quadrant under 4.3.7.

Octavia has a double lower (limbic) thinking preference with the B and C quadrant being her preferences. She capitalises on her C quadrant and is passionate about exploring new possibilities (D quadrant) and planning experiential opportunities (C and D quadrant) for the learners. She is a self-regulated professional learner, improvising new innovative learning opportunities, but also thinking through ideas (A quadrant) and is committed to thorough planning (B quadrant). The challenge for me was to be more flexible in the B quadrant through organising and structuring the content for our one-on-one peer mentoring sessions. We would both be comfortable talking about the learners and listening to each other and sharing ideas (C quadrant). I observed that Octavia was already flexible in her thinking preferences and she fully capitalised on her C quadrant regarding setting assignments and underscored her B quadrant by doing the homework and assessment tasks first in her school book. This also formed part of her own action learning process. With regard to our one-on-one sessions Octavia gave me clear instructions for what she wanted to focus on, such as Dropbox. I prepared a formalised (A quadrant) mentoring session, planned steps (B quadrant) to deliver the technical content after which we continued with the practical application (B quadrant) and explored different possibilities (D quadrant) of Dropbox.

Lana has an upper (cerebral) double dominant profile with the A and D quadrants as her primary thinking preferences. The planning for Lana's one-on-one peer mentoring sessions changed completely, since she did not want to continue with iPad training, but was still interested in continuing with Whole Brain® facilitating learning. Lana capitalises on her D quadrant and she moves quite easily through her A and D thinking modes, something that became apparent during the preliminary and semi-structured interviews. The challenge for both of us was to extend our thinking to the B quadrant and not to get distracted. Thus, my planning for Lana's one-on-one peer mentoring sessions was structured, organised (B quadrant) and I motivated her to integrate and talk about her experiences (C quadrant). One of the challenges I set for her, despite her apathy about the idea of the use of an iPad, was to organise a session where we explored (D quadrant) ExplainEverything through experimenting (D quadrant) and experiential learning (C and D quadrants). I observed that Lana responded very well to the session and she noted that it was an App that she would be able to use in her teaching practice.

Lana is a confident and self-assured Physical Science teacher. Without realising it, she has already done Whole Brain® facilitating learning to a lesser degree at Wilberforce High School; however, the classes that she facilitates for underprivileged learners on Saturdays ('Saturday teaching practice' is used in the rest of this study to refer to this particular teaching practice) are complete Whole Brain® facilitating learning. She has a natural aptitude to adapt and be innovative and by completing the HBDI® just showed her that she was able to think in a Whole Brain® way, using her primary thinking preference to the maximum by being innovative and constructing experiential activities (C and D quadrant) that could be done with very few resources while still facilitating learning of difficult

constructs (A quadrant) in Physical Science so that the learners could comprehend.

Herrmann (1995:248) states that expanding one's preference might be easier for some than for others. Lana is an example of a right-mode thinker who found it very difficult to function in the left-mode thinking style at school level, especially in Physical Science. Despite this and the way in which her Science teacher misunderstood her, she accepted the challenge and decided to continue her studies in Science, the subject that she was told she had no talent for. A further interesting observation that was made during the professional development programme with Lana is that, contrary to the norm, she expanded left-mode thinking style, whereas generally, according to Herrmann (1995:248) right-mode people find it more challenging than left-mode thinkers to expand their thinking styles. Since Lana has an upper double thinking preference she might, as stated by De Boer et al. (2013:7), experience internal conflict between the A and D primary quadrants; however, it also makes it easier to be more flexible in the two different styles.

In contrast to Lana's experience, Helena is a left-mode thinker with her highest thinking preference falling in the A quadrant. She is 'quite astute' (Herrmann 1995:248) to change and consciously states that she cannot be creative. My motivation was to introduce ideas that Helena would be comfortable with and suggest ways in which she would be able to accommodate D and C quadrant thinking styles. A more in-depth analysis and reflection regarding all the professionals follows in the next section, 4.3.6.

Table 30 is an adaptation of the Communication Walk-Around Exercise by Herrmann (1996:119) and Whole Brain® learning and design considerations (1995:419). The purpose of the

Communication Walk-Around process is to determine to what extent a learning task is designed using the thinking preference. Herrmann's (1996:120) walk-around process ensures that one uses forms of communication that incorporate each quadrant. The professionals could use this adaptation that I used in designing and planning Whole Brain® facilitating of learning in their own teaching practice when designing learning tasks. It could be adapted to suit their teaching practices. When I planned the workshops and one-on-one peer mentoring sessions I would consider the questions within each quadrant to evaluate to what extent I accommodated a certain quadrant or to what extent an App could be utilised within a specific quadrant. Bearing this in mind I would facilitate learning and the professionals had to evaluate to what extent the Apps and the new knowledge about technology or software would add to transforming their teaching practices.

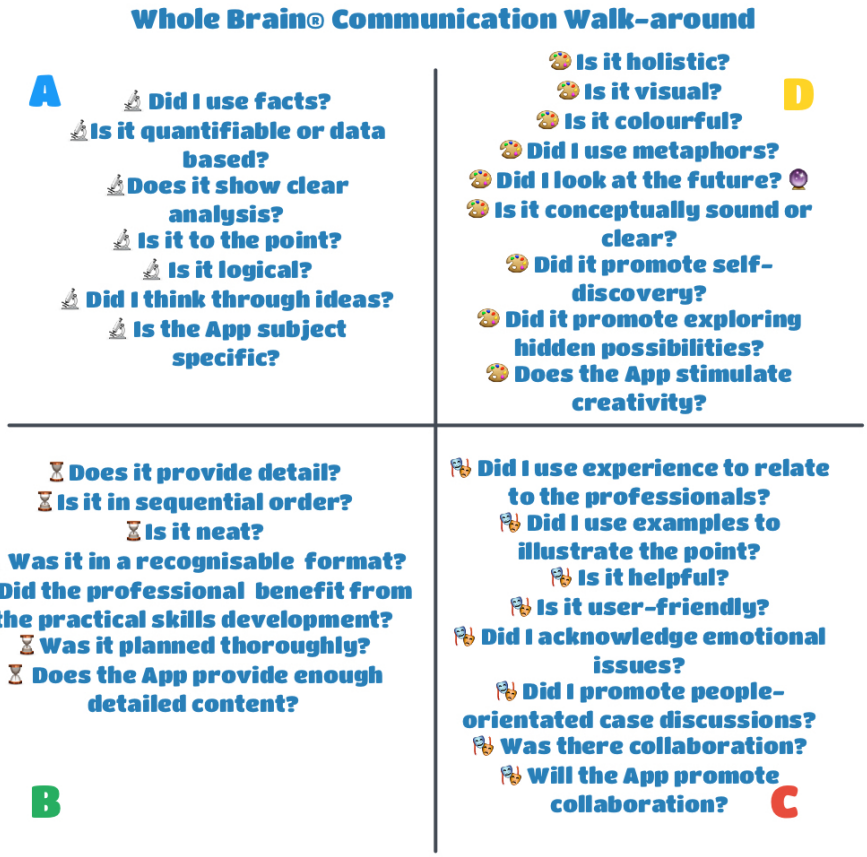


Table 30: An adaptation of the Communication Walk-Around Exercise by Herrmann (1996:119) and Whole Brain® learning and design considerations (1995:419)

After analysing and reflecting on the sets of data it became clear that becoming a Whole Brain® teacher was not necessarily an easy accomplishment for all the professionals, although they did show a key element, enthusiasm, to learn more and to take responsibility for their own learning, becoming self-regulated and exploring Apps and planning to become more flexible in their thinking preferences to accommodate learners with different thinking preferences and prepare to facilitate Whole Brain® learning. Together we formed a Whole Brain® community of practice and represented a variety of learning areas. In our community of practice there were professionals who formed part of the same department, forming their own community of practice focusing on a specific learning area, for example Brynhildr and Kypris in the Mathematics department and Octavia, Helena and Lana within the Physical Sciences and Natural Sciences department as well as Alexander and myself in the History department.

4.3.6 Analysing and reflecting on the professional development programme

The initial planning for this study seemed straightforward and although I realised that some dilemmas might arise, nothing prepared me for the escalation of the challenges that were raining down on me like Lyndon B. Johnson's Operation Rolling Thunder. The challenge was to become flexible enough and focus on using my less preferred B quadrant (as mentioned in the previous section) to address the issues that arose, one by one, analyse the dilemma, envision a solution, act and apply it and evaluate and reflect on the outcome. The different dilemmas later literally made me see De Boer et al.'s (2013:88-89) cyclic action research model as a series of tornadoes postulating more questions to emerge, therefore more innovation and new ways to find solutions. The cyclic Action

Research model underpins every aspect of this study and indeed there was a shift in focus during the Action Research and I had to reformulate my initial vision. Matters that led to more de-routing cycles were the change of professionals, misunderstandings regarding the integration of iPads, time constraints, over-estimated expectations, technological frustrations and the straw that nearly broke the camel's back, Wilberforce High School made a policy change. However, since this study followed an asset-based approach, I had to ensure finding constructive solutions to the dilemmas and I had to take up my role as peer mentor and empathise with the professionals' frustrations, but also motivate them to continue with their own self-regulated learning.

Firstly, the ICT professionals at Wilberforce High School were given an iPad with the understanding that it was their property and they would become part of the 'ICT champions' to take the lead in the initiative of using iPads with the idea that they would later take up the role of becoming mentees to the other people within their departments. However, the iPads were given on loan from the organisation that was contracted by Wilberforce High School. A few professionals created their own Apple IDs and started to download software. Some of the professionals (including a few members of staff who initially wanted to be part of this study) gave the iPads back and showed no more interest in the initiative after it had become apparent that there was a misunderstanding between the management of Wilberforce High School and the organisation that provided the iPads. The iPads were actually on loan only to the staff members until they felt comfortable enough to buy their own devices from the company.

Some professionals understood this initial miscommunication or *rashōmon effect*[7] (Akutagawa 2006) and they wanted to stay part of the ICT professional development program. Another dilemma emerged (after the fieldwork commenced) when the iPads had to be returned quite unexpectedly at the end of 2014. The professionals were given the option of buying a new device. One professional (Alexander) opted for this option. This was quite concerning since one of the research questions for this study investigated to what extent the professionals could use technology to facilitate Whole Brain® learning.

Secondly, there was uncertainty as to when the professional development programme would take place. Initially I planned a series of workshops of about an hour duration. The concept was to encourage collaboration between the professionals so that we could come up with innovative ideas of how to facilitate Whole Brain® learning. Many internal changes occurred, leading to an increase in workload for the professionals. Thus, less time was available to have these workshops. The time that was set aside by the ICT coordinator for the ICT professional program was only for 'basic iPad training' and I was not permitted to apply Whole Brain® facilitating learning during these sessions. It made my task to establish a community of Whole Brain® practitioners considerably difficult. Thus I had to go back to the drawing board and find an innovative solution. Since it was too difficult to find a time slot to get all the professionals together, I initially thought that even if I could see for instance two professionals simultaneously we would be able to have technical, organisational, people-oriented or future

[7] The rashōmon effect is the different interpretations that each individual might have regarding an event. In the case of Wilberforce High School there was confusion regarding how and why the professionals were selected; then the complete misunderstanding of the iPads leading to some dismay and a loss of valuable professionals who would have added to the community of practice and constructing knowledge from their multiple realities.

oriented discussions. However, as Murphy's law would have it, even trying to find a time to meet two professionals was difficult.

Back to the drawing board again and I decided to have one-on-one peer mentoring sessions and we would then discuss technical, organisational, people-oriented and future-oriented issues regarding the implementation of Whole Brain® facilitating of learning and to what extent the iPad can help to facilitate Whole Brain® learning. The one-on-one peer mentoring sessions actually worked very well and I feel that I actually benefited much more as opposed to just being a facilitator of a bigger group. I was able to engage in the learning during the learning sessions, thus through the cooperative inquiry both the professionals' and my knowledge was, as postulated by Gravett (2005:41), 'in a reciprocal unity'. Thus I became part of the learning and as stated by Winter and Munn-Giddings (2001:19) during the constructs of collaboration and Action Research the facilitator (me) is also a learner.

Thirdly, the challenge that I experienced in my mentee practice was the initial one-way communication. I had to understand that due to the increase in workload, more work pressure and personal pressures experienced by the professionals they could not always respond to lengthy emails. The form of communication had to be simplified and instant. I then established a WhatsApp group, promoting collaboration by sending information to the professionals. This was a platform where I could send out a message if I saw an interesting App that might benefit our community of practice. However, this form of communication was used not only to provide me with a stage to communicate, but also for the professionals to take up their role as professional learners and actively participate in technical discussion. The WhatsApp group also became a platform for technical support.

The fourth challenge that was experienced was technical difficulty. Many of the professionals became frustrated with the lagging behind of technology at Wilberforce High School. Technical problems included weak or no Wi-Fi connection, a lack of funding to buy connectors or an App to connect the iPad to the digital projectors and a lack of funding for the professionals to buy Apps that they could use in their teaching practices. Initially I regarded this as an 'outside context problem.' [8] However, I initiated temporary solutions; for example, I bought another iPad to download Apps that might be useful for professional development and to facilitate Whole Brain® learning. With regard to the Wi-Fi, I was perplexed. Thankfully I managed to buy a mobile Wi-Fi device as an option to use during the one-on-one peer mentoring sessions.

Lastly, one of the prevalent challenges that we all had to face was the change in school policy. It affected everyone and it meant a complete restructuring of every teacher's teaching practice. I was concerned as to what impact the policy change would have on the professional development programme. It was my role as mentor to continue motivating the professionals and to adapt the professional development programme to accommodate the change in policy in accordance with the asset-based approach postulated earlier in this study. All the professionals remained part of the professional development programme and they were self-directed; we had established a community of practice as 'professional friends' supporting one another through all the dilemmas emerging.

[8] An outside context problem is, for example, when the Spanish encountered the Aztecs and annihilated them due to the superiority of their weapons (Toledo swords and armour), war dogs, horses and well-trained mounted conquistadors that could dismember approximately seven native people within a minute. An outside context problem usually refers to a society that has superior technology and conquers another society that has so-called 'inferior' weapons and is unable to defend itself.

4.3.6.1 Analysing the feedback from the observations sheets and reflecting on my mentorship practice

The Ethics Committee of the University of Pretoria cleared the instrument that I designed to obtain feedback from the professionals. I did, however, realise while I was doing the analysis and final write up of this study that the instrument must be redesigned and simplified. The instrument included quantitative and qualitative questions; however, due to a misinterpretation by some of the professionals regarding the quantitative evaluation of my mentorship practice, I could use only the qualitative data from this instrument to reflect upon my mentorship practice.

When I handed out the observation sheet I briefly explained how to complete it and informed the professionals that they might complete it anonymously; however, none of the professionals chose this option. Three professionals misunderstood the quantitative parts of the instrument. Two professionals lost their original forms and completed the observation form again and this might have led to a deviation from their original feedback. Two professionals collaborated and completed the question regarding what they had discovered during the workshops or one-on-one mentoring sessions. The two other professionals (Lana and Helena) who could have collaborated because they are part of the same department could not find time to meet and discuss the matter.

Thus I had identified a few problems with this instrument and it made it challenging to analyse. Therefore I took the sections that had been filled in correctly to obtain greater insight into my role as mentor and to reflect on my mentorship practice.

Kypris and Brynhildr collaborated and reflected on my professional practice. Kypris felt that I had reached most of the learning outcomes while facilitating the Whole Brain® learning one-on-one mentoring sessions. She commented that it 'Provided a better understanding of my brain type and that being one [referring to a particular thinking preference] doesn't exclude the other.'

Kypris and Brynhildr brainstormed some of the main ideas that they had discovered during the workshops and one-on-one mentoring sessions. They both realised that they needed to equip themselves as best as possible to take the different thinking preferences of their learners into account. They also noted that they should relate what they *teach* (construct used by the professionals) to real-life situations. The aforementioned conclusion underpins what I have observed and analysed during the preliminary (See 4.3.3) and semi-structured (See 4.3.8) interviews. Kypris and Brynhildr realised that they had similar objectives of accommodating learners with different thinking styles.

Kypris requested that I should continue with my ICT professional development program to support her with regard to 'using technology to help different styles of learning,' underpinning her objective to continue her professional development forming part of her lifelong learning.

As general feedback Kypris stated 'Appreciate that you take the time to help us improve our teaching by developing different things.' I found this comment very encouraging and it motivated me to be more innovative so that we could collaborate more and explore more possibilities for incorporating Whole Brain® facilitating of learning.

Alexander was the first professional to hand his observation sheet back, illustrating the capitalisation on his B quadrant preference. He made the following request: 'I would suggest that willing professionals share some strategies they use, or feel could work well, to incorporate Herrmann's Whole Brain® model in their teaching'. This underpins one of the outcomes of my study, the establishment of a Whole Brain® community of practice. One of the characteristics of Action Research is that there is a continuation of innovation and it promotes transformative learning. Being aware of Alexander's request for collaboration suggested that there is a need for establishing a Whole Brain® community of practice, especially if I recall the challenges that Alexander, Heidi, Octavia and Lana experienced (See 4.3.8.4).

Alexander stipulated that some of the discoveries that he had made during the workshops and one-on-one mentoring sessions were to design projects that accommodate the different thinking preferences. He was able to include sections that would appeal to the different thinking preferences. Another discovery that Alexander made was to pair learners with diverse thinking preferences together to complete a task. From the aforementioned comments I can deduce that he had taken up the role of transforming his teaching practice and he became flexible in his thinking preference; he had the desire to continue to become more flexible, collaborate and to become a lifelong learner.

Under the general feedback he wrote the following comment: 'The workshops and one-on-one sessions have been enlightening – with lots of insight gained or brought forth. I think follow-up workshops, where ideas on the incorporation of the Whole Brain® teaching model are shared in various subjects, would be helpful'.

Once again Alexander underscored some of the main objectives of this Action Research study to establish a Whole Brain® community of practice where we would work collaboratively to share ideas in order to transform our teaching practice and to accommodate learners with different thinking preferences and ultimately become Whole Brain® thinkers ourselves.

Heidi stipulated that she had no requests or suggestions for the next one-on-one peer mentorship session. Under general feedback she stated: 'Training is interesting and a lot of effort is taken to help us'. I could not deduce much from this narrative and I had to change the observation sheet to probe this matter again.

Octavia was the second professional to hand her observation sheet back. She commented that she had to ask for clarification as to what was needed in answering the questions of the observation sheet. Her statement underscored the deviation of this instrument and pointed out that I had to simplify it or use a different method to produce a more in-depth response.

Octavia made three comments regarding my one-on-one peer mentorship sessions. Firstly, she stated that she '[has] had some wonderful new ideas how to incorporate more visual effect and even dance into my lesson.' From the aforementioned I deduced that Octavia had taken up the role and responsibility to suggest innovative ideas to transform her teaching practice. Secondly, she stated that 'Thersia's suggestion for making elemental superheroes' referred to one of our exploratory (D quadrant) one-on-one peer mentoring sessions. I found that the last five sessions that I facilitated before the analysis and write up of this study started were very productive and we were moving towards developing and creating a Whole Brain® community of practice. Thirdly, under

general feedback, Octavia stated, 'Very interesting. Found the chart listing descriptors of all the quadrants, skills, typical phrases used very informative and will help to accommodate my learners.' In correlation with the Whole Brain® descriptor chart I designed a class list (See exemplar Appendix IV) that the professionals could use during their classroom observations and allocate a descriptor to a learner to obtain a better understanding of his or her thinking preference.

After reflecting on Octavia's statement I wanted to promote more collaboration for exploring innovative possibilities to transform the professionals' teaching practices and my mentorship practice and teaching practice. I wanted to introduce Herrmann's (1996:129) different stages of process storming (See Figure 32 page 220) more prominently in my mentorship practice to build upon the brainstorming that we had done during the exploratory one-on-one peer mentoring sessions.

Lana stated, 'I feel I have been a Whole Brain® teacher for longer than I taught. This was confirmed by workshops'. Although she stated that she found the incorporation of Apps into her lessons challenging, she stipulated in the observation sheet that 'the one App that made visual flow diagrams' was interesting. The App that Lana referred to is ExplainEverything. What is quite interesting is that we had our on-on-one peer mentoring session and I quickly showed her the App just for interest's sake after I had had a very successful one-on-one peer mentoring session with Helena, Lana's colleague in Physical Science. Lana and I capitalised on our C and D quadrant thinking preferences by exploring the possible applications for innovative facilitating of learning further by doing two more one-one-one peer mentoring sessions on ExplainEverything.

The main ideas that Lana discovered during the workshops and one-on-one peer mentoring sessions were, 'I learnt that I am in a unique position to facilitate learning to learners that fall within all the quadrants as I am a Whole Brain® thinker to start with'.

Designing the facilitating of learning for Lana challenged me in the sense that I was the pedagogical ICT program facilitator. As mentioned earlier in this study, Lana decided to not be part of the ICT professional development program since she felt that she needed only the Whiteboard and Whiteboard marker to facilitate learning. Fortunately she showed an interest in Whole Brain® facilitating of learning; therefore our one-on-one peer mentoring sessions created another cycle in my Action Research investigation.

Feedback that I received from Helena noted that she 'started to implement Whole Brain® teaching. Still a lot to learn'. Helena showed initiative by joining this study. Initially she had inhibitions about her own capabilities of flexibility of thinking; however, a year later it was evident that Helena took up her role and responsibility to be an innovative and professional self-regulated learner, transforming her teaching practice and contributing extensively in the WhatsApp Whole Brain® peer mentoring group.

As mentioned earlier, Brynhildr and Kypris collaborated and reflected on the workshops and one-on-one peer mentoring sessions. For the question stipulating my facilitating of Whole Brain® professional development Brynhildr indicated that 'it was motivational. More understanding of my brain type and how to embrace other brain types'. Although Brynhildr is a self-motivated and professional self-regulated learner she wanted to be part of the ICT professional development program – an indication that she is a lifelong learner. She noted that she found the incorporation of

technology difficult. I find this comment quite interesting, since Brynhildr is one of a few teachers at Wilberforce High School who fully embrace technology in her class.

In the semi-structured interview it came to light that she had been sending emails since the start of email as a form of communication. A few years ago she took the initiative to collaborate with Wilberforce High School's 'technical guru'[9] to mentor her to become more proficient in the use of technology. In one of our one-on-one peer mentoring sessions Brynhildr asked for assistance to buy an album from iTunes. She explored the different possibilities and was eager to go home and explore the iTunes store further. With very little facilitation and support, Brynhildr used her logic (A quadrant) to set up an Apple ID and buy a record. From this mentoring session I could deduce that she was flexible in her thinking preference since she loved music (C quadrant) and having access to iTunes opened up a wider variety of songs she had struggled to find in a music store.

Brynhildr requested that at our follow-up one-on-one peer mentoring sessions she wanted the focus to be on 'using technology to incorporate different brain profiles'. Therefore I suggested that we should look if there would be a possibility to find a time when Brynhildr, Kypris and I could meet so that we could explore together how to incorporate iPad technology to accommodate different thinking preferences. If one looks at Kypris's HBDI® preference code 1211 and compares it to Brynhildr's HBDI® preference code 1221 and my HBDI® preference code 1211 one becomes aware of our preferred thinking preferences and we

[9] Due to ethical considerations I cannot divulge the identity of the 'technical guru.' She is well respected at Wilberforce High School and has a wealth of knowledge regarding computer literacy.

explored different ways to accommodate thinking preferences that were not aligned with our own. In the continuation of my Action Research professional development programme I am going to explore Herrmann's (1996:129) process storming (See Figure 32 page 220) in more detail and I am making the assumption that the introduction of a Whole Brain® Walk-Around for Brynhildr and Kypris would promote creativity. Both of them already use more visual instructional media and software that they run from their SmartBoard and the next step is to be ready when the iPads are rolled out at Wilberforce High School.

Herrmann (1996:128) argues that knowing one's thinking style provides the opportunity for a heterogeneous community of practice (Herrmann uses the construct *team;* however, for the purpose of this study I use *community of practice*) that has the possibility of being innovative and creative. Herrmann (1996:129) adds that characteristic of a high-performance community of practice is to capitalise on more than one creative process with regard to a particular 'problem situation' (the construct *problem situation* will be replaced by *asset-based identification)* (Du Toit 2009). The process is similar to brainstorming except that not only the D quadrant thinking preference is used but also multiple processes, namely process storming. Herrmann (1996:129) postulates that using the process storming creative strategy would generate a greater number of ideas than using a single process. Thus, the next cycle in my Action Research spiral had begun and I made the assumption that it would underpin my one objective of creating a Whole Brain® community of practice. Figure 32 is an adaptation of Herrmann's process storming of multiple thinking styles and Du Toit's asset-based approach to envision transformation.

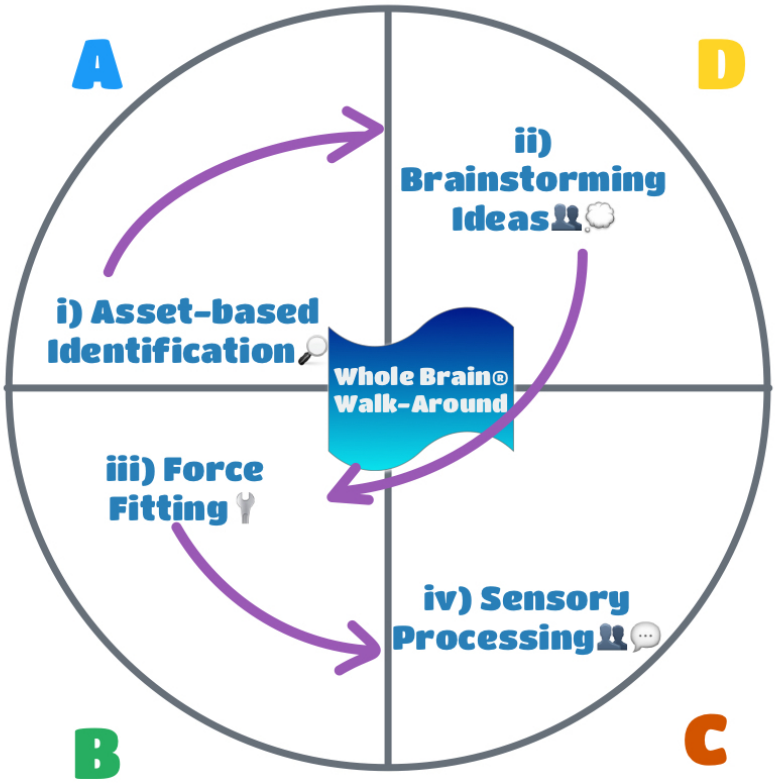


Figure 32: An adaptation of Herrmann's (1996:129) process storming and Du Toit's (2009) asset-based approach

During Brynhildr and Kypris's brainstorming session where they reflected on what they had discovered during the ICT professional development program, Brynhildr noted that 'we realise, more than ever, we must equip ourselves to incorporate the different learning styles'. This remark underscores the fact that my mentorship practice was true to the characteristics of Action Research and that it would continue even after the completion of this study. Brynhildr and Kypris commented that the one-on-one peer mentoring sessions made them come to the 'realisation that preparation for lessons is important'. This does not imply that they had not prepared before; I assumed it meant that they were more aware of the different thinking styles and they would have to become more flexible in their own thinking style to accommodate the thinking preferences that were different from their own. During the semi-structured interview it emerged that Brynhildr felt that she could be

more flexible and accommodate different thinking styles; however, that would mean thorough preparation.

The last statement that was made was to 'keep on learning when it comes to technology'. Brynhildr and Kypris took up the responsibility for their own learning when they decided to be part of the ICT professional development program. They also wanted to be part of this study, indicating that they wanted to take up the role of transforming their teaching practices. Both Brynhildr and Kypris are lifelong learners who capitalise, as mentioned by Mezirow (2003:58) on transformative learning.

Consequently the road so far indicated that my Action Research was a continuing cycle with new cycles emerging from the original action. Reflecting on the 'tornado' metaphor stated earlier, I had come to the realisation that if I became more flexible in my least preferred B quadrant I would be able to delineate and structure the new cycles and plan for future interventions. Figure 33 (page 223) is a representation of my Action Research process based on Du Toit's (2009) visionary action research model. I used Du Toit's (2009) visionary action research model to show how the professionals' action learning process proceeded during this study (See 4.3.8.2). The context is Wilberforce High School where I envisioned starting a professional development programme. I planned the first initial stages; however, I soon had to change the original facilitating Whole Brain® learning plan when I was appointed as the pedagogical facilitator of the ICT program. Therefore a new cycle started in my professional development Action Research model and I had to incorporate the use of an iPad with Whole Brain® facilitating learning.

Lana indicated in the professional development Action Research programme to leave the ICT context early during the fieldwork; however, she remained part of the Whole Brain® facilitating learning study. During the semi-structured interviews it became apparent that Lana felt stagnant and after probing further by asking a follow-up question, it was determined that Lana's Saturday teaching practice was actually the platform where she was a Whole Brain® teacher. She felt a sense of freedom on Saturdays as her teaching practice was freer and accommodated all the different thinking styles. Thus, in Figure 33 (page 223) Lana's action learning cycle has another cycle emerging representing her Saturday teaching practice where she also did formal reflection as part of her action learning. Two professionals are illustrated symbolising the six volunteer professionals indicating their action learning cycles and how they took up their role to facilitate innovative learning tasks (See 4.3.7) in their teaching practices. Lana's Action learning cycle started quite early in the peer mentoring fieldwork, thus she is indicated separately from the other professionals.

During the Action Research I started to collaborate with teachers from another private school. Thus a new spiral emerged where we shared innovative ideas and commented on one another's designing of tasks and transforming our teaching practices. I am also continuing to transform my teaching practice, an overview of my teaching practice will be discussed in Chapter 6 under 6.1.1 Back ⏮ t^1. Furthermore, I have incorporated the Whole Brain® community of practice as a separate spiral emerging from the original action research spiral. Lastly the continuation of transforming my professional practice offers new possibilities in my Action Research paradigm.

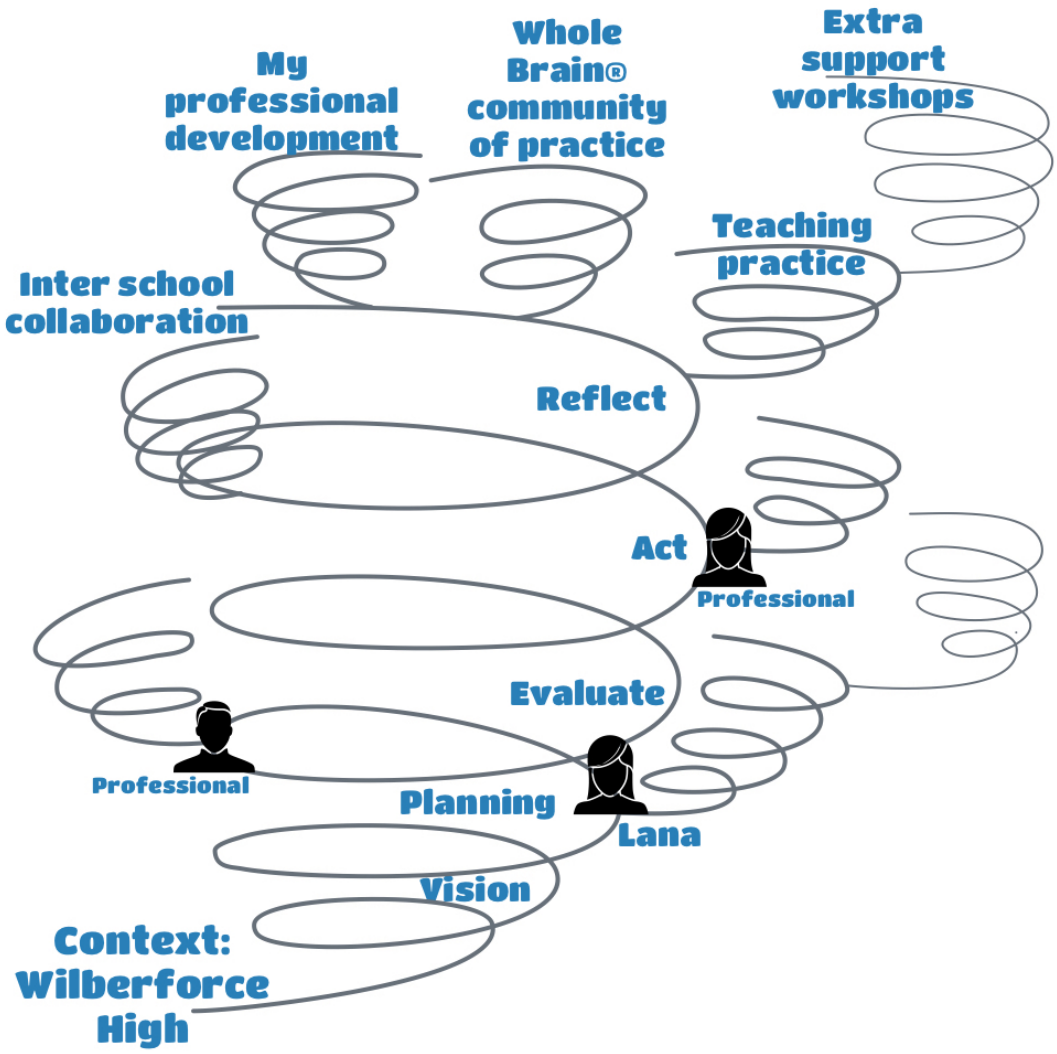


Figure 33: My Action Research process adapted from Du Toit (2009)

4.3.7 Exploring the possibilities of Whole Brain® flexibility

Herrmann (1996:195) describes 'metaphoric modelling' as a technique where an organisation uses a metaphor through creative materials to construct a company. I suggested that each professional should envision what his or her ideal teaching practice would be like. We would frequently come back to this point during

the one-on-one mentoring sessions. It also reflected my primary thinking preference (D quadrant) and the requisite rather to be more idealistic and optimistic and to maintain a positive and reassuring approach in my mentorship practice.

Kypris took up her role as professional learner and she wanted to take responsibility and capitalise in a self-regulated way to become more familiar with the capabilities of an iPad. She showed interest in Herrmann's Whole Brain® thinking and noted that she had to become more aware of technology and be able to accommodate learners with different thinking preferences in her teaching practice. Our first few sessions familiarised her with the device; thus we had technical discussions (A quadrant) and the learning was structured (B quadrant). From the preliminary interview and the teaching practice observation I deduced that she would be more comfortable to start working in these two thinking preferences; therefore I had to be flexible and extend my thinking, especially in the B quadrant.

In one of the workshops that I facilitated I observed that Kypris worked very well collaboratively. She worked with Heidi and together they explored and practised in a sequential (B quadrant) manner the uses of Pages. Kypris was more confident after the workshop and she actually started to use her iPad to take minutes during the grade meetings and learning area meetings. This was a big step for her. On several occasions she told me that she was not technologically knowledgeable; however, she needed to motivate herself to become more confident because she wanted to be able to accommodate the learners. During the last six months' sessions we were more exploratory and experiential and we shared ideas (C and D quadrant). We were also fortunate enough to have a few longer sessions and we could focus on the practical side of practising skills (B quadrant) necessary to make use of the Apps for administrative

purposes but also as a way of accommodating Whole Brain® facilitating learning. Although Kypris's primary thinking preference was in the A quadrant, her D quadrant thinking preference was also one of her preferred thinking styles. The latter came as a surprise to me, because I did not observe that she fully capitalised on her D quadrant thinking preference during the teaching practice observation. However, since she had a preference in the D quadrant it was easier for me to accommodate her in the professional development programme and to introduce flexibility.

In May 2015 Kypris asked me to have a practical session. She had an idea for a presentation, but she wanted to make it more appealing to the learners and she wanted to make sure that she incorporated the different thinking styles. She wanted to plan facilitating the learning of parabolas. She explained to me what it was, and I had to be flexible and extend my thinking preference into the A quadrant; however, I also needed to think of a way to explain the concept parabola so that learners that had different thinking styles could understand it. We looked at the guidelines for building a presentation. We used ExplainEverything. I told her that I wanted to know how it could be applied in real-life. We found a visual source that showed where one would find parabolas in a cone shape (See Appendix III). Immediately it made sense to me and I told her at a later stage after a one-on-one peer mentoring session with Brynhildr that the learners could be given an assignment – for example, to determine the parabolas of the Sydney Opera House or a Roman aqueduct. We explored the possibility of contextualising parabolas and explaining where the construct came from. Kypris also used the Golden Gate Bridge as an example (See Appendix III). Kypris was very wary of time constraints in Mathematics; therefore by being able to introduce more detail (B quadrant), telling the story (C quadrant) and providing visual and aesthetic

real-life examples (D quadrant) showcased her flexibility to accommodate thinking preferences that differed from hers.

Alexander attended the majority of the one-on-one peer mentoring sessions and most of the workshops that I presented. He took up his role in taking responsibility for his own learning and he is a supporter of lifelong learning. As mentioned earlier in this chapter, he is an avid reader and even the books that he reads are for enrichment and to educate himself further expanding his knowledge base. On average I facilitated more basic iPad professional development sessions with him than with any of the other candidates, due to Alexander's enthusiasm and passion for self-discovery. He is a self-regulated learner and he continues to explore new possibilities (D quadrant). He was comfortable during the practical skills development sessions and during the workshops he was completely self-regulated and did not collaborate with the other professionals. It does not mean that he did not capitalise on his primary C quadrant; it merely suggests that he is flexible in his thinking preference and moves from the C quadrant mode to the B quadrant mode to acquire the skills.

Alexander was also one of the first candidates that I introduced Whole Brain® learning to. One of his learning areas is Life Orientation; thus he was aware of Kolb's experimental learning and Gardner's multiple intelligences. He wanted to use Whole Brain® facilitating of learning in his teaching practice, but he also wanted to make the learners aware of their own thinking preferences. He had an idea to structure a Life Orientation research assignment (See Appendix V) for the learners to investigate their thinking styles. We organised a one-on-one peer mentoring session to brainstorm (D quadrant) some ideas in ExplainEverything. We started off with the Whole Brain® thinking preference model. The learners would be

given a checklist to reflect on a few descriptors in each thinking preference and in such a way obtain a general idea of what their thinking preference might be. After completing this assignment they had to research a career that was associated with their primary thinking preference. The research had to include a flow chart of the career, what it entailed and the estimated annual income. We were dabbling with the idea that learners should also find a person who was employed in the career that they investigated, be it a family member or a famous South African.

Then, to promote flexibility and challenge their primary thinking preference, they should also investigate a career that was not associated with their preferred thinking preference. Alexander set the assignment and when he reflected (Appendix VI), he stated that the learners found it challenging. An interim reflection resulted in Alexander having to envision a diverse way to simplify and synthesise (D quadrant) the assignments and go back to the basics (A quadrant). During the research phase of the assignment some learners found it difficult to reflect and determine which of the descriptors defined their thinking preference. Alexander constructed a questionnaire to accommodate these learners to obtain a better understanding of the left mode and right mode of thinking or Sperry's split-brain methodology and from there go back to the Herrmann Whole Brain® thinking preference model to determine where their preference was. Some of the learners responded well to the assignment and they were eager to engage with the challenge of research.

Heidi is a self-regulated learner, with a passion for acquiring more knowledge for her professional development. She is innovative and capitalises on the use of her primary D quadrant thinking style. During our one-on-one mentorship sessions we did a lot of

exploring possibilities (D quadrant) and experiential opportunities (C and D quadrant). We explored ExplainEverything, Morpho Booth, Aurasma and a variety of German Apps. Heidi responded well to the German Apps, especially the ones where learners could participate. I even tested one of the Apps on a group of my learners who did not have German. They enjoyed it so much that they wanted to continue learning vocabulary. Heidi downloaded most of the Apps that I recommended; however, she was frustrated due to the fact that she was not able to utilise these Apps to facilitate learning because of the technological dilemma of an unreliable Wi-Fi connection as well as the financial constraints and that she was still waiting for a connector to her digital projector after nearly a year. Regardless the aforementioned factors, Heidi wanted to continue the sessions so that she could start to plan and explore the possibilities of the iPad as teaching tool for the future (D quadrant).

Heidi wanted to bring animation into her learning opportunities to explain the terminology better. I suggested the use of Morfo Booth and App Smash (coined by Greg Kulowiec), the animation with Aurasma. App Smashing is when one combines two or more Apps. In Morpho Booth one can either take a photograph or select a photograph or picture from one's camera roll. Morpho allows one to superimpose a mouth and eyes onto the photograph or picture. One can then record one's own normal voice or in a high pitch or low pitch. The App then synchronises one's voice with the lips. One can import the animation into Aurasma. Aurasma is an App for augmented reality. In education it is used to take screenshots of, for example, a picture of the Red Baron in a classroom. The teacher can then make an animation in Morpho Booth and superimpose the animation on the picture of the Red Baron or Rammstein[10] (See

[10] Rammstein is a German Industrial Metal band.

Appendix VII). When the learners follow the teacher's Aurasma thread, their iPads recognise the trigger image of the Red Baron or Rammstein and the animation pops up and provides further information. Similarly one can link videos, speeches, songs or other images to the trigger image. Heidi was the only professional who envisioned how she would be able to use these in her teaching practice. Unfortunately we were not able to explore the possibilities of augmented reality experiences fully since the iPad roll out was not yet in place.

As mentioned earlier in this chapter Octavia joined the professional development programme at a later stage; however, she is a diligent and self-discovery (D quadrant) learner. Furthermore she is self-regulated and accepted the role of taking responsibility for her own learning and quickly caught up with the rest of the community of practice. The time allocation of the one-on-one mentorship sessions was a challenge. Both of us teach during the same blocks and our afternoon duties also clash. Therefore we actually decided to meet each other before school and on two occasions we met after school. We did much basic iPad professional development and I had to extend my flexibility to accommodate Octavia's more dominant B quadrant in the sense of thorough planning and being flexible to extend to the A quadrant to apply logic and to be able to lead a technical discussion. We had experiential opportunities and Octavia responded positively to the spontaneity (D quadrant) of the sessions. She also enjoyed the playfulness (D quadrant) of the sessions. We brainstormed a few innovative ways to engage the different thinking styles and she stated how she would provide the learners with a periodic table and then give them a story to read with missing words. The missing words represented elements on the periodic table. I suggested that she could develop an assignment where the learners should design superheroes that

represent the elements and invent a story around them. Octavia liked the idea and she was going to formulate it as an assignment.

Lana was selected for the ICT professional development program; however, she had strong opinions about the use of technology (as mentioned earlier in this chapter) and thus declined to stay part of the ICT community of practice. She did, however, want to know more about Whole Brain® facilitating of learning. Although our thinking preferences were very similar, my challenge was to be flexible and introduce ideas of flexibility to Lana so that she might be able to apply it in her own teaching practice. She was, however, very concerned about time constraints and the pressure that was placed on the learners and the teachers to obtain high academic results. I observed that this dilemma actually repressed Lana's spontaneity. Initially I could identify with her facilitating of learning regarding the use of key words, mind maps and flowcharts, since I made use of these tools as well. However, I did observe that she was definitely more flexible in the A and B quadrant to facilitate learning in her teaching practice.

When Helena volunteered to be part of this study I was delighted because I knew that she would add to the A quadrant thinking preference of our Whole Brain® community of practice. She took the role of taking responsibility for her own learning and together we had mirror image thinking preferences. The challenge for me was to present the one-on-one mentorship sessions in such a way that Helena would be comfortable and continue motivating her to become flexible in her least preferred quadrants, the D and C quadrant to accommodate learners who had these thinking preferences. From the teaching practice observation I noticed that she is flexible in the C quadrant, accommodating this thinking preference. She explained friction and illustrated the concept with a

box on a slanted platform. This action prompted group interaction (C quadrant) among the learners as well as a technical case discussion (A quadrant). I anticipated that if Helena could be flexible in the C quadrant she would be flexible in the D quadrant. During the first part of the one-on-one mentorship sessions we engaged in going back to the basics, thinking through ideas (A quadrant) and I had to become flexible and accommodate her in her B quadrant thinking preference. What would challenge Helena was to take part in free-flow and spontaneous activities. She was reluctant regarding her own capabilities of becoming flexible to be creative; however, I had already observed that she was able to be flexible and I proposed to take up my role as facilitator to motivate her in this regard. One of our first innovative moments was when we looked at creating a mind map (Appendix VIII).

I claimed that a mind map would accommodate D quadrant thinkers in the sense that it provides a holistic view of the theoretical construct. We explored several Apps, for example iThoughts, Popplet and iMindMap that can be used to create a mind map. Helena took up the role of reflecting (See Appendix IX) on her own teaching practice and she did so by writing notes on her SmartBoard, evaluating how effective the learning to construct knowledge had been for the learners. She evaluated what worked and what did not work and from there planned a new and innovative way of facilitating learning. During one of our last one-on-one mentoring sessions we engaged in a discourse on how to expand flexibility to our least preferred quadrants. Helena gave me an example of a mind map that she drew during her reflection on facilitating learning in acids and bases. This was our *Eureka* moment. Helena is confident and she became flexible, thinking in a holistic manner, synthesising the content, thereby accommodating the D quadrant. We brainstormed some ideas and I suggested that

we could adapt the mind maps to accommodate each thinking preference.

I described the fact that for someone with a thinking preference similar to mine there needed to be visual sources to enhance association. For example, with the reactions of acids and metals I recommended linking them to a contemporary Heavy Metal band and that the learners could be given an assignment to write a song for the band that would incorporate the theory of acids and metals. Helena is a self-regulated learner and she has taken the responsibility to become a lifelong learner and continue learning and exploring new possibilities (D quadrant) to transform her teaching practice. During a one-on-one peer mentoring session in August 2015 Helena was excited to show me an App with wiggling molecules that she had found. She stated that this would accommodate the D quadrant thinking preference since the App does have a flair of playfulness to it. One can turn the molecules, enlarge or rotate them. It would also accommodate the C quadrant thinking preference because of the movement, and if learners were to engage with the App it would stimulate sensory movement. She would also be able to project the App on her SmartBoard using AirServer and control the movement from her iPad.

Brynhildr's thinking preference and my thinking preference were completely different. I was delighted when she indicated that she also wanted to be part of my study and I knew that it would challenge me to be more flexible and become more dominant in thought in the A quadrant, and especially in the B quadrant. Brynhildr's excitement regarding the ICT professional development program was clear from the start. She took up the role and responsibility of being a self-regulated learner and of lifelong learner who liked to keep up with new technological trends. She

was probably one of the most enthusiastic scholars regarding the utilisation of the iPad.

My colleague and coordinator of the ICT professional development program facilitated the 'basic training' in using the basic features of the iPad. One of her first workshops included the use of a calendar and how to synchronise it with Google calendar and with one's devices. Brynhildr capitalised on her B quadrant thinking preference (it is her third best preference) to plan and organise her time. She was very diligent and the only professional who made use of Google calendar when we decided on a time for a one-on-one mentoring session. As discussed earlier in this chapter, Brynhildr was flexible and expanded her thinking preference to the B quadrant (time limit), D quadrant (exploring) through the experiential opportunity (C and D quadrant) of engaging in an advanced Mathematics quiz. Consequently she enjoyed the assignment so much that we were quite late for our morning meeting because we reflected on the experience while walking to the meeting and could not stop laughing at the challenge of the experience, especially regarding the time limit before the App makes a sound and one has to move to the next problem.

Brynhildr expanded her thinking to the D quadrant; although it is her secondary thinking preference she did not fully capitalise on it during her facilitating of learning. One of the first and foremost reasons was time constraints and because the expectations were high to ensure good results. We did, however, at one of our recent one-on-one mentoring sessions, brainstorm a few ideas regarding Pythagoras. I suggested the use of visual images and showed her what Kypris and I had explored during our one-on-one mentoring session. Brynhildr liked the idea and started to plan how she would implement it in her facilitating of learning. Although she did not

respond in the same way as Kypris regarding the 'story' (C quadrant) behind Pythagoras, she was flexible in her thinking preference to acknowledge the value of association and how it would promote Whole Brain® learning. We also discussed how learners might use real-life examples and she wanted to see what type of examples there were. I showed her examples of a parabola bridge that had graph paper superimposed on it to help candidates to measure it. She was very positive about the idea and wondered if there was an App that she could use to superimpose a graph on architectural parabolas that she could find. We found the Notepad+ App that included a variety of graph papers. Due to Wi-Fi problems she was not able to download the App. For Brynhildr making use of more visual sources in her teaching practice indicated her flexibility and she took up the role of taking the initial steps to become a Whole Brain® facilitator of learning.

Reflecting on the fieldwork I realised that it underpinned the characteristics of Action Research. There is no *alpha* and *omega* regarding this study. I did have a vision in the context of Wilberforce High School and assumed that there would be de-routing cycles emerging from the fieldwork. However, I did not anticipate so many de-routing cycles to emerge. I found it challenging and I am looking forward to continuing the professional development programme and to incorporating more scholars into our Whole Brain® community of practice.

4.3.7.1 Whole Brain® learning tasks in my own teaching practice

I have applied Ned Herrmann's Whole Brain® thinking in my own teaching practice ever since I completed the PGCHE course. Being in a more flexible environment than in my previous employment, I

am able to be more flexible in my teaching practice, but more so in my extra support workshops. Although time constraints are a factor, I allocate time for a variety of activities and assignments for each section. My teaching practice is part of my living theory of practice underpinning my Action Research model (See Figure 33 page 223). Therefore the quality of my teaching practice adds to the qualitative data of this study and provides a deeper understanding of my Action Research model as a whole and how I capitalise on my preferred thinking preferences to be innovative and transform my teaching practice. As stated in Chapter 1, McNiff and Whitehead (2009:15) describe Action Research as 'living theories practice' constructing meaning of one's practice and providing 'real-life explanations'.

During the course of a topic that I facilitate, for example Aboriginal people of Australia (See Table 31 page 241) I have some set tasks to accommodate the different thinking styles. The first lesson consists of a word search (A quadrant and B quadrant). The objective of the word search is to give the learners a certain time to complete the word search. They are timed and the first three learners to complete the word search are rewarded by receiving either Super C's, a lollipop or a chocolate. The Grade 8 and Grade 9 word searches are less complicated; the words' direction can cross over each other and can be either spelled forward or backward. From Grade 10 to Grade 12 the word searches are more complicated and I design them so that the words' directions can be forward, backward and in all directions using David Regan's ArmoredPenguin.com. The learners enjoy this activity very much and they love the competition and keep a record of their times to see if they can improve their previous time.

On a non-specific date and without warning learners come to the class and they have to write a pop quiz test (C and D quadrant). The pop quiz is usually set as a motivation test and to have some fun in the classroom. The learners are not allowed to collaborate, but sometimes they do. The answers are taken in and handed back randomly and marked by a peer. The answer sheets are returned. The objective is for learners to reflect on what they struggle with and where they need to focus.

The topic facilitating learning consists of a few components, slideshow presentations (A and B quadrant), a film or a video that is either a documentary (A and B quadrant) or an entertaining story about a person or event (C and D quadrant) with related music (C quadrant). Complementing the facilitating of learning are keywords (D quadrant) that are in chronological order (B quadrant) and during the extra support workshops learners fill in the definitions (A quadrant) for the keywords. A variety of notes are provided to the learners; digital notes (A and B quadrant) constituting of factual terminology, concrete Historical information, expert Historical sources with a logical layout (A quadrant). The digital notes include practical concrete examples, repetition and step-by-step (B quadrant) delineation of the cause and effect of a particular event. Supporting the digital notes are the slideshows that are basically a summary (D quadrant) of the content with visual (D quadrant) examples. YouTube videos or reference to music (C quadrant) is incorporated in the digital notes, usually with a link provided that the learners can use. Paper-based notes that incorporate extra reading and fact-based information (A quadrant), timelines, outlines of important events (B quadrant), synthesis of information, maps, photographs and cartoons (D quadrant) are also compiled. Workshop notes include keywords and a holistic synthesis of information (D quadrant) planned with activities that encourage

cooperative learning (C quadrant), for example discussing issues around the influx of refugees entering Europe.

Learners are encouraged to make their own summaries to construct meaning from the new knowledge. During the extra support workshop learners have to complete a time circle (B quadrant) to evaluate how they spend time and where they can incorporate learning; a few techniques by Buzan (2010) are discussed and in each instance learners collaborate (C quadrant) to complete the activities. The Smashin' Scope (Buzan 2010:33-38) activity is done as a self-reflection (C quadrant) to understand which of the techniques, for example humour or imagination (D quadrant), would apply to the learner. For the Grade 8 group an assignment on reducing information using the BOST technique (Buzan 2011:38) was done individually. The Number Shape (A and D quadrant) system (Buzan 2011:116) assignment was completed in pairs (C and D quadrant); thereafter the learners had to create a story (C quadrant) using the Number-Rhyme (A and B quadrant) system (Buzan 2011:128). The learners responded very well to the latter activity and we listened to all the stories after which I conducted an informal oral assessment to show them how well they could remember the content. Learners were instructed to create a mind map (Buzan 2011:138) and they had to use different colours and pictures (D quadrant) to design it. They were given the choice to work individually or with a friend (C quadrant).

The last method (See Appendix XI) that I did with my Grade 8 learners was the Memory Palace (Buzan & Harrison 2010:77-81). I could observe that the learners with a B quadrant thinking preference responded well to this technique. Although it is a very old method used by ancient scholars it incorporates the imagination and holistic thinking (D quadrant) and through association follows

steps (B quadrant) to construct meaning and create a story (C quadrant) to remember the factual evidence (A quadrant); it is still a very effective study method. In the course of the year the learners are motivated to use a variety of different study methods when they make notes. Times are allocated after facilitating learning for the learners to make summaries collaboratively (C quadrant) and creatively (D quadrant). They are also given activities, for example with the commencement of the World War I topic they were given poppy mandalas to colour (colour therapy). Another poppy World War I poster was handed out and they had to colour that, but then they were restricted to the use of colours. The poppy had to be red, with black and a bit of yellow. Learners who enjoyed colouring the mandala in different colours were perplexed, but the A quadrant and B quadrant learners continued diligently. When the learners were given a free choice in colouring the mandala, those with an A quadrant and B quadrant thinking preference wanted clear instructions and wanted to know what colours they should use. The learners then had to find out the significance of the poppy in World War I that relates to storytelling and human interest (C quadrant) as well as doing research and finding a reliable source (A quadrant). The colouring activities were given as an icebreaker to introduce the fact-based (A quadrant) cause and effect (B quadrant) theory of Wold War I that would be facilitated by making use of ExplainEverything.

This year I introduced ExplainEverything as an alternative to PowerPoint presentations and systematically (B quadrant) redid my presentations. ExplainEverything incorporates a variety of ways to export the presentation either as a video, PDF, image or project format and it can, for example, be exported to the camera roll photos, iMessage, Dropbox, YouTube or Google Drive. The latter is an ideal platform for Google School. In addition one can import a

PowerPoint presentation into ExplainEverything, something that the professionals at Wilberforce High School were quite impressed with. Furthermore music and videos can be incorporated (as in PowerPoint) and there is a function to record one's learning opportunity (voice and writing) so that it could be shared, in for example, Google Drive as part of revision. There is a writing feature as well as typing, thus with the proper software and Wi-Fi connection the learners and teacher can all participate in real time during the facilitating of learning.

At the beginning of this year I noticed that the matriculants struggled to understand the cause and effect of events leading to the Vietnam War as well as Johnson's Escalation policy. I compiled a concept map in ExplainEverything and keywords with pictures. The learners were instructed to bring glue, scissors, colouring pencils and highlighters to the workshop. An A3 format sheet of paper was given to each learner after which I discussed the concept map. After the discussion the learners could collaborate (C quadrant) or had to reconstruct the concept map on their own. Initially the learners with an A quadrant and B quadrant thinking preference were out of their comfort zones, but quickly commenced to make sense of the information. The learners with a C quadrant and D quadrant thinking preference did not stay within the A3 paper format and asked for more paper to add to the original sheet and some learners started pasting on the other side.

Before I start with a topic I plan how (B quadrant) to accommodate different thinking preferences in my teaching practice. I use the same format as planning Herrmann's (1996:119) Communication Walk-around (see Table 30 page 206) and this year I incorporated the comprehensive flexible Whole Brain® model for learning and

facilitating learning. As an example I am incorporating Scientific Racism with a specific focus on the Aborigines of Australia.

When facilitating learning regarding Scientific Racism I rely on my previous knowledge of Archaeology and Anthropology to explain key constructs to the learners. In the first few years (and at my previous school) I used *Rabbit-proof fence* (Noyce 2002) and it worked very well as learners were so enthralled by the story that they excused themselves from the previous lesson earlier to be on time for my class. However, it did not last and learners became more disconnected with the issues around racism. I also noticed that they had neither empathy for nor understanding of the aboriginal culture. Therefore I introduced an overarching construct *cultural relativism*[11] to use as reference for all the topics in the Grade 11 History syllabus. Thus, from the stance of cultural relativism, learners must comprehend and acknowledge their own biases when looking at a culture different from their own, but at the same time recognise that the culture that they study shares values and beliefs that are valid. Thus the expectation is that learners must be able to understand the cultural beliefs of the Aborigines, including religious, artistic symbolism, value systems and traditional rituals (C and D quadrant).

With this backdrop learners then investigate the reasons for British colonisation as well as the systematic killing of the Tasmanian Aborigines during the Black War. Learners investigate key massacres by looking at case studies (B quadrant) and policies, for example *terra nullius* that was introduced by the British government (B quadrant). As example we referred to the Mabo land rights case.

[11] A term coined by the anthropologist Franz Boas believing that all cultural beliefs are equally valid, thus no culture is superior to another and one must understand a culture from this backdrop with the knowledge of one's own beliefs and values.

A thorough investigation into the land rights of Aboriginal and Torres Straight Islanders was done obtaining factual evidence (A quadrant) from a variety of online educational booklets as well as *Mabo: life of an island man* (Graham 1997), a documentary (A and B quadrant) and *Mabo* (Perkins 2012), the dramatisation of Eddie Koiki Mabo's life and events leading to the High Court case to challenge *terra nullius* and reclaim the land that belonged to his ancestors. The learners responded so well to the latter that some of them stated that 'Mabo is Australia's Mandela'. They were truly engaged in this topic, studying all the notes, studying difficult legal terms in order to construct fact-based (A quadrant) arguments by using *Mabo* as a case study (B quadrant) and underpinning it with the treatment of aboriginal people (C quadrant). The following table indicates the planned accommodation of the different quadrants for the Aborigines of Australia topic. Some of the assignments and activities fall in more than one quadrant.

A quadrant	D quadrant
Analysis	**Synthesis**
Black War Word search Keywords Terminology Captain Cook and Crown lands British settlements	Mind Map
Concrete information	**Metaphors and visual illustrations:**
Digital notes Fact-based slideshow presentation Expert sources: Australian curriculum notes	Aboriginal Art Aboriginal birth and burial rights
Case study	**Conceptualising**
Mabo: life of an island man (Graham 1997)	Learners had to create their own Aboriginal artwork using Aboriginal symbolism
Quantitative research	**Symbols**
Radiocarbon dating Number of Aborigines who died in: Tasmania Myall Creek massacre Kurnai massacres Black Line	Aboriginal artwork interpretation (See Appendix XII) Totemism Uluru and the importance of landforms (Appendix XII and Appendix XIV) The role of animals in the Aboriginal culture Dreamtime
Assessment task	**Assessment task**
Mabo essay Term tests and examinations Mabo workshop worksheet	Jake Gordon bonus question (See Appendix XIII topic 1) Aboriginal people of Australia workshop worksheet (Appendix XII)

B quadrant	C quadrant
Practical concrete examples	**Music**
Truganini the last Tasmanian Aboriginal Ned Kelly a bush ranger or Australia's 'Robin Hood' Melbourne goal Port Arthur Pemulwuy; a resistance warrior Yagan; a resistance warrior	Black Arm Band Artists' Murundak: songs of freedom (Gadd & Graham 2011) Midnight Oil songs: Beds are burning (1987) Truganini (1993)
Sequencing of events	**Human interest narrative**
Keywords Timeline - prehistory to present Timeframe of Australian History	Stolen Generations and the importation of British children *Mabo* (Perkins 2012) Aboriginal culture and lifestyle Aboriginal religion Coranderrk Aboriginal reserve Torres Straight Islanders Respond to two incidents regarding disrespect of the Aboriginal culture (See the one example in Appendix XIV)
Policies:	**Storytelling**
Terra nullius	Dreamtime Totemism
Case study	**Assessment task**
Mabo: life of an island man (Graham 1997)	Kevin Rudd essay Aboriginal people of Australia workshop worksheet (Appendix XII) Aboriginal civil society protests (Appendix XVI topic 4 of the 2014 research task)
Assessment assignment	
Mabo essay	

Table 31: Accommodating the different thinking styles in History

I capitalised on my D quadrant and conceptualised a 'hook' to introduce new concepts to the learners and later refer them to the 'hook' to make sense of the cause and effect of historical events. One such character I created was Raoul, an elderly Cuban gentleman who suffered from Alzheimer's disease. I created a story (C quadrant) around this character and how he took part in the Cuban Revolution fighting side-by-side with Fidel Castro (Fidel's brother is also Raoul) and Ché Guevara. The learners had to determine where Raoul fitted into (frustrating the A quadrant and B quadrant learners) the whole context of communism. Raoul was incorporated in workshop worksheets (See 2.1 Appendix XVII) and in formal assessment assignments (See Appendix XIII topic 2). The

objective was to use Raoul to 'hook' the new constructs of the Cold War and superpowers on for this year's topic. The learners were also very excited to learn the true identity of Raoul. I linked Raoul to the Civil Rights Movement and other civil society protests and protests against the Vietnam War up to the assassination of Martin Luther King in 1968 when James Earl Ray (King's assassin) later denied killing King and claimed that it was 'Raoul'.

School outings were planned as an extension of knowledge that could be related to a theme that we studied. The 2014 outing consisted of visiting four locations, each relating to a topic in History. Learners chose their own groups of five to eight learners. They then chose a captain and a vice-captain. Both captain and vice-captain received lists with their group's name (learners chose a name and logo). Each list had the names of their group members and destinations. They had to ensure that the group stayed together and each one in the group was on time for the bus. Since we visited so many locations planning and timing (B quadrant) were of the essence. The Ditsong National Museum of Natural History (A and B quadrant) was our first stop and the learners had to obtain information in the Genesis exhibition and the *Plio-Pleistocene* fossils to come to an understanding of the origin and timeframe of human kind. Our next stop was the Cultural Historical Museum (C and D quadrant) where the learners had free range to walk through the exhibitions of cultural artefacts, art works and a selection of artefacts relating to the Anglo Boer War. A practical demonstration of African traditions and touching a variety of objects led to experiential learning through kinaesthetic activities (C quadrant).

The third stop was Melrose House (B and C quadrant) where the learners could observe the wealth of George Jesse Heys and the Victorian lifestyle as well as relate to the Anglo Boer War and the

signing of the Peace of Vereeniging. The learners felt quite confined since they were not allowed to touch or photograph anything – a marked difference from what they had experienced at the Cultural History Museum. The last stop was Fort Klapperkop (A and B quadrant) where the learners had to observe the strategic importance of the fort and imagine (D quadrant) how it could be used to defend Pretoria.

As part of the learners' action learning I introduced a more formal form of reflection. Initially I designed a matrix (See Appendix XVIII) with key descriptors of what the learners should focus on (B and C quadrant). On the same page as the matrix I instructed the learners to provide their 'Aboriginal name' (D quadrant) as a reminder that they should use the construct of cultural relativity when answering the questions. This year I designed a checklist (B quadrant) including my general comments that I usually write (Appendix XIX). Space was left for more personalised comments that the learners had to rewrite. They then had to write down the amount of marks that they had lost next to the comment that I wrote and tally (A quadrant) the marks to determine the total marks lost. From this reflection the learners gained greater understanding of where they should improve. Accompanying the list was a list of workshops that the learners could attend according to their reflections. I had already reflected on the assessment tasks (I wrote down my observations as I assessed), thus I could planned the extra support workshops.

This year I incorporated more experiential learning (C and D quadrant) by incorporating a re-enactment of the Viking conquest of the British Isles. The research assignment consisted of a group work activity where the learners could either film a documentary, a news report or do a re-enactment. The learners could choose their own

groups and among them they had to decide who would do the research (B quadrant), be an editor (A quadrant), the director (D quadrant) and the scriptwriter (C quadrant). They had to do thorough planning (B quadrant), including a storyboard (D quadrant) and set dates (B quadrant) to meet in order to start shooting their film. After completing the assignments we watched the videos in class and had a short discussion (A, B and C quadrant) about the technical features of the video, evaluated whether the facts were trustworthy and whether the assignment outcome was appealing or entertaining to the audience.

The next part of the assessment was an individual assignment in which the learner had to choose a topic and design a slideshow using PowerPoint, Keynote or ExplainEverything. The slideshow had to be concise, incorporating factual evidence (A quadrant) as well as visual (D quadrant) sources. During a general reflection session the Grade 8 learners noted (and here one could observe their thinking preferences) that some had obtained new knowledge when they did their own research (A and B quadrant) and designed (D quadrant) the slideshow, while others felt that they learned more by experiencing and re-enacting (C quadrant) what they had researched as a group. Due to the popularity of the re-enactment we re-enacted trench warfare. The class was divided into two groups. The larger group had to carry their bags on their backs and we went to a narrow area where they had to stand. The smaller group role-played the German troops (C quadrant) and were instructed to go to Heidi and learn a few German commands and plan to attack the British troops. The learners representing the British in the 'trench' had to remain standing for a couple of minutes, feeling the agony of carrying heavy bags. They had to respond to a whistle to go over the top and attack the Germans. The learners gained a better understanding of the heavy gear that

World War I troops had to carry and they also envisioned (D quadrant) how fatal the 'Big Push' was. The learners who represented the Germans attacked the British troops with precision and in most of the re-enactments most of the British troops succumbed.

In Grade 11 the research task carries quite a weight of the senior-based assessment mark. In 2011 I designed a Heritage task (See Appendix XV) that investigated the influence of heritage on one's life, thus one topic incorporated intra-reflection, investigating one's family history and family stories (C quadrant). The second topic related to the museums that we visited that year, reflecting on the design of the museums (Ditsong National Museum of Natural History, Cultural History Museum and the Pretoria Art Museum) and how many visitors there were. They then had to design their own museum (D quadrant) and draw up an action plan (B quadrant) in which they had to illustrate the types of exhibit. The third option was to film a silent movie, an animation, a dance or do a mash-up of a 1920s Jazz song (C quadrant). The research components of each task related to the A and the B quadrant. The learners also had to do planning (B quadrant) for the assignment. The assignments that were handed in were diverse and of a very high standard. There was a 1920s horror film and the learners even borrowed a vintage car of a teacher to shoot the 'murder scene' in. The third option was by far the most preferred option for the learners. I do not reuse previous assignments, but rather use them to reflect on and as part of my Action Research cycle improve the original idea.

In 2014 I incorporated structured planning (See Appendix XVI) and the learners had to start off by identifying key descriptors of themselves on the Ned Herrmann Whole Brain® model in their

planning to determine which topic would accommodate their thinking preference. The assignment contained clear instructions and a time management table (B quadrant). The research assignment incorporated a topic for each thinking preference. They had to include a concept map (D quadrant) as part of the assignment to simplify or provide a holistic overview of the topic that they investigated. The first topic related to politics of the Middle East and they were given a statement on which they had to agree or disagree and provide factual (A quadrant) evidence to support their answer. The second topic was from a socialist point of view about the cover-up of Nicola Tesla's inventions. This was quite a challenging task since the learner was expected to sift through a number of conspiracy theories in order to obtain the truth and relay a detailed essay (B quadrant), evaluating the truth of the statement. Topic 3 was a 'hook' for the following year's Cold War topic by investigating anti-nuclear protest art, anti-apartheid protest art and animal rights protest art (D quadrant). The last option incorporated human rights issues (C quadrant), specifically the Civil Rights Movement in the USA, also a 'hook' for the same topic in Grade 12, as well as civil disobedience and passive resistance in South Africa as an extension to the Aborigines in Australia topic, the Black Armband, a group of Aboriginal musicians who sang protest songs and identified with the cause of the African Americans and people oppressed by apartheid in South Africa.

Thus my teaching practice cycle is part of my Action Research and I apply the Whole Brain® thinking model in facilitating learning. I may do an extension of the work, for example incorporating Johannes Kerkorrel's 'Sit dit af' (1989) as part of Afrikaner protest music against apartheid in the Grade 12 syllabus. I have also planned enrichment tasks; for example, I would take sections from old 'scientific' books that give detailed descriptions (B quadrant) of the

differences of race (A quadrant). I usually challenge the learners to critique the validity of the sources. Another enrichment task that I use as a similar activity not to accept at face value so-called 'factual evidence' is from Macaulay's (1979) Motel of the mysteries, a post-apocalyptic archaeological investigation of our civilisation. It completely misinterprets artefacts, for example that toothbrushes were earrings. Learners found it difficult but soon realised that the texts form part of Scientific Racist constructs. Wilberforce High School provides a platform for facilitating Whole Brain® learning since two of the dimensions (as discussed in Chapter 3) illustrate the concept of teaching beyond the curriculum and innovative teaching. It was with experience as part of my Action Research model that I continuously reflected and redesigned assignments and facilitated learning to accommodate the different thinking preferences.

4.3.8 Analysing the semi-structured interviews

The semi-structured interviews were conducted, by appointment, at Wilberforce High School. The interview schedule included welcoming the professionals and thanking them for their participation. The semi-structured interviews formed part of the qualitative data set. The questions of the semi-structured interview probed the action learning process of the professionals in their teaching practices as well as reflected on the effectiveness of Whole Brain® facilitating learning and the use of an iPad. The last questions focused on innovative methods used to accommodate thinking preferences within the professionals' teaching practices as well as reflecting on challenges that they were faced with and how they addressed these challenges.

4.3.8.1 Analysis of the last preliminary interview question and the follow-up last semi-structured interview question

During the preliminary interviews I posed a question to probe to what extent the professionals thought the iPad might change learning experience. I asked a follow-up question during the semi-structured interviews as to what extent the iPad might be useful for facilitating Whole Brain® learning.
The wording of the preliminary and semi-structured interview questions was as follows:

- Preliminary interview question: 'Do you think that the use of technology, for example an iPad, would change the learning experience?'
- Semi-structured interview question: 'To what extent will the iPad be useful to implement Whole Brain® learning?'

An analysis of the professionals' responses to these questions was written up and coded separately, starting with the analysis of the question asked during the preliminary interview (Table 32 page 250) and then the follow-up question (Table 33 page 252) that was asked during the semi-structured interview.

Ten codes were identified for the technology question that was asked during the preliminary interview. Three professionals stated that technology might change the learning experience and five candidates felt that the learners would respond well to iPads being introduced as a learning tool. Three professionals, Kypris, Lana and Brynhildr felt very strongly that it would not replace the teacher; however, Kypris noted that it might complement her facilitating of learning if the learners were, for example, watching a video from Khan Academy. Lana also stated that an App might be 'more

interesting' than her facilitating of learning, but it would not replace her. She was also concerned that if the learner relied on an App only, his or her understanding might be jeopardised.

In contrast to Lana's observation, Kypris and Alexander felt that the iPad would motivate learners to become self-regulated learners. Alexander felt that an iPad would accommodate different thinking preferences.

Two professionals, Kypris and Octavia were of the opinion that the iPad would provide more 'visual learning' whereas Heidi felt that it would also be a time-saving device, making, for example, communication quicker and easier. Contrary to Heidi's observation, Lana and Helena felt that due to time constraints in their syllabus, they were not sure how they would be able to integrate the iPad within their facilitating of learning. Three professionals felt that the iPad would not significantly change learning.

Response / Names	Change learning experience	Learners will respond well	Will not replace teacher	More visual	Complement learning	Self-regulated learning	Accommodate thinking preferences	Time-saving	Learning will not change significantly	Time constraint
Kypris		☑	☑	☑	☑	☑			☑	
Alexander	☑	☑				☑	☑			
Heidi		☑						☑		
Octavia	☑									
Lana			☑						☑	☑
Helena		☑		☑					☑	☑
Brynhildr	☑		☑							

Table 32: The codes used regarding technology

After more than a year's interval I asked to what extent the iPad would be useful to implement Whole Brain® learning (Table 33 page 251). The follow-up question was to determine if there was any change of opinion regarding the use of an iPad to implement Whole Brain® learning.

Six of the seven professionals felt that the iPad would be an efficient tool to use in order to facilitate Whole Brain® learning. The exception was Lana, who felt that she needed only her Whiteboard and Whiteboard marker to facilitate learning. Two professionals, Alexander and Heidi noted that the iPad would help them to accommodate learners with different thinking preferences. Two professionals mentioned that the mobility of the device made it functional (A quadrant). Alexander mentioned how he was now able to work on the bus and not waste that time (B quadrant). Brynhildr noted that she was able to provide immediate feedback to her learners if they could not solve a Mathematical problem. Three professionals referred to the time-saving qualities of the iPad. Alexander and Brynhildr also mentioned the time saving qualities of the iPad. Brynhildr used TeacherKit as an example in which she could quickly take roll call or note if homework was not done (B quadrant); she also started a WhatsApp group.

The WhatsApp group is people-oriented (C quadrant) and it does lead to technical discussions (A quadrant) and future discussions (D quadrant) but also planning (B quadrant) for formal assessments. Alexander and Brynhildr mentioned the collaboration (C quadrant) possibilities of the iPad. Alexander referred to collaboration between teachers that would be one of the advantages of the iPad. Similarly, Heidi noted the advances of collaboration, for example to connect with someone in Germany by using Facebook.

Three professionals stated that the iPad could be used for experiential learning (C and D quadrant). Kypris used the example to see how Mathematics was applied in real life. Heidi referred to accommodating the thinking preferences through experiential learning and accommodating the different thinking preferences; for example, to draw a body and label it (D quadrant) and to play games (C quadrant) and to apply (A quadrant) and practise (B quadrant) the vocabulary.

Octavia mentioned that the iPad could make the learning more visual (D quadrant) as well as incorporate music (C quadrant, harmonising, sensory movement and kinaesthetic) assignments. Lana, although not believing that learning would change by the use of the iPad, thought that the iPad might enhance the experience. However, she postulated that one cannot merely just show the learners a simulation and assume that they understand it.

Three professionals stipulated that the iPad would add to the learning by using more visual examples. Alexander mentioned that the iPad could be used for reflection, underpinning his own action learning by being able to make a note immediately or make a correction.

Response / Names	Efficient	Accommodate	Mobility (A quadrant)	Time saving (B quadrant)	Collaboration (C quadrant)	Experiential learning	Visual (D quadrant)	Reflection
Kypris	☑					☑	☑	
Alexander	☑	☑	☑	☑	☑			☑
Heidi	☑	☑			☑	☑		

Response / Names	Efficient	Accommodate	Mobility (A quadrant)	Time saving (B quadrant)	Collaboration (C quadrant)	Experiential learning	Visual (D quadrant)	Reflection
Octavia	☑					☑	☑	
Lana						☑		
Helena	☑						☑	
Brynhildr	☑		☑	☑	☑			

Table 33: The codes used describing the use of an iPad to facilitate Whole Brain® learning

4.3.8.2 The professionals' action learning

The following set of questions relates to action learning; the professionals were asked to reflect on their own teaching practices to probe and obtain greater insight into the transformation that occurred during the previous year after the fieldwork of this study had been initiated. The first question is an initial probe trying to determine what could be done differently. The second question is a more in-depth probe and relates to how the teaching practice was transformed and the third question investigated if action learning (reflecting) is useful. Each question was analysed in sequential order per candidate.

- Reflecting on your teaching practice, what could you have done differently?
- How did you transform your teaching practice?
- Do you find reflecting on your teaching practice useful? Explain.

Kypris's action learning (See Figure 34 page 255) grew from an interest in her own professional development as part of her lifelong learning to be innovative and transform her teaching practice to accommodate the learners who capitalised on the use of technology. Her initial planning was to incorporate the iPad into her facilitating of learning and she also wanted to know more about the different thinking preferences. From her new knowledge she could evaluate and construct meaning to plan and act and she started by promoting more collaboration (C quadrant) in her teaching practice, where learners are given the opportunity to sit together in pairs or groups and work on Mathematical problems. From this action she observed that the academically stronger learners acted as mentors to the ones who found the Mathematics problems challenging. After reflecting, Kypris realised that she needed to incorporate more real life examples, for example relating trigonometry to astronomy or flying. She also noted that she wanted to focus on the practical application of Mathematics, for example in architecture and by doing so keeping in mind to plan for accommodating the different thinking preferences and take action by introducing more experiential learning.

Kypris stated that she did find reflecting on her teaching practice useful. For example, if one has been teaching the same content for so many years one becomes 'jaded or blaze' and expected the learners to just know how to do it; however, reflecting on her teaching practice she asked herself if she should be doing it differently. Similarly Leamnson (Gravett 2005:33) stated that teachers tend to confuse the obvious with the familiar. Teachers may feel familiar with the theory of their learning areas that is strengthened by the repetition of the content during the facilitating of learning. Thus, a teacher must realise that learning still needs to

be facilitated in order to reap its and adding to one's knowledge (Gravett 2005:34).

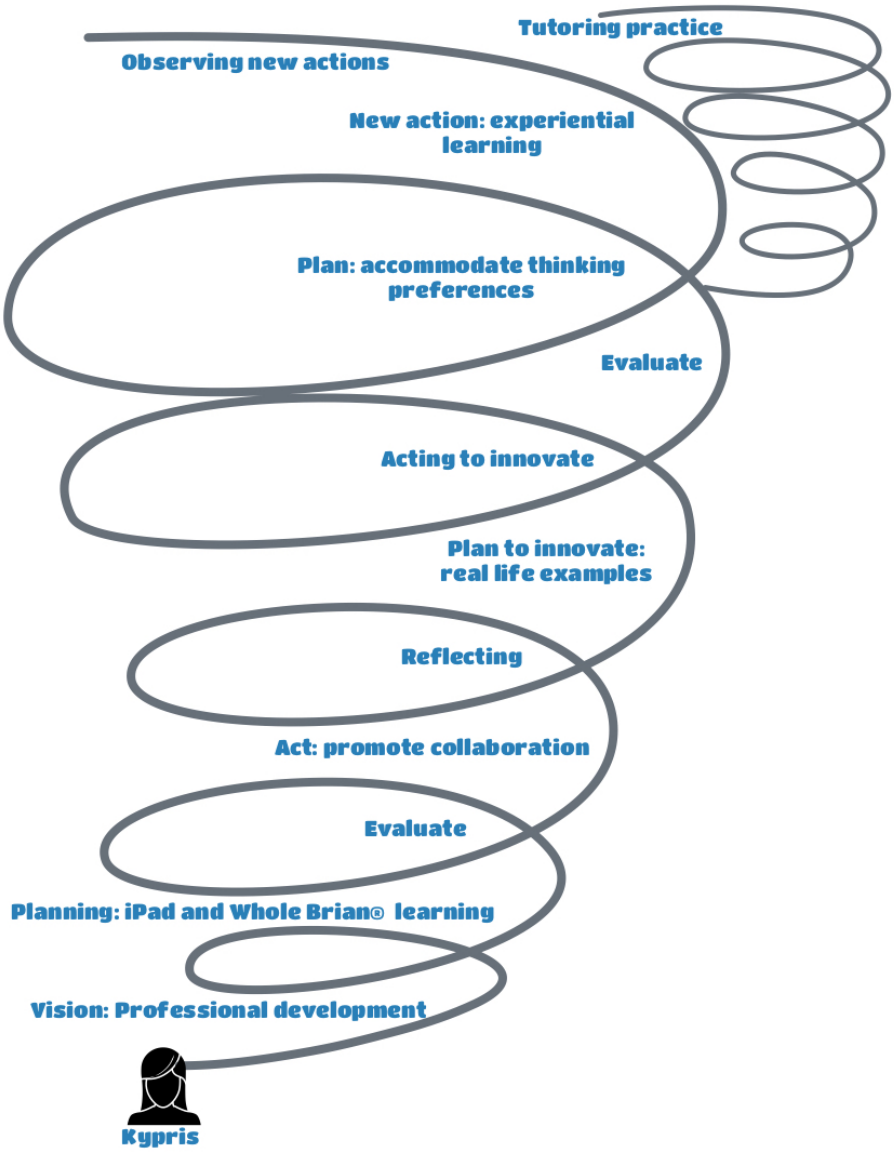


Figure 34: Kypris's action learning process adapted from Du Toit (2009)

Alexander took up responsibility for his own professional development and he planned (See Figure 35 page 256) to use the iPad and Whole Brain® thinking to transform his teaching practice. Firstly he accommodated learners, for example the soccer players and dancers (C quadrant), postulating that no two classes were the same and he had to adapt the lessons to accommodate learners' thinking preferences. Alexander capitalised on his C quadrant

thinking preference and this is discussed in 4.3.8.3. After evaluating the initial steps taken to accommodate learners, Alexander decided to focus on encouraging them to become self-determined and self-regulated in their learning underpinned by investigating their own psyche. A Life Orientation Whole Brain® assignment (as mentioned in 4.3.7) was set and during the research phase Alexander had to adapt the assignment and set a questionnaire to support learners so that they would be able to construct meaning of the new knowledge and determine their thinking preferences.

Alexander stated that he did find reflecting on his teaching practice useful because he was able to identify what he needed to work on, for example tailoring the facilitating of learning to be inclusive.

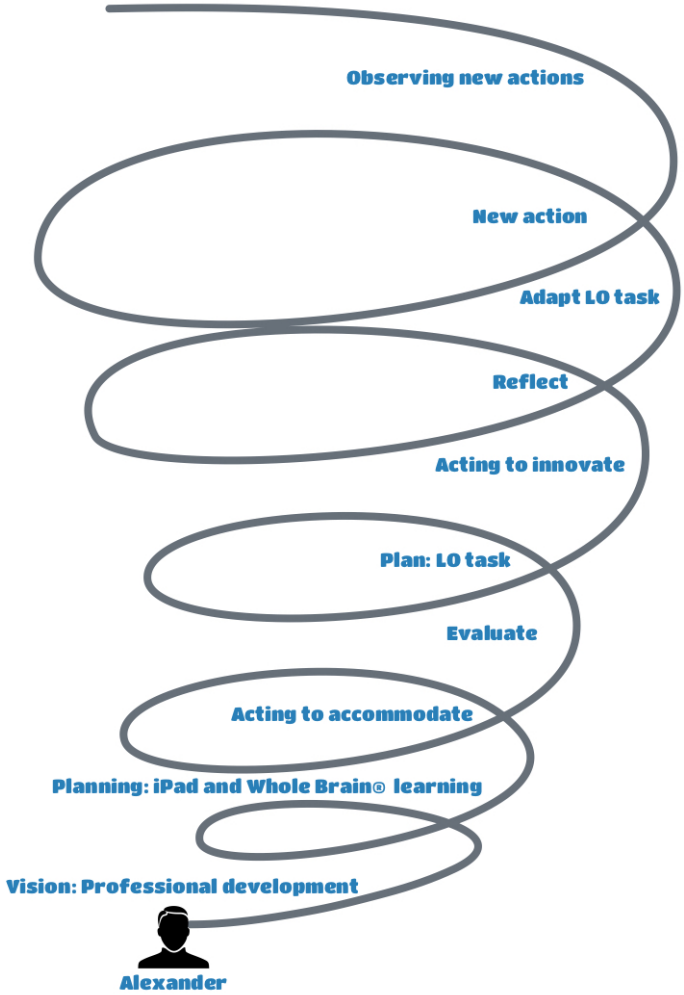


Figure 35: Alexander's action learning process adapted from Du Toit (2009)

Heidi envisioned transforming (See Figure 36) her teaching practice by being part of the ICT team and implementing the iPad in her teaching practice. She was also interested in knowing more about Whole Brain® thinking and how to accommodate learners with different thinking preferences.

Figure 36 Heidi's action learning process adapted from Du Toit (2009)

Heidi is a professional self-regulated learner, constantly reflecting and adapting her actions as she postulates that she does not like to repeat activities and prefers to be innovative and design new learning tasks for each group. She has incorporated more visual media, especially YouTube since the start of the peer mentoring

sessions. From evaluating this action she has set an assignment where learners had to imagine (D quadrant) that they were travelling to Germany and they had to translate the information that was in German into English (B quadrant). After reflecting on this action, Heidi planned more experiential tasks for each class leading to new actions to be taken and she mostly relied on oral feedback (C quadrant) from her learners in reflecting on her teaching practice.

Octavia is a professional self-regulated learner underpinning the principles of lifelong learning and taking accountability for her own professional development (See Figure 37 page 259). She capitalises on her C quadrant thinking preference by constantly collaborating. She does not only collaborate with Natural Science, Life Science and Physical Science teachers at other schools, but also has an external moderation practice, where she moderates and sets examination papers for other schools. She diligently keeps record (B quadrant) of her experiences (C quadrant) and as noted earlier she completes the assignments before she hands them out to the learners, thus reflecting on their validity.

Through her action learning process Octavia continuously attempts to improve and find different ways of facilitating learning to accommodate as many learners as possible. She also affirmed that she does not want to become stagnant, so she continues to 'reinvent' herself. She utilises action learning in her teaching practice to generate innovative ideas (See 4.3.7) to transform the facilitating of learning. She focuses on experiential learning that accommodates the C and D quadrant.

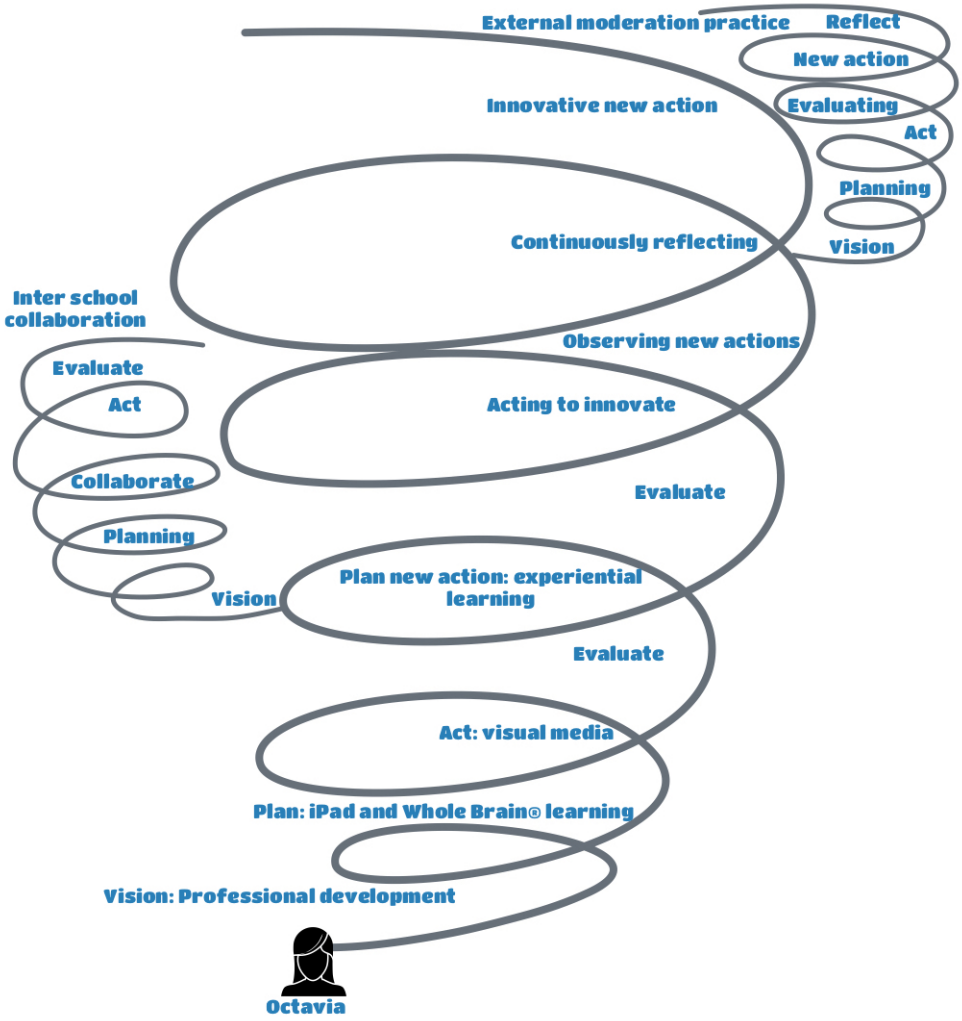


Figure 37 Octavia's action learning process adapted from Du Toit (2009)

Lana's initiative started when she was selected as part of the ICT champions' team. She volunteered to be part of this study, showing interest in the facilitating of Whole Brain® learning. After evaluation (See Figure 38 page 261) of her professional practice she decided (as mentioned previously) to continue with the Whole Brain® one-on-one peer mentoring sessions. Within her teaching practice she envisioned innovation by making more use of the Smartboard, complementing her facilitating of learning with the use of the Whiteboard. She stated that the Smartboard used to be a white elephant. Now she imports videos and has observed that her facilitating of learning has become more interesting for the learners.

I deduced that Lana shows flexibility in her thinking styles, being quite adamantly indifferent to the incorporation of technology, since her teaching method has been working up to now; therefore she incorporates and utilises the SmartBoard. This is a different take on the initial observations and assumptions that were made during the teaching practice observation and preliminary interview.

Within Lana's action learning cycle she describes that she always comes back to a 'blank Whiteboard' and starts to plan the next action to take. She extends her action learning to extra support practice (extra support sessions for learners at Wilberforce High School). As mentioned previously, she teaches on Saturdays. Her Saturday teaching practice is a formalised action learning process, where it is required that she reflects after each learning session and submits the reflection (See Appendix XX). The learners reflect on her facilitating of learning and she uses the feedback to reflect on the learning that has taken place. She evaluates and reflects on the highlights as well as the challenges that arose. Lana acknowledged that she does not apply the same systematic reflection at Wilberforce High School due to time constraints and the amount of administration.

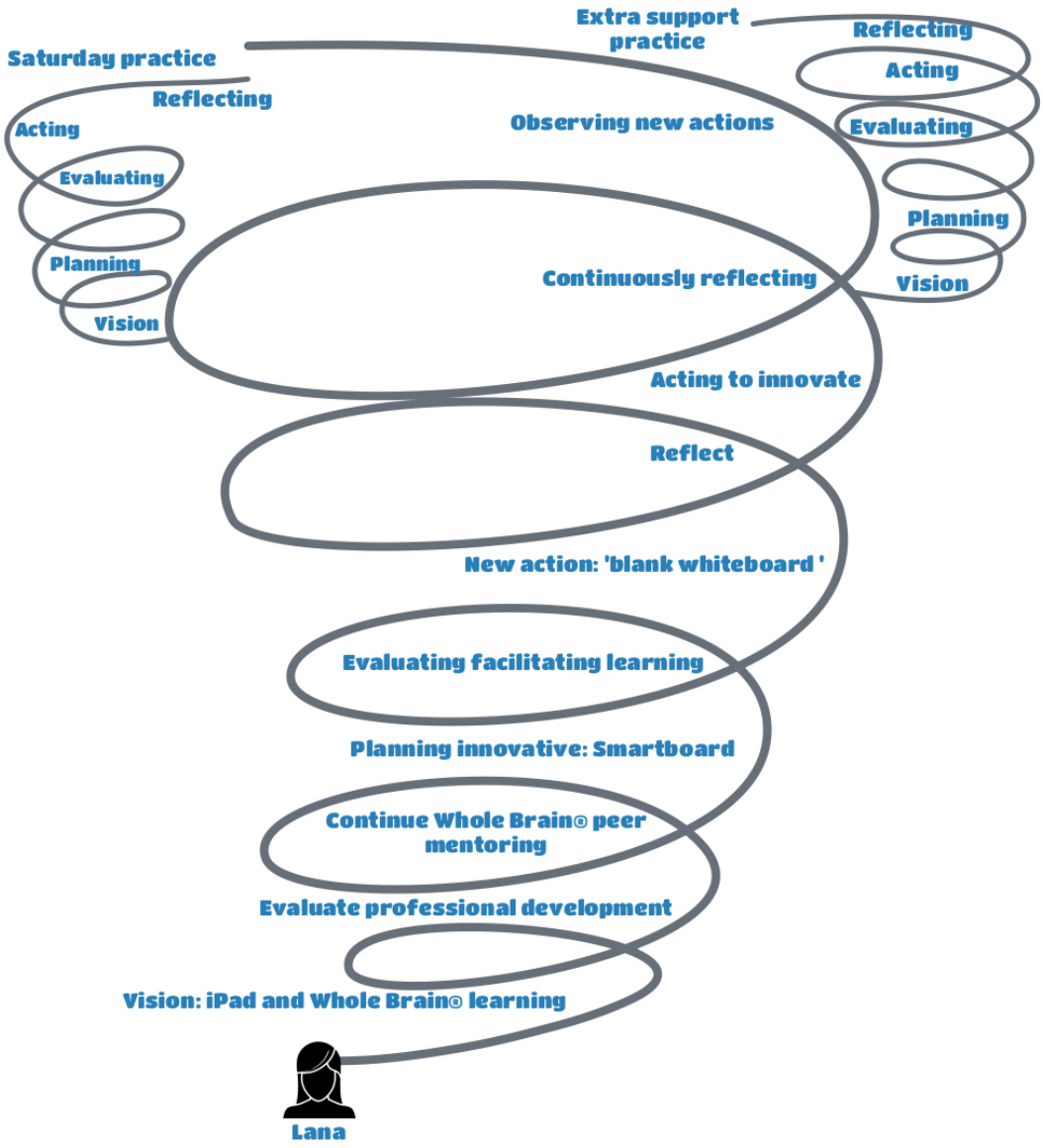


Figure 38: Lana's action learning process adapted from Du Toit (2009)

Helena envisioned transforming her teaching practice by taking responsibility for her own learning. She fully capitalises on being a professional self-regulated learner and she constantly contributes valuable and supportive findings that she has made either within the community of practice during workshops or on the WhatsApp group. She is self-motivated and searches independently for new ways of innovative facilitating of learning. While planning to accommodate (See Figure 39 page 262) divergent thinking preferences she discovered a Chemistry App (as mentioned before)

that simulates wiggling molecules. She used it during the facilitating of learning and observed that the learners responded positively to the movement. She now would like to utilise the dynamics of such an App as soon as all the learners are equipped with iPads; she envisions the new action to be taken to create more experiential (C and D quadrant) opportunities.

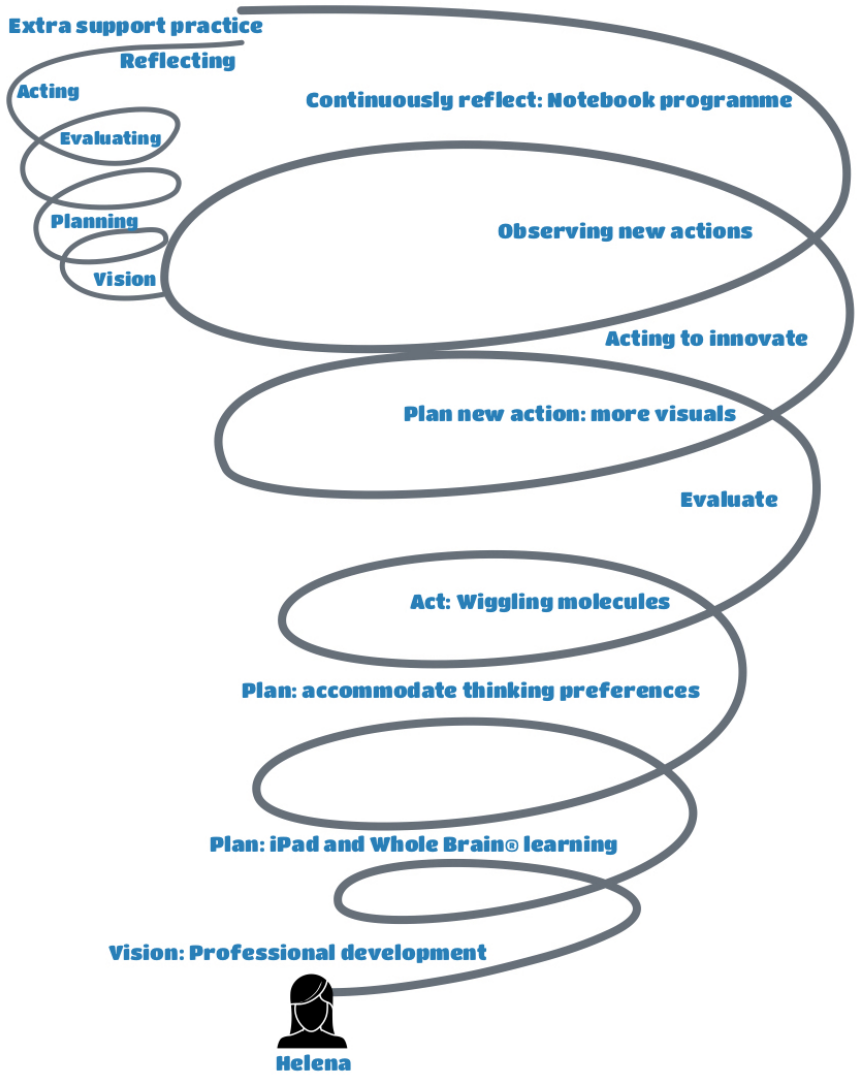


Figure 39: Helena's action learning process adapted from Du Toit (2009)

Helena takes responsibility for her own action learning and she reasons that reflecting on her teaching practice is one of the most important steps she takes to evaluate if she could have done the facilitating of learning differently. As stated earlier in this chapter, she uses her SmartBoard to make notes in the Notebook program

where she envisions how she can facilitate the learning differently for next year (D quadrant). I could deduce that Helena does become more flexible and uses the D quadrant to plan for future learning. Interestingly she introduced reflection for her leaners as part of their action learning. They had to reflect on their June examination and write a short paragraph. Similarly in my teaching practice, I encouraged my learners to reflect (See 4.3.7.1).

Brynhildr joined the ICT professional program to become more familiar with emerging new technologies. She is a lifelong and professional self-regulated learner who extends her flexibility to the D quadrant to explore innovative ways to facilitating learning in her teaching practice. In her action learning (See Figure 40 page 264) cycle she not only continues to innovate her teaching practice, but she also has a tutoring practice where she tutors not only learners from other schools, but also university students. She capitalises on her experience and reflects on her actions to evaluate what has worked well. She realised that she needs to incorporate more visual (D quadrant) examples and decided to simplify (D quadrant) Geometry and she successfully used Graph sketching. She decided to make use of a Trigonometry Sketchpad program that was utilised successfully. She envisions using more visuals as well as incorporating YouTube videos (C and D quadrants); she added that she would have to plan these actions thoroughly (B quadrant) in order to be successful.

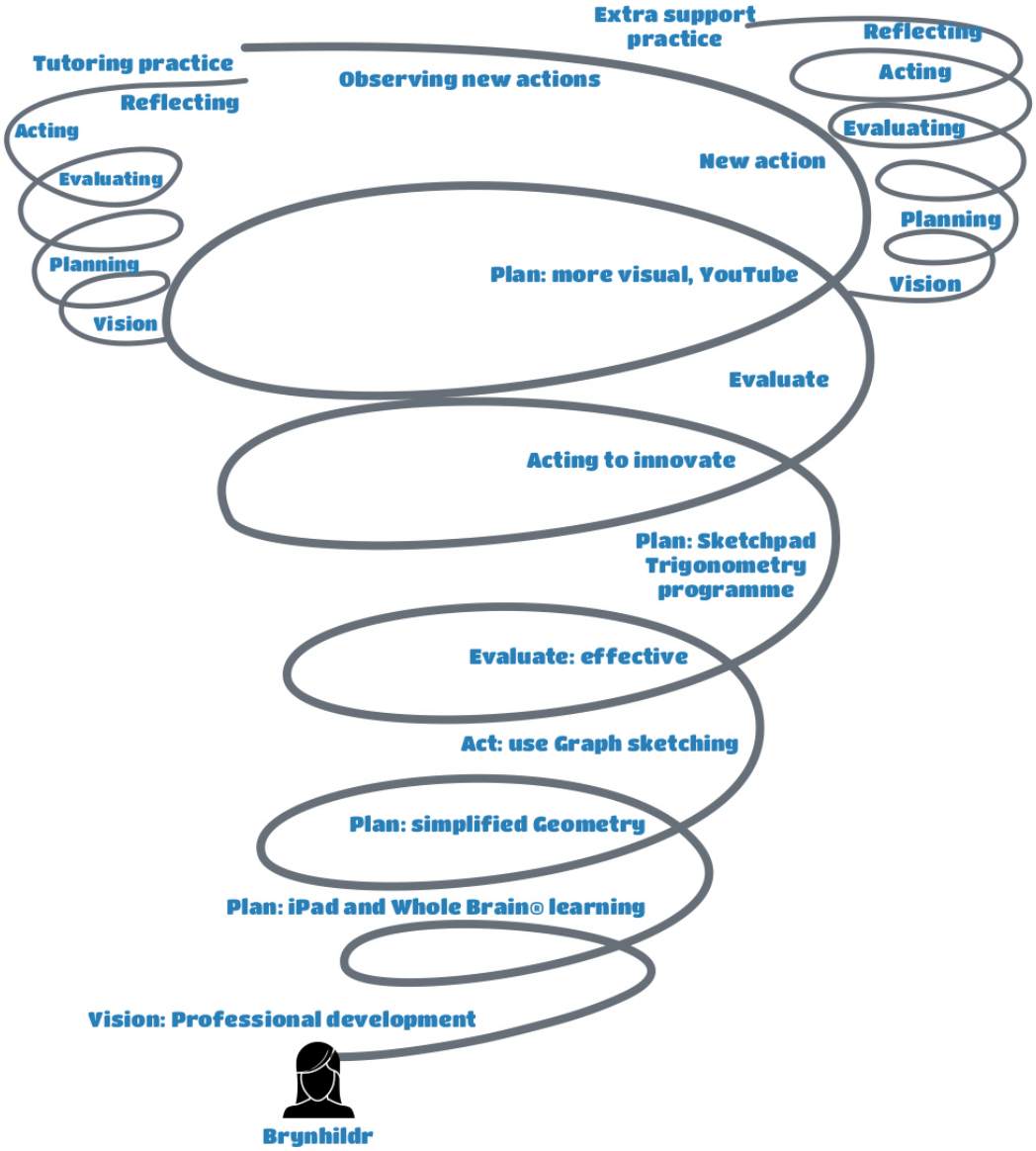


Figure 40: Brynhildr's action learning process adapted from Du Toit (2009)

4.3.8.3 The professionals' Whole Brain® facilitating learning

The following questions were posed to probe to what extent the professionals were making use of Whole Brain® facilitating learning. The construct *Whole Brain® teaching* was used during the interview so that the interviewees would not be perplexed. I used the language that they were familiar with. For the write up of this study I replaced *Whole Brain® teaching* with *Whole Brain® facilitating*

learning or *Whole Brain® learning* to be consistent with the terminology used in this study.

The following questions regarding Whole Brain® facilitating learning were asked during the semi-structured interview:

- 'Do you find the implementation of Whole Brain® teaching effective?'
- 'How did the learners respond to your facilitating of Whole Brain® teaching?'
- 'Can you describe a few innovative methods that you used in your teaching practice?'
- 'How is your brain profile aligned with your facilitating of learning and designing assignments? How do you capitalise on your preferred (dominant) quadrant(s)?'
- 'How do you challenge yourself to facilitate and design assignments based on your non-preferred quadrants?'

Ten codes (See Table 34 page 269) were identified and rich data was gathered regarding the flexibility of thinking of each professional. Three professionals noted that they were now more aware of the thinking preferences when they planned facilitating learning. Five of the professionals observed that the learners were more interested when the facilitating of learning accommodated more thinking preferences. Alexander, Heidi and Lana noted that they could see that learners with an A quadrant preference were challenged by assignments that were set to accommodate, for example, the C and D quadrants. Six participants stated that they accommodated all the thinking preferences, and this was a marked difference from the remarks during the preliminary interviews where the professionals were not certain if they incorporated all the thinking styles in their teaching practices. All the participants made provision for the A quadrant in their teaching practice, be it with

regard to the formal assessment tasks or presenting concrete information. All the participants made provision for the B quadrant in the form of well-structured activities with clear instructions. These activities usually underpinned the clear objectives of the A quadrant. Kypris and Lana mentioned that the formal assessment assignments restricted them in the sense that they were not able to include the C and D quadrant thinking preferences in the prescribed assignments.

All of the participants incorporated the C quadrant in their teaching practice. Kypris and Brynhildr both accommodated the C quadrant by motivating the learners to take part in the learning process. Kypris would make use of collaboration at the end of the lessons. Helena incorporated dancing (C quadrant) as part of movement. Alexander indicated that he changed his classroom setup to promote more learner-centred assignments and to facilitate discussions (C quadrant). The desks reminded me of a conference room setup. In the middle there were desks facing one another in a rectangle and there was a second row of desks around the rectangle. The learners faced one another. Some more examples of how Alexander introduced a learner engaging approach (capitalising on his primary C-quadrant thinking style) were to provide a simple concept and instructing the learners to brainstorm ideas (D quadrant) and generate creative ways. He also introduced a practical skills argument referring to President Zuma's (Smith 2015) comment that South Africa's problems started with the arrival of Jan van Riebeeck. Alexander also promoted discussions and got learners to reflect on and discuss the answers to questions set.

I deduced that Alexander capitalised on his primary C quadrant preference and he acted upon his vision (as stated in the preliminary interview) to transform his teaching practice from a

teacher-centred to a learner-centred learning environment. Heidi capitalised on her C quadrant when planning innovative learning tasks. She incorporated a variety of games (C quadrant), which relates to the A, B or D quadrants (See Table 34 page 269). Games relate to experiential learning. Similarly, Octavia, Lana and Helena use experiential learning in their teaching practices. Helena incorporates dancing, whereas Heidi, Lana and Octavia's experiential tasks can be classified as C or D quadrant activities.

Octavia provided a few examples of innovative ways to design experiential tasks (C and D quadrant); for example, in Bio-mimicry the learners sit with their eyes closed and listen to the sounds around them. They are given an object (still with their eyes closed) and they are instructed to touch the object and if they observe that it is hard, they have to explain why it might be hard. The aforementioned reminded me of an excellent Art exhibition at the Pretoria Art Museum known as *Seeing Blind* (2001). I was working as a tour guide and the goal of the exhibition was to accommodate blind people. Art students at the University of Pretoria were given the task to create artworks that could be touched. One of the artworks that was very well received by the learners and visitors of the museum was *Ophelia*, a life size statue suspended from the ceiling, creating the feeling that she was floating. Fabric covered her body so that people who could touch it. The artist, Willem Boshoff, exhibited his Blind Alphabet installation. The explanation of the statues was provided in braille only. He wanted seeing visitors to experience being excluded, as the blind are usually excluded. Therefore one needed a blind person to interpret his artwork. Octavia capitalised on her preferred C quadrant and focused on providing experiential tasks (C and D quadrant) related to feeling or kinaesthetic learning (C quadrant).

Two other innovative tasks that Lana gave to the learners during her Saturday teaching practice were a rap song (similar to an innovative technique used by Octavia) that they had to make about organic chemistry (C quadrant) and designing a board game (D quadrant). Another assignment was based on the Amazing Race (C quadrant). She observed that after the facilitating of these learning tasks the learners were able to answer the questions on the topic correctly (A and B quadrant).

Another interesting learning experience that Lana facilitated was when the learners from her Saturday teaching practice had to calculate the slope of work energy and power (See Appendix XX). The learners did not have rulers. Lana made use of collaboration and experiential learning (C and D quadrant) and the learners responded by using their shoelaces to form the angle so that they could do the calculation (A quadrant). Lana stated that due to time constraints and the academic expectations at Wilberforce High School, she was not able to explore more free-flow and spontaneous ways to facilitate learning. During Lana's Saturday teaching practice she explored more innovative ways of facilitating learning.

All of the professionals incorporated a D quadrant thinking preference in their teaching practices. Kypris specified that using the visual example of where parabolas can be seen (See Appendix III) in a cone shape (D quadrant) made the facilitating of learning in this regard more effective. As mentioned earlier she also looked at Parabolas real-life examples like bridges and using Trigonometric rules (sine, cosine and area rules) to solve real-life problems.

Response / Names	More aware of thinking preferences	Learners were interested	Learners were challenged	Accommodates all the thinking preferences	A quadrant	B quadrant	C quadrant	Experiential learning (C and D quadrants)	D quadrant	Limitations: assessments
Kypris	☑			☑	☑	☑	☑		☑	☑
Alexander		☑	☑		☑	☑	☑		☑	
Heidi	☑	☑	☑	☑	☑	☑	☑	☑	☑	
Octavia		☑		☑	☑	☑	☑	☑	☑	
Lana		☑	☑	☑	☑	☑	☑	☑	☑	☑
Helena	☑	☑		☑	☑	☑	☑	☑	☑	
Brynhildr				☑	☑	☑	☑		☑	

Table 34: The codes used regarding Whole Brain® facilitating of learning

Kypris stipulated that she used the SmartBoard more often; she changed the way that she usually taught parabolas (by providing background and visual examples) and she also changed the way in which she facilitated the learning of graphs. Another example of innovative practice was when she sent learners to obtain quotations for buying a car. They then had to calculate (A quadrant) if they could afford the car. She stated that this assignment would make use of the imagination (D quadrant). Furthermore she said that for patterns and sequence she would refer to the golden ratio, Fibonacci or nature. She then postulated that Art and Design learners would be able to make use of these constructs.

Kypris observed that accommodating different thinking preferences was still a challenge for her and something she needed to work on in her action learning process. She was more aware of thinking preferences, incorporating interesting elements, for example

patterns and sequences; however, she would have to set more Whole Brain® learning tasks around those.

Alexander deduced that he capitalised on his preferred (C quadrant) thinking style that is people-oriented. He promoted people-oriented discussions. He also motivated his learners to read more, and *reader* was the Key descriptor that he chose in the HBDI® survey.

Alexander capitalised on his primary C quadrant preference by being people-oriented; he believed that it made it easy to facilitate learning. He was of the opinion that it resonated with the learners; moreover, his choice of learning areas, History and Life Orientation was not outside his preferred thinking preference. He underscored the importance of motivating his learners to read more. He stated that one of his fears was giving an assignment that would not stimulate learning. Therefore he opted for assignments that they would enjoy. He mentioned that he wanted to create an assignment that was creative and interesting and that was why he wanted to set assignments on thinking styles and Whole Brain® thinking. Alexander therefore became flexible in his learning style and extended it to the D quadrant. During one of our one-on-one mentoring sessions we thought about the initial idea for the aforementioned learning task that Alexander later refined and set.

Another interesting assignment that Alexander gave to his learners was to think about time management (B quadrant). They had to reflect (C quadrant) on what they spent their time on. They had to write their findings on a Post-it note and paste it on a board. After the assignment the class looked at the reflection of each learner and had an organisational discussion (B quadrant) and shared personal reactions (C quadrant). Alexander fully capitalised on his primary C quadrant thinking preference and he used his secondary

B quadrant thinking preference, facilitating activities that accommodated the aforementioned quadrants. Furthermore, he was flexible, using the D quadrant to take initiative and create tasks that the learners would enjoy.

Heidi stated that the activities she facilitated varied. An example is when she got the learners to explain content, based on the flipped classroom idea. She made use of competitions and games, for example hangman. On Fridays the Grade 8 learners played games (C quadrant). There was a learning colours board game where the learners had to identify the colour and then learnt the colours off by heart. They also played a memory game and a family game where the learners had to place the family members in the correct order. Lastly, there was a puzzle on Germany that learners had to build. The Grade 10 and Grade 11 learners played a game similar to *Snakes and Ladders*, known as *Crocodiles and Monkeys*. The objective of this game was to learn verbs; if a learner selected the incorrect verb, he or she had to move back.

The above-mentioned accommodates C quadrant and D quadrant thinking preferences, providing experiential opportunities and the reference to the vocabulary and verbs relates to the A and B quadrant thinking preferences. Thus, these activities incorporate more than one thinking preference. On Fridays the learners had to write a short test (B quadrant) lest they did not study. She utilised short oral assessments; for example, on some topic that was prominent in the media. She would give them a word and they would have to make a short sentence with it.

Heidi felt that she was 'quite on par' with her capitalising on her thinking preference. She 'loved being artistic' and bringing creative and innovative ways to facilitating learning. She made use of games

(C quadrant) and drawing assignments (D quadrant). One such drawing assignment was that the leaners had to draw a feature of a friend on a paper stuck on the wall. They were given a time limit and then had to switch and draw, for example the nose. The activity continued until the whole face was drawn (See Appendix XXI). After the learners had completed the drawing they had to write an essay on it. She also stipulated that she might give them an instruction to use an adjective, noun and a verb with the letter A that involved structuring (B quadrant) meaning. She started a WhatsApp group where the learners could interact and communicate, forming a community of practice. Heidi capitalised on her preferred primary D quadrant and her preferred secondary B quadrant and C quadrant and the HBDI® results were underpinned in her facilitating of learning. She was sympathetic regarding the feelings (C quadrant) of the learners and similar to Octavia, she made use of innovative and experiential learning.

Octavia stated that she tried to incorporate as many innovative ways as possible and she identified the practical, 'hands on' and experiential opportunities (D quadrant) as very important in her teaching practice. As seen from the analysis earlier Octavia capitalised on her D quadrant thinking style to think of assignments that were playful and included movement and feeling (C quadrant). In an assignment for Grade 9 designed by Octavia learners had to build compounds using sweets, jelly tots and jelly babies (See Appendix XXII). After building these compounds the learners could eat the sweets. The compounds and reaction assignment was a Whole Brain® learning task. The first instruction was that the learners should use toothpicks and jelly tots to build the molecules (C and D quadrant). A table was drawn listing (B quadrant) the molecules. In an adjoining column the learners had to draw (D quadrant) a diagram of the molecule and in the third column they

had to write the element or compound (B quadrant). The second part of the learning task included equations (A quadrant). The learners had to balance the equations and then use the jelly tots and toothpicks to build the listed (B quadrant) equations. In the adjoining column the learners had to draw (D quadrant) the reaction. She stated that she tried to facilitate 'entertaining' (experiential learning) tasks, for example tasting food or testing the fats to see if they left an oily or fatty stain. She did much practical work, for example the heart rate test (as mentioned earlier in this chapter).

Octavia demonstrated innovative and self-discovery (D quadrant) facilitating of learning, and also capitalised on her preference in the B quadrant by thoroughly planning the programme of learning. She remarked that she thought of the learners (C quadrant) when setting the assignments. Thus, she incorporated structure (B quadrant) coupled with social experience (C quadrant) when designing assignments; and this underpinned her double dominant lower or limbic mode of preference. She stipulated that she was well organised and never unprepared for a lesson and planned ahead (B quadrant).

Octavia's designing of innovative tasks underpinned the findings of her HBDI®; she capitalised on her primary C quadrant preference as well as her secondary B quadrant preference. Her double dominant lower thinking preference was observed during the preliminary interview as well as the teaching practice observation. She conducted much research and communicated with peers at other schools using her aptitude for peoples' skills to establish a community of practice. I observed that Octavia capitalised on her D quadrant thinking preference to be innovative.

Lana stipulated that she did not need the laboratory or 'fancy things'. She used whatever she could find to make the concept real, thus initialising experiential learning (C and D quadrant). Lana's thinking preference and approach to finding innovative ways to facilitate learning, reminded me of the Dadaists who used whatever objects they could find to create artworks.

Lana did not do thorough planning (B quadrant) for her Saturday practice; however, she fully capitalised on her D quadrant and I surmised that because she was challenged at Wilberforce High School to adhere to the timetable and focus on academic achievement, she was able to explore the hidden possibilities (D quadrant) in having more freedom to experiment (D quadrant) on Saturdays. She made use of spontaneity, free-flow and playful ways to revise the topics that learners covered in their schools. She would, for example, stage a treasure hunt (See Appendix XX) and she stated that the feedback that she received from the learners was very positive, some of them stating that it was the best session they had ever had.

Another interesting learning experience that Lana facilitated was when the learners from her Saturday teaching practice had to calculate the slope of work energy and power. They did not have rulers. Lana made use of collaboration and experiential learning (C and D quadrant) and the learners responded by using their shoelaces to form the angle so that they could do the calculation (See Appendix XX).

Lana stated that due to time constraints and the academic expectations at Wilberforce High School, she was not able to explore more free flow and spontaneous ways to facilitate learning.

However, her Saturday teaching practice implemented more innovative ways of facilitating learning.

Helena assisted the learners (C quadrant) when facilitating learning, although she underscored her belief that Science is a 'structured' subject, she felt it was necessary to motivate the learners. She visualised (D quadrant) accommodating the C and D quadrant more during the facilitating of learning. She stipulated making use of dance movement (C quadrant), a funny acronym (B and C quadrant), analysing a problem by using De Bono's (2000) *Six Thinking Hats* or showing a video (D quadrant) when facilitating learning so that the learners would remember theory better. With regard to Chemistry and Physics she demonstrated (B quadrant). Helena showed that she had taken up the role to become flexible and use her least preferred D quadrant and to think of innovative ways to accommodate learners who did not share her thinking preference.

Helena described when she taught acids and bases she did a physical titration experiment (A quadrant), played a video and used an animation (D quadrant) of molecules (the wiggling molecules App) inside titration reaction and then the learners had to do a calculation (A quadrant).

Another example that indicated Helen's innovation to become more flexible in her thinking preference was a practical session where the Grade 10s could choose any mode of transportation, except a car (See Appendix X). She observed how innovative the choices were, for example a hot air balloon, drone, speedboat and one learner chose Harry Potter's broomstick (Rowling 1997). The aforementioned assignment gave the learners an opportunity to explore hidden possibilities and experience a bit of playfulness (D

quadrant). The learners had to set a graph (A quadrant) and set a question paper (B quadrant) using their chosen mode of transportation. The learners took the initiative to be innovative.

In the previous year Helena tried to accommodate learners who did not share her preferred thinking style. She capitalised on her preferred quadrants by being 'very efficient' (A and B quadrant). She indicated that she saw the finer detail (B quadrant) and challenged the learners to do the same. Helena said that since she knew what her HBDI® thinking preference was she was more aware of the different thinking styles and she challenged herself to find another innovative way, for example showing the 'big picture' (A quadrant) before she started with the detail (B quadrant).

When the fieldwork commenced Helena took up her role as a professional self-regulated learner. She showed initiative: despite initial reserves, she challenged herself to accommodate the thinking styles that differed from her double dominant left thinking preference. Helena especially capitalised on incorporating the D quadrant thinking preference, designing discovery activities; for example, the transportation activity and showing the learners the 'big picture' first before she commenced doing the theoretical detail.

The effective facilitating of learning that Brynhildr incorporated since they started the fieldwork was to link Algebra to Graphs, thus visually showing the algebraic problem on a graph (See Appendix II), making it visually (B and D quadrant) accessible for the learners. She pointed out that the learners immediately comprehended on seeing the connection between the two. She made use of a program such as Autograph (See Appendix II). The program includes three operating modes, namely Dimensional statistics and probability, Dimensional graphing, coordinates,

transformations and bivariate data, and Dimensional graphing, coordinates and transformations (Autograph Maths 2015). In Trigonometry she used a visual program. She deemed it important to 'struggle with them on the board.' Lastly, she underscored (as seen in the Preliminary interview) the importance of her SmartBoard and she noted that she would be lost without it.

Brynhildr was challenged to be flexible and to think outside her primary preference, the A quadrant. From the fieldwork it became apparent that she incorporated more visual sources (D quadrant) and together we looked at how to include real-life examples of parabolas (discussed earlier in this chapter).

Brynhildr indicated that the challenge for her was to be more visual and to link the problems to real-life ones. She said that she tried to be more systematic (B quadrant) on the board. She acknowledged that she was very verbal and that her teaching practice was teacher-centred instead of learner-centred. She confirmed her intention to involve the learners more (C quadrant); however, she found it challenging due to time constraints. Thus she acknowledged that she 'lectured' (A and C quadrant) very often.

Despite Brynhildr's strong logical (A quadrant) thinking preference she challenged herself to be more flexible in her teaching practice by expanding her thinking to the D quadrant and showing more visual and real-life examples (Appendix XXIII) as well as involving the learners (C quadrant) more during the facilitating of learning.

Table 35 (page 278) provides an overview of the innovative assignments designed by the participants to accommodate different thinking preferences. Some of the assignments were designed to incorporate more than one thinking preference.

	A quadrant	B quadrant	C quadrant	D quadrant
Kypris	Challenging Mathematical problems to solve Logic and formulas	Architecture: bridges Patterns and sequence	Car dealership – budget for a car Collaboration	Patterns and sequence. 3D cone: parabolas Visual examples: bridge
Alexander	Technical case discussion: Jacob Zuma's Jan van Riebeeck remark (Smith 2015)	Reading Systematic research Time management: Post-it activity and reflection (C quadrant)	Media analysis Write letter to Jacob Zuma Classroom: conference room Cooperative learning	Cartoon analysis Brainstorming ideas
Heidi	Memory game Puzzle Vocabulary	Flipped classroom. Fridays: 10 mark tests Drawing (D quadrant) and writing essay on drawing Colour board game – memorising colours	People oriented discussions Motivates learners: choice of assessment Family game Hangman Simon Says German bakery WhatsApp group	Drawing faces Crocodiles and Monkeys game Colour board game
			Experiential learning	
Octavia	Balance equations Formulas	Practical: measure heart rate before and after running	Eat sweets after compounds have been built Practical: run; 'hands-on' Cell rap song	Building compounds of balanced equations 'Fun activities'
			Experiential learning	

	A quadrant	B quadrant	C quadrant	D quadrant
Lana	Calculations Formulas	Calculate the slope of work energy and power - learners used shoelaces to form angle	Treasure hunt Rap song Amazing Race Experiential learning	Interactive, spontaneous; Free flow Designing a board game
Helena	Calculations. De Bono's (2000) *Six Thinking Hats* Physical titration experiment Setting a graph Formulas	Practically demonstrate: Chemistry and Physics Funny acronym De Bono's (2000) *Six Thinking Hats* Set a question paper	Dance movement Experiential learning Funny acronym De Bono's (2000) Six thinking hats Reflecting on examination	Imagine transportation Mind Map De Bono's (2000) *Six Thinking Hats* Video animation Wiggling molecules
Brynhildr	Logic and formulas	Systematic explanation	Involve learners	Visual real-life examples

Table 35: Accommodating the different thinking preferences

4.3.8.4 How the professionals dealt with challenges

Two questions probed the challenges experienced by the professionals as well as how they responded to these challenges. They formed part of the qualitative data set and promoted reflecting on the professionals' teaching practices as part of their action learning process.

These questions were posed:

- 'What did you find challenging?'

- 'How do you propose to respond to the challenges that have arisen?'

Five codes (Table 36 page 282) were identified regarding the challenges that the professionals faced. The professionals' responses to these challenges were coded and are discussed in the next section, 4.3.8.4. The answers were quite varied, incorporating just a few similarities between the professionals. Kypris found the lack of technological support challenging and pointed out factors such as an unreliable Wi-Fi connection and outdated software leading to frustration rendering an inability to integrate technology more effectively into her teaching practice.

Three professionals felt that the learners were non-responsive during the facilitating of learning and they were not self-regulated. Heidi stated that some learners failed to take responsibility for their own learning. Alexander ascribed the non-responsive nature of the learners to the stereotyping of Life Orientation as a subject in which they could take a 'break'. Alexander was preoccupied with creativity, finding it difficult to involve the learners. Contrary to Heidi and Alexander's experience, Octavia was challenged by the learners when she joined Wilberforce High School. She assumed that the learners challenged her by being non-responsive and not involved in her teaching practice due to the fact that she was new to the school. Octavia's objective was to remain passive, even if some learners or parents confronted her.

Helena found it challenging to accommodate the different thinking preferences in her teaching practice and simultaneously be able to complete the syllabus due to time constraint. Time constraints were a real challenge for Helena and Brynhildr as they mentioned it

during the preliminary interview more than a year earlier. Alexander noted that he saw the Grade 9 learners only once a week.

Lana professed that creativity was her top priority. She pointed out that when she started to work at Wilberforce High School she was very creative; however, her colleagues (and she did not mean this in a derogatory way) were so structured (A quadrant) that they had finished with their preparation (B quadrant) before Lana did. She felt that the organisation and structure (B quadrant) stilted her to conform and weakened her creativity. In her Saturday teaching practice she was the 'creator of my own classroom, architect of my lesson'.

It is interesting to note that Lana and Helena were in the same department. If one looks at their HBDI® results (mentioned earlier in this chapter) Lana's preference code is 1221 and Helena's preference code is 1122. Lana has an upper (or cerebral) double dominant thinking preference and Helena has a double left mode thinking preference. They both share a dominant thinking preference in the A quadrant. However, Lana's primary thinking preference is the D quadrant and Helena's is the A quadrant. Helena's secondary preferred thinking preference is the B quadrant whereas Lana extends her thinking preference to the B quadrant when she is under pressure and accommodating her peers. She probably feels under pressure because the other members in the Physical Science department have a 'traditional thinking preference' as opposed to hers. However, this is a stereotype if one thinks of Albert Einstein who also did not excel in Mathematics when he was at school and of Nicola Tesla who capitalised on their D quadrant thinking preferences. Therefore I propose that they should, as a department, become more aware of one another's thinking preferences and not only see it in the context of their teaching own

practice. As a department they should capitalise on the fact that they represent a diversity of thinking preferences.

Response / Names	Technology	Non-responsive learners	Accommodating thinking preferences	Preoccupied with creativity	Time constraints
Kypris	☑				
Alexander		☑		☑	☑
Heidi		☑			
Octavia		☑			
Lana				☑	
Helena			☑		☑
Brynhildr					☑

Table 36: The codes delineating the challenges faced by the professionals

4.3.8.5 The professionals' future visions

The last question that was asked during the semi-structured interview probed the professionals' future (D quadrant) vision for their teaching practice. The codes that were identified are seen in Table 37 (page 289).

The wording of the last question was as follows:

- 'How do you envision your teaching practice to change over the next year?'

Once again from the diversity of the answers it is clear that the multiple realities of the professionals underpinned a constructivist theory. The professionals constructed meaning from the challenges that they experienced in their reality, leading to multiple answers to address the aforementioned challenges. Ten codes (See Table 37 page 288) were identified in how the professionals proposed to respond to the challenges and their future vision as part of their action learning process. Some of the solutions envisioned by the professionals were coded under the four quadrants to obtain a better understanding of their reaction under pressure.

Kypris asked me to support her with some of the technical issues; she also wanted to continue to be part of the professional development programme to gather a better understanding as to what extent she could incorporate technology in her teaching practice, underpinning her desire for lifelong learning. Furthermore, she preferred to make use of her iPad, as opposed to installing new software on her laptop. She postulated that she would start on a 'small' scale but at least she would make an effort to start.

Kypris wanted technology to support her own knowledge. She pointed out that each department should collaborate and each teacher should select a section to prepare and share with peers. She was of the opinion that collaboration (C quadrant) would address the time constraint that they experienced in Mathematics.

Kypris was flexible in her thinking preference by using her least preferred (B quadrant) to think through the challenges and proposing that the challenges be resolved in a structured (A quadrant) manner. Her response to the challenges underpinned the findings of the HBDI® (see 4.3.4.2) that when she is under pressure she extends her thinking preference to the C quadrant (proposing

collaboration) and as stated previously, capitalises on her rational thought by talking through the challenges.

Alexander's objective was to engage the learners and motivate (C quadrant) them to work. He believed the teaching process is simple: from a teacher-centred facilitating learning to learner-centred learning where the learners take responsibility for their own learning, generating their own topics and becoming self-regulated.

Alexander's response was quite different from that of Kypris. He was thinking in terms of his primary C quadrant preference and he identified the challenges he experienced of his planned innovation (D quadrant) to have a more learner-centred teaching practice. Alexander becomes more flexible in the D quadrant when he is under pressure but suggested solutions relating to his dominant C quadrant, despite the fact that the C quadrant recedes slightly when he is under pressure. His suggested solutions and future vision also underpin his learning areas, more specifically Life Orientation, where the learning is based on a learner-centred approach.

Heidi found that learners were not always focused and she urged them to be more self-regulated, especially when completing assignments, and to take responsibility for their own learning. To motivate the learners she introduced writing shorter tests more regularly. She underscored the fact that the learners should take responsibility for their own learning.

Heidi initially indicated that she did not know what she would do since it depended on the type of learner that she had in her teaching practice. This response showed that she found it difficult to think in terms of the future (D quadrant) but she quickly rebutted

and said she would probably use more visual sources (D quadrant) and try to accommodate the learners.

Heidi's main challenge was similar to Alexander's. It is interesting to note that both of them have a high C quadrant thinking preference and Heidi becomes more dominant in the C quadrant when she is under pressure (see 4.3.4.4). Both of them are concerned about the learners not taking responsibility and capitalising on their learning. In Alexander's case the learners were not taking Life Orientation seriously and they were not self-regulated; this resulted in Alexander becoming more authoritarian in his teaching practice.

Octavia stipulated that she would take the challenges one at a time and deal with these challenges as they occurred. She felt that it was important for personal growth. She wanted to incorporate more Whole Brain® activities and learning preferences. She specified that she wanted to use dance and music (C quadrant) to facilitate the learning of muscular and skeletal movement. She stated that she had many ideas, capitalising on her D quadrant thinking preference and continuing with her action learning cycle.

Despite being challenged by some learners, Octavia remained positive and she actually regarded these challenges as part of her personal growth and learnt from them. She followed a constructivist approach and wanted to make sense and construct meaning of what she experienced – known as 'radical constructivism' (Slabbert et al. 2009:57).

Octavia's response underscored the analysis of the HBDI® adjective pairs (See 4.3.4.5) and how her thinking preference shifted when she was under stress. Her B quadrant became more dominant and her primary C and D quadrant thinking preferences receded.

Lana felt that she might function better in a 'down and out school.' She was also of the opinion that the more planned, controlled and sequential (B quadrant) things are the less creative she became. Thus she proposed that the best solution at that stage was to have one grade that she could teach on her own so that she could have more freedom. However, she questioned herself and felt that it might be a 'selfish' solution. This response is on par with the HBDI® (see 4.3.4.6) analysis where Lana's C quadrant thinking preference recedes when under pressure; thus she wanted to 'isolate' herself and either go to another school or to teach a grade on her own.

Lana acknowledged that every member of their department has his or her strengths; thus they came to an agreement that she would take one grade on her own. She felt that her self-confidence was weighed down and that her way of thinking was 'too different.' Regarding Lana's future vision she was uncertain whether she could answer the question in advance. She acknowledged that it was similar to her teaching style, 'not planned' (D quadrant).

Lana's thinking preference is being challenged by implementing increased administrative efficiency (B quadrant) assuming that it also has to do with some of the dilemmas experienced at Wilberforce High School, for example the change in policy (therefore the increase in administration) and time constraints. The observation made by Herrmann (1996:44) that people with quite a considerable difference in their thinking styles often find it difficult to understand one another, might explain the challenge that Lana was experiencing in 2015. The Physical Science department met and Lana expressed her concerns about her creative block. As a department they made the decision to accommodate Lana by giving her a grade to facilitate learning on her own. It shows that as a

community of practice the other members of the department became flexible in their thinking preferences, showing understanding for the pressure that Lana was under and they decided to accommodate her.

Helena capitalised on her secondary B quadrant thinking preference by prioritising what she deemed to be the most important. She postulated that she needed to make an executive decision; for example, when she had to do a demonstration or an explanation of theory. Her conclusion was to reflect upon the matter and to determine which one would accommodate most of the learners in the endeavour to facilitate Whole Brain® learning.

Helena envisions that she wants to use her iPad for more than just videos and Apps. For example, she wants to use real time. When a student makes a mistake she wants to be able to facilitate the learning and support him or her. This vision is similar to what Brynhildr does with her learners. As mentioned earlier in this chapter, Brynhildr uses her iPad to respond quickly to queries from learners. Thus, both of the professionals use the iPad as part of their community of practice. Helena's suggested solution underpins (See 4.3.4.7) the HBDI® finding that her B quadrant becomes more dominant when she is under pressure. Her endeavour to support the learners in real time also relates to the extension of her C quadrant when she is under pressure.

Helena mentioned that she also wants to improve her teaching style by continuing being part of the professional development programme and continuing being a professional self-regulated learner. I suggest that Lana and Helena should actually form a community of practice, and although they are already collaborating, they should both aim to become more flexible in their thinking

styles to accommodate each other. They should include other members from their department and capitalise on their Whole Brain® thinking preferences to introduce innovation and transformation in their individual teaching practices.

Brynhildr, like Alexander, does not believe that she can address this challenge of time constraint. In terms of future vision, Brynhildr is of the opinion that it would depend on whom she teaches. She specified that the younger learners could be more innovative although she has not taught juniors for a while. She noted that with regard to the seniors she used more visual sources; otherwise no significant changes were made.

From Brynhildr's response it was clear that she was more willing to explore new possibilities (D quadrant) with the Grade 8 or Grade 9 learners than with the senior ones. This was mainly due to the time constraint that was Brynhildr's biggest challenge. Her HBDI® analysis (See 4.3.4.8) corroborated her response to the challenge and future vision by looking at the challenges as a problem to solve (A quadrant) and using a practical (B quadrant) approach when thinking through ideas (A quadrant) for solutions. She did indicate some flexibility in the D quadrant when she declared that she could explore more innovative teaching methods for the Grade 8 and Grade 9 learners.

Response / Names	Lifelong learning	Self-regulated learners	Engaging learners	Collaboration	A quadrant	B quadrant	C quadrant	D quadrant	iPad	Whole Brain® application
Kypris	☑			☑			☑		☑	
Alexander		☑	☑					☑		

Response / Names	Lifelong learning	Self-regulated learners	Engaging learners	Collaboration	A quadrant	B quadrant	C quadrant	D quadrant	iPad	Whole Brain® application
Heidi		☑			☑			☑		☑
Octavia										☑
Lana								☑		
Helena	☑					☑	☑		☑	☑
Brynhildr								☑		

Table 37: The professionals' future visions

The participants' responses to resolve challenges and how they envisioned their teaching practice in future corresponded with the quantitative analysis of the HBDI®. Thus the qualitative data from the semi-structured interview supported the findings of the HBDI®.

4.4 SYNTHESIS

In this chapter I probed the epistemology of my Action Research investigation. I chose the C quadrant to represent this chapter, since it was an experiential opportunity leading to discussions and group interactions, but it also led to emotional involvement, my ill health and some of the professionals who became ill, or who were involved in motor vehicle accidents; one colleague and a dear friend passed away and it had a profound effect on our Wilberforce High School community. Despite all these challenges new dilemmas that were experienced were, for example, uncertainty about the iPad program, time constraints, 'technical difficulty' and a change in school policy that all had to be overcome. The aforementioned made me recall *Friends* (Crane and Kauffman 1994-2004) and I

decided to use it as another metaphor for this chapter as it underpins the C quadrant. I experienced how we as a community stood together, despite all the challenges and we supported one another throughout. Fortunately, Action Research makes provision for deviations that might occur during the investigation and fieldwork and it opens up the potential for new innovative ideas emerging, underpinning the statement made by McNiff and Whitehead (2009:15) that the process of 'rigorous action research methodology' leads to the 'generation of living theories practice'. In Chapter 5 I will come to a final conclusion regarding this study and comment on the results and the deviations of the results.

CHAPTER 5
CONCLUSIONS

5.1 INTRODUCTION

Action Research does not suddenly stop in mid-cycle, but is rather a continuation of reflection, innovation and discovery underpinning MacNiff and Whitehead's (2009: 20) statement that 'this becomes your living theory of practice'. Although this chapter presents the concluding remarks to this study, my Action Research cycle will continue and I will immerse myself further in formulating new ideas and more cycles will emerge from my professional practice. The cyclic process of Action Research reminds me of galaxies rather than the pitfalls of black holes as postulated by Steven Hawking, but most interestingly it is similar to the birth of a star.

Herrmann (1995) uses the metaphor of the birth of a star, and this actually got me interested in what type of 'stargazing' is done today, and I thought of Hollywood. A few years ago a friend sent a picture of a collage of photographs via WhatsApp relating to a quote of Abraham Lincoln (1809-1965): 'You can have anything you want if you want it badly enough. You can be anything you want to be, do anything you set out to accomplish if you hold to that desire with singleness of purpose' (Chang 2006:32). The anonymous artist of the collage made a compilation of photographs of Johnny Depp, underscoring the statement 'you can be anything you want to be' emphasising that Depp is such a flexible actor that he can play any role. Photographs of different characters were used in the collage. Originally not wanting to be an actor, Depp was more interested in playing the guitar; however, after starting his career in *A Nightmare on Elm Street* (Craven 1984) he shot to fame in *21 Jump Street* (Cannell & Hasburgh 1987-1990) and soon became a teen idol.

Depp wanted to break with that image and decided to star in the offbeat, sometimes referred to as 'B-rated' *Cry Baby* (Walters 1990) and later a breakaway role as *Edward Scissorhands* (Burton 1990) that paved the way to creative collaboration with Tim Burton. Johnny Depp personifies the goal that I set for myself, not to be trapped in my comfort zone and thinking preferences, but to be able to emancipate – typical of Action Research and similarly described by Zuber-Skerritt (1996:83) as 'emancipatory when it aims not only at technical and practical improvement, the professionals' transformed consciousness, and change within their organisation's existing boundaries and conditions, but when it also aims at changing the system itself or these conditions which impede desired improvement in the organisation'.

My emancipation was firstly to be liberated from my constraints and become a Whole Brain® thinker, being able to apply Whole Brain® facilitating of learning on a bigger scale than my own teaching practice and applying it to the professional development programme. Thus, just as an actor has to take on the role of many different characters, I had to be able to take on the role of mentor and continue to maintain my teaching practice, but also be a professional friend for my mentees.

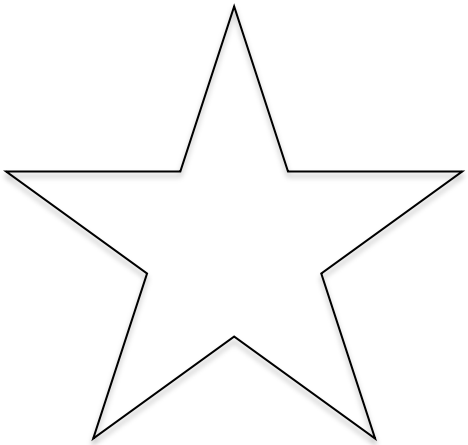


Figure 41: What is stargazing in 2015?

Actors are able to portray a diversity of characters, due to their keen insight into human nature (C quadrant). The best actors (like Johnny Depp) and actresses are able to portray a variety of roles in such a convincing fashion that they actually portray their thinking style flexibility. Similarly, we must aspire and reach for the stars to change and become more flexible in our thinking style to accommodate people whose thinking styles differ from our primary thinking preference.

Herrmann (1995:319-320) illustrates what change can mean by the introduction of a personal computer to someone who is used to a typewriter. He notes that even the 'most adaptable people resist certain types of change'. What I find interesting is that this is exactly what I experienced while conducting this study. When the announcement was made that a group of people from Wilberforce High School were selected to initiate the introduction of the iPad as a teaching tool, assuming that by now everyone was computer literate and the typewriter a distant memory of twenty years ago, I made the most of the opportunity. Some professionals had reservations about the incorporation of the iPad in their teaching practices.

Assiduus usus uni rei deditus et ingenium et artem saepe vincit (Cicero 106 BC - 43 BC) means that constant practice devoted to one subject often outdoes both intelligence and skill (Latin Phrases 2015). Cicero has a very valid point, namely that if one strives to learn more, and does not merely focus on rote education of the intellect, one will develop skills. Herrmann (1995:320) recommends that if one is faced with change, one should become creative and utilise all four quadrants to analyse and brainstorm alternative ideas or as he later proposed, do *process storming* (Herrmann,

1996:129). It is from the aforementioned that I postulated the initiative to commence with this study.

5.2 SUMMARISING THE MAIN FACTORS

In this Action Research study I wanted to contribute to my own professional development as well as the professional development of my community of practice by introducing Herrmann's Whole Brain® model and facilitating the principles of Action Research to promote the scholarship of teaching and learning. In the true nature of the Action Research paradigm a new cycle emerged from my original Action Research cycle (Du Toit 2009), namely the ICT initiative at Wilberforce High School to introduce iPads into teaching practice. As mentioned earlier in the study, I was selected to be the peer mentor and I had to design a professional development iPad program to support professionals who were selected to join the ICT initiative, but I was granted permission to incorporate Whole Brain® facilitating of learning as long as it did not infringe on the time set out for integrating the iPad into teaching.

Calhoun (2002:19) stipulates that data gathered during the Action Research process does not only guide the transformation of the teaching practice but leaders emerge from the community of practice. These 'transformational leaders' (Calhoun uses the construct *leader*, but for the purpose of this study I am using *transformational leader*) set examples through the actions that they take during the Action Research process (See Chapter 4). According to Calhoun (2002:19) promotes the use of multiple data sets and postulates that data gathered at a school can also be used in correlation with 'external knowledge base' as sources to continue with the process of assessing the effectiveness of teaching practices. Resonating with Calhoun's description of the construction

of knowledge, I found that the professional development programme not only underpinned my role as mentor and co-learner, but it also transpired that professional self-regulated learners emerged from the professional development programme. I reflected in my journal that the professionals collaborated and explored (D quadrant) possibilities during the experiential opportunities (C and D quadrant) during the workshops: for example, when we looked at the function of the camera they collaboratively worked together, taking pictures of one another and making videos. In one workshop Brynhildr (A quadrant thinking preference) together with one of the non-volunteer professionals determined how to import a photograph in Pages while I was busy facilitating Kypris and Heidi's inserting tables. Professionals, for example Brynhildr and Helena, who have an A and B quadrant thinking preference were therefore challenged to become more flexible in their C quadrant to learn in a small group.

By engaging the professionals in giving them hands-on (C quadrant) experience of practising skills (B quadrant) with Apps, such as TeacherKit, iTunes and Dropbox they were constantly challenged. We had technical discussions (A quadrant) about the practical application of the iPad in the Wilberforce High School context. The organisational and administrative (B quadrant) value of the iPad was discussed on several occasions to determine strategies to implement it. During the technical and organisational discussions the professionals with a C or D quadrant thinking preference were challenged. I noticed that the volunteer professionals took responsibility for learning, searching for more Apps that could be used in the classroom. Wilberforce High School called our community of practice 'ICT Champions' with the understanding that we would continue to collaborate with other staff

members to promote the use of iPads, before the roll-out phase commenced.

5.3 ANSWERING THE RESEARCH QUESTIONS

Chapter 4 outlines the empirical research findings and assumptions. An in-depth analysis of the gathered data was conducted. I want to reflect on my primary and secondary research questions to evaluate to what extent these questions have been answered. This is a summative report on the assumptions that were made in Chapter 4.

5.3.1 Primary research question

In the primary research question I attempted to probe to what extent I contributed to the professional development of our community of practice.

- *How can I, as mentor, contribute to the professional development of teachers as a community of practice?*

My initial Action Research vision was to introduce Whole Brain® learning at Wilberforce High School; however, I had to adapt my study to incorporate technology in the teaching practice. When I first proposed Whole Brain® learning at a general meeting I had about ten volunteer professionals. However, obtaining ethical clearance took longer than anticipated and being appointed the iPad pedagogical facilitator made me rethink my original proposal. It reminded me of Apple's 'Think Different' commercial of 1997 that stated: 'The people who are crazy enough to think they can change the world are the ones who do' (Isaacson 2011:v). I did not expect to change the world; I envisioned making teaching practice more efficient by using an iPad and introducing Herrmann's Whole Brain®

facilitating of learning. The professionals started utilising the administration Apps, for example TeacherKit; and professionals such as Helena are using AirServer to project the wiggling molecules App. Brynhildr, Heidi, Helena and I have established WhatsApp groups (C quadrant) for our learners as a quick mode of communication but it is also a platform for collaboration.

During writing down my reflections after each session I came to the conclusion that I was not only a mentor of professional learning, but that I was also a co-learner, as postulated by Gravett (2005:29) and stated in Chapter 1. I used my new knowledge to evaluate and construct meaning in my professional practice and acted on the revised vision by attending the iPad EdTech Summit in March 2015. Furthermore I needed a better understanding of the professionals' thinking preferences to plan further one-on-one peer mentoring sessions. By observing the professionals in their teaching practices I was able to determine what thinking preferences were focused on during the facilitating of learning. My findings were underpinned by the analysis of the preliminary and exploratory interviews.

Thus my adaptability to change the new cycles that emerged from my Action Research process equipped me to engage better with the professionals and support their iPad needs, and provide them with a new view of facilitating learning by incorporating Whole Brain® facilitating learning.

5.3.2 Secondary research questions

For the first secondary research question I wanted to explore to what extent the facilitating of Whole Brain® mentoring would lead to transformation:

- *How can the facilitating of Whole Brain® mentoring contribute to transforming a mentoring and teaching practice?*

Initially I assumed that the introduction of Whole Brain® facilitating of learning would be done in the early stages of the fieldwork; however, this would not be the case. I also assumed that the professionals would be able to grasp the facets of the iPad quickly, especially when they attended the iPad coordinator's basic iPad workshops. I introduced the construct of Whole Brain® thinking during the early stage of the fieldwork, but we have explored the possibilities of Whole Brain® facilitating of learning in more detail since October 2014.

During the fieldwork I realised that I needed to become more fluent in the B quadrant. When I filled in the 2015 HBDI® survey (See Chapter 4) it came to light that my B quadrant had receded slightly from the 2005 result and I had become more flexible in the A quadrant. I ascribed it to a career change and the expectations at Wilberforce High School. As part of my own Action Research cycle and new knowledge regarding assessment and the theory of my subject I focused more on fact-based information and facilitating of learning as well as capitalising on my D quadrant thinking preference to synthesise the information and provide the learners with a holistic overview of the content. Wilberforce High School is (as mentioned by my peers, for example Lana in Chapter 4) academically-driven, striving to instil academic rigour into the learners. Therefore I needed to become more factual and critical (A quadrant) of my own teaching practice to optimise the learning experience (See 4.3.7.1) for my learners and provide them with the scaffolding to obtain high marks. Thus I also had to become a more flexible Whole Brain® thinker in my mentee practice by consciously extending my flexibility to the B quadrant to plan and outline the

one-on-one peer mentoring sessions systematically. I also had to adhere to certain timelines, for example setting aside three sessions (depending on the professionals' needs) to explore ExplainEverything and incorporate a practical hands-on session (C quadrant) in the first session and systematically providing more time for practising the skills (B quadrant) to become proficient in using this App. With regard to the professionals, as analysed in Chapter 4, it became evident that some were already flexible in their thinking preferences; however, they were now aware of Herrmann's Whole Brain® model and they took up the responsibility for transforming their own teaching practices to accommodate learners whose thinking preferences might differ from their own. Heidi (preference code 2111), Lana (preference code 1221) and Octavia (preference code 2112) were identified as being flexible in their thinking preferences.

Heidi and Octavia have years of experience and they both collaborate with other teachers and do research to come up with innovative ideas. Lana's work with disadvantaged learners despite a lack of resources forced her to capitalise on her D quadrant thinking preference and set assignments, for example a 'treasure hunt' (C quadrant) to obtain greater insight into Newton's laws (Appendix XX). The assignments that the professionals set for the learners, for example Heidi's variety of games (See Chapter 4) were divergent and accommodated different thinking styles. The colour memory game that is played with small groups makes provision for the C quadrant and it also provides practice (B quadrant) to memorise the colours. Octavia makes use of many hands-on experiences and many of these learning tasks incorporate food (See Appendix XXII). They both capitalise on their preferred C thinking preferences, providing assignments that incorporate sharing ideas as well as

their D thinking preferences by motivating learners to visualise and either draw the image or construct compounds with sweets.

The discovery of Lana's (See Chapter 4) Saturday teaching practice was a *Eureka* moment for both of us. She was under the impression that what she does on Saturdays is not relevant to this study; however, where her thinking style is challenged at Wilberforce High School, she capitalises on her preferred A quadrant and D quadrant thinking preferences during her Saturday teaching practice. She is innovative and explores new ways of facilitating learning.

Lana's learners take part in experiential learning (C and D quadrant), playing games or incorporating a rap song motivating learners to collaborate and be part of cooperative learning (C quadrant); for example, the learners tied their shoelaces together to measure the angle and they then took part in a technical discussion (A quadrant) about calculating the angle in order to complete structured tasks (B quadrant). Lana facilitates Whole Brain® learning during her Saturday teaching practice workshops; however, she is constrained at Wilberforce High School due to time constraints and the belief that the learners may not achieve the expected academic results. However, her experience that initially was an 'obstacle' (Gravett 2005:9) was challenged during my facilitating of Whole Brain® learning by exploring the possibilities of the ExplainEverything App. Lana has taken responsibility for her own learning and she envisions transforming her teaching practice at Wilberforce High School by incorporating her SmartBoard more when facilitating learning.

Helena (preference code 1122) also believed that she could not be creative and she also did not want to be challenged to 'make drawings' as she stated during one of our one-on-one peer

mentoring sessions. However, during consecutive one-on-one peer mentoring sessions and the introduction of new knowledge and especially after the completion of the HBDI® survey, Helena took responsibility for her own learning and transformation by becoming a self-regulated learner and finding subject specific Apps, for example wiggling molecules to use in her teaching practice. This is quite significant in Helena's action learning process, since she now incorporates more visual material in her facilitating of learning to accommodate the D quadrant thinking preference. During her action learning she reflected and decided to draw a mind map (See Appendix VIII) to accommodate the D quadrant learners. Drawing a mind map was challenging for Helena and she asked me to help her so that we could collaborate in an innovative way to present the mind map next year by using an App to design it. This was an important part of Helena's self-discovery and I postulate that it initialised her flexibility in using her least preferred D quadrant, indicating the start of a new cycle in her action learning process.

Kypris (preference code 1211) and Brynhildr (preference code 1221) created their own community of practice. I liaised individually with each and during experiential learning (C and D quadrant) opportunities when we explored the practical application of ExplainEverything. We focused on accommodating learners with a C and D quadrant thinking preference, incorporating real-life examples of architecture and providing them with the opportunity to work in pairs or small groups to collaborate and find solutions to the Mathematical problems (A quadrant). The practical one-on-one peer mentoring sessions incorporated acquiring skills through practising (B quadrant) working with Apps, for example ExplainEverything, Math quizzes, SciKey, TeacherKit, Dropbox, Grafio, Notepad+ and Pages. We also had technical discussions (A quadrant) on how these Apps could be used in teaching practice, for

example using Notepad+ to design parabolas that the learners could use for calculations. During Kypris's planning to facilitate of Whole Brain® learning we realised the potential of using real-life examples to construct meaning in Algebra, thus Kypris looked for architectural examples to include in her facilitating of learning so that learners with a D quadrant thinking preference as well as a B quadrant thinking preference could be accommodated.

I shared the above-mentioned exploratory discoveries (D quadrant) of using ExplainEverything and real-life parabolas examples made by Kypris and myself with Brynhildr. We further explored the possibilities (D quadrant) of how to accommodate the C and D quadrant thinking styles in constructing meaning from parabolas, but still incorporated A quadrant and B quadrant thinking; we used the Notepad+ App. There are visual sources on parabolas in real-life on the Internet, but Brynhildr wanted to have the freedom to use her own visual examples. She wanted to take real-life examples and superimpose them on graph paper so that the calculations could be done via the App. The solution was App Smashing. A real-life example would be taken (See Appendix XXIV) and the background deleted with the EraserFree App. I found Notepad+ App that has a variety of graph paper options, for example, Axis Graph paper that Brynhildr wanted to use as background. Kypris and Brynhildr collectively have years of experience. They are now collaborating (as seen in Chapter 4 when they collaborated to answer the observation sheet) and attending the professional development programme to obtain new knowledge so that they can transform their teaching practice by fully implementing the iPad. Both have taken up the responsibility for their own learning and they are lifelong learners by continuing their learning with regard to changing technology.

Kypris and Brynhildr's incorporation of more real-life examples of practical application of Mathematics was the first step taken for innovation by accommodating the C and D quadrant thinking preferences. Both incorporate more visual examples (D quadrant) and allow the learners to take responsibility for their own learning and give them an opportunity to either explain the solution to the learners or work collaboratively to find the solution (C quadrant). Kypris uses collaboration in certain sections of the work. The next cycle for Kypris and Brynhildr will be to incorporate the iPad fully in their teaching practice and use the Apps that we explored to facilitate learning.

Alexander (preference code 2111) is a novice teacher who capitalises on his preferred C and B quadrant thinking preferences and he is committed to reading extensively in order to find motivational material to use for his teaching practice. At this stage he uses the iPad for administration and research purposes, and is especially impressed with the mobility of the device so that he can work while travelling on the bus. During the semi-structured interview he reflected and stated that he is comfortable with his thinking preferences, therefore choosing History and Life Orientation learning areas to utilise and incorporate his preferred thinking preferences fully. The challenge for him is to extend his thinking preference to the A and D quadrant. When he is under pressure he becomes more creative (D quadrant). In the fieldwork Alexander used various ways to motivate the learners to take actively part in the learning. He uses an inspirational quote that the learners discuss every day as an icebreaker (C quadrant). He also changed his classroom (See Chapter 4) to promote group discussions (C quadrant). The Grade 9 Whole Brain® Life Orientation task (discussed in Chapter 4) was set to introduce the

learners to Ned Herrmann, but also provided an intra-personal investigation to determine what career might suit the learner.

Figure 42 is a composite of the professionals in the peer mentoring practice. The descriptors are those that were chosen when the professionals completed the HBDI® survey.

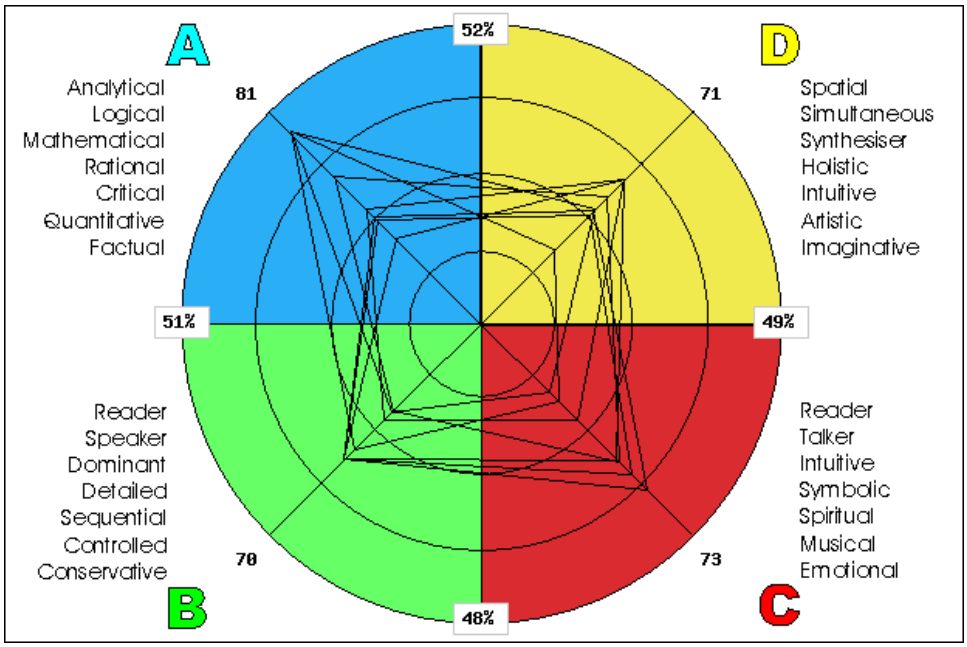


Figure 42: A composite of the HBDI® professionals in the peer mentoring practice

Herrmann (1996:150) is of the opinion that if there is a large enough group in, for example a high school, the composite profiles of the individuals would represent Whole Brain® thinking. If one looks at the small sample of peer mentee professionals (See Figure 42) from Wilberforce High School, it provides a good indication of a Whole Brain® group. Similarly Du Toit (in De Boer et al. 2013:112) postulates that his PGCHE programme (comprising students and colleagues) makes up a composite Whole Brain® Thinking group. The work of Herrmann and Du Toit underpins my objective and vision of creating a Whole Brain® community of practice. During the semi-structured interviews and by using the observation sheets it

materialised that the volunteer professionals would like to continue their scholarship and become Whole Brain® facilitators facilitating Whole Brain® learning, thus continuing with the next cycle in their respective action learning cycles.

The second secondary question that I wanted to probe underpinned my Action Research principles regarding to what extent it would promote a scholarship of teaching and learning:

- *How can the principles of Action Research be applied to promoting scholarship of teaching and learning?*

During the one-on-one peer mentorship sessions we would reflect discuss the needs of the professional's teaching practice and new knowledge to plan to what extent the new knowledge would add to our collective knowledge and each professional's own constructed knowledge to become innovative. I could reflect on the narratives from the semi-structured interviews, immediately probing further, for example Lana's innovative facilitating learning in her Saturday teaching practice and Octavia's future vision to incorporate more Whole Brain® thinking activities, such as dancing and music so that the learners can observe how their muscles work. During further probing in the semi-structured interview it also came to light that Helena introduced reflection (Chapter 4) for her learners in her teaching practice. In reflecting on the feedback provided during the semi-structured interviews I could determine to what extent the professionals relied on reflection. All of the professionals concurred that reflection is an important part of their teaching practice (Chapter 4), but the way in which they reflected differed considerably. Heidi, Brynhildr and Lana reflected on their teaching practices, but did not necessarily write the reflective notes down. Lana kept a written record of her reflection on her Saturday

teaching practice, providing feedback to the organisers. Helena incorporated reflection diligently after each section, either using her Notebook software of the SmartBoard to make notes of what worked and what did not work (See Appendix IX) together with written notes that she filed with the topics completed. She used these reflections when planning facilitating learning of future topics.

The professionals constructed meaning by adding new knowledge of facilitating Whole Brain® learning and the iPad to their own knowledge, evaluating and reflecting how they would be able to apply the new knowledge in their individual teaching practices, for example using TeacherKit to increase administrative productivity (B quadrant). Heidi and Octavia reflected on the assignments that they had given to the learners and determined how much learning had taken place by analysing the marks achieved when assignments were completed or by observing the outcome of the activity; for example, when Heidi (Appendix XXI) gave her Grade 11 class the face drawing activity she observed that it was not as effective as with her previous groups. Heidi and Octavia adapted the assignments or changed them completely. Lana subconsciously reflected on her teaching practice at Wilberforce High School but did not necessarily keep a record of her reflection. She observed what worked well while facilitating learning and might adapt and make some changes for the next class. During her Saturday teaching practice she was more systematic (B-quadrant) and reflected after each workshop to see what worked and what did not work (Appendix XX). She realised that playing games and providing more experiential opportunities worked better and that the learners could complete the worksheets more efficiently. She planned games, for example the Amazing Race or a treasure hunt or incorporated music like a rap song.

Thus the professionals made use of reflection in their action learning process, but they differed in the way that they reflected. Reflection might be done by thinking about the learning and asking the learners about it, for example Heidi, or a more structured form of reflection like Octavia and Helena keeping record of the learning that had taken place. The professionals mostly observed the learning within their teaching practice and looked at the response of the learners. They obtained insight into how thoroughly the learners understood concepts by evaluating the assignments after which they would act to start a new cycle within their action learning process.

A secondary research question that I postulated was to what extent the iPad can be used to facilitate Whole Brain® learning. Although there is a wealth of research currently being done on the use of iPads in schools (See 2.2.7 in Chapter 2), I could find no study being conducted on the use of iPads to facilitate Whole Brain® learning. The research question that I asked is:

- *How can the iPad assist in administering the facilitating of Whole Brain® learning?*

As mentioned before, I had to adapt my original vision and incorporate the use of the iPad to be able to conduct this study. At the time the vision seemed to fit in with my planned Whole Brain® facilitating learning; however, due to some challenges (See 4.3.6 in Chapter 4) that arose it initially seemed as if this secondary research question would not be answered. Due to the characteristic of changeability within the Action Research model and this being an asset-based approach the challenges were overcome. The one-on-one peer mentoring sessions continued preparing the professionals for the iPad rollout. Thus the professionals were fully prepared and

knew exactly which Apps they could use in their teaching practices and to what extent these Apps would support Whole Brain® facilitating learning.

Therefore the professionals' 'needs' (Gravett, 2005:11) had to be respected and they had to be encouraged in my professional development programme as well as the general ICT program (in collaboration with the iPad coordinator) to become independent and self-regulated learners to look at the Apps that we recommended and take initiative to look for other Apps that might be relevant in their subjects. Heidi and Helena both searched independently looking at other Apps to use in their teaching practice.

During the one-on-one peer mentoring sessions the professionals of Wilberforce High School would systematically review relevant Apps in their subjects. The professionals would review these Apps during the peer mentoring sessions and provide immediate feedback or they would download the App and 'play' (C and D quadrant) with it at their leisure and provide oral feedback at our next one-on-one peer mentoring session. Professionals mostly wanted to download potentially usable Apps to evaluate as part of their action learning cycle, and practise, discover and explore (B and D quadrant) new possibilities on their own. A major form of communication and collaboration was our WhatsApp group to inform all the professionals about useful Apps. The afore-mentioned method is similar to Murray and Olcese's (2011:44) collection and analysis of educational Apps. They would review the Apps and categorise them into Means' educational technology groups. I have adapted Means' categories as seen in Table 38 and some Apps fall in more than one category. The ICT professionals and myself are also adding to an existing list of Apps that are shared with other schools as part of the ICT training program initiative. The professionals reported which

Apps were useful directly to me during the one-on-one peer mentoring sessions. If the professional did not find an App suitable, we did not continue to explore that App. For example, Helena did not like the Morpho Booth animation App (D quadrant) and could not envision how she would use it in her teaching practice.

Tutor Apps: Creating and App smashing	
Aurasma	iBooks
Brainstorming	iMindQ
ComicBook!	Mindomo
ExplainEverything	Morfo Booth
EraserFree	Notebook+
Flashcards	Photo Comic Bubbles
Grafio	
Educational exploration	
TED	iTunes U
Khan Academy	
Administrative tool	
Corkulous	Teacherkit
iDoceo	Time
MyTime	Time Management
Sticky	
Slideshow Apps	
ExplainEverything	Keynote
Haiku Deck	PowerPoint
Communication and collaboration	
WhatsApp	iDoceo
Dropbox	TeacherKit
ExplainEverything	
HBDI®	
Sharing platforms	
Dropbox	GoogleDrive
Examples of subject specific Apps	
German	Mathematics
GermanNouns	Math Exponents
German Radio	Math Keyboard
GermanTV	History
Learn German Deluxe	History Battle
Life Science	History Events
MathBoard	Science@VL
MathBrush	SciKey
MathPad	Speakit.tv
Math.Trig	Verb trainer
Mathematics Free Probability Quiz	Wie Geht's

Table 38: An adaptation of Means' educational technology groups

A similar study was conducted by a group of librarians at Ryerson University (Toronto) to see to what extent the iPad can be used for effective time management and academic organisation (Eichenlaub, Gabel, Jakubek, McCarthy & Wang 2011:18). At the time of writing up this study most of the voluntary professionals used Apps, for example TeacherKit or iDoceo for productive time management (B quadrant) and to simplify administration (See Table 38 page 309). The professionals also used Google calendar (B quadrant) and synchronised all their devices (D quadrant). During the final stages of gathering data for this study the iPad coordinator and I continued with technical facilitating of learning (B quadrant), underpinning sequential and self-paced learning by providing time in the workshops or one-on-one peer mentoring sessions for the professionals to explore (D quadrant) the Apps (Table 38).

The technical facilitating of learning at Ryerson University (Eichenlaub, Gabel et al. 2011:21) took longer than anticipated. The technical training at Wilberforce High School also took longer. At Wilberforce High School the iPad one-on-one mentoring sessions and workshops were separated into basic training and peer mentoring subject specific and Whole Brain® facilitating learning. Eichenlaub, Gabel et al. (2011:21) deduced that there was a need for general iPad help and subject specific application. They recommended 'iPad Literacy' drop-in sessions. The iPad coordinator set aside times in her professional practice that were similar to the aforementioned drop-in sessions. I had to facilitate learning for five of these sessions, focusing on the functions and applications of the camera and photographs of the iPad, TeacherKit, iDoceo, iTunes, Dropbox, Pages. As mentioned before, the one-on-one peer mentorship sessions focused on subject specific iPad application and Whole Brain® facilitating of learning.

The subject specific one-on-one peer mentorship sessions were presented in the teachers' free periods. Kypris, Alexander, Heidi, Brynhildr and other non-participants in this study asked for contact sessions during the November 2014 examinations. We had one workshop that Kypris, Alexander and Brynhildr were able to attend and I had on average about three one-on-one peer mentoring sessions per professional in November. Mostly individual one-on-one peer mentorship sessions were conducted in this study. Peluso (2012:127) recommends that students (the construct *student* is replaced with *professional* for the purpose of this study) should be part of 'curriculum development' but for the purpose of this study I looked at one dimension, namely teaching beyond the curriculum at Wilberforce High School.

I have concluded that during the peer mentoring sessions the professionals either individually or through collaboration were able to evaluate which Apps worked best in their own teaching practice, adding to their experience and constructing new meaning. Underpinning my objective of professionals taking up the responsibility for their own learning is the construct *transformative learning*. Transformative learning, as described by Gravett (2005:30) occurs as a result of critical discourse and when the professionals postulate questions and reflect on the new knowledge developing new assumptions and a new way of viewing their reality. This is evident of the constructivist approach followed that formed part of the epistemology of my Action Research.

This study adds to the body of knowledge by complementing the work by De Jager (2011), *Professional development of beginner teachers: an action research approach to mentoring* and Boshoff's (2014) *Professional development of academic staff in private higher education*. My study fills the gap and adds to the construction of

knowledge underpinning constructs of Action Research, professional development and a Whole Brain® community of practice.

5.4 GAPS AND DEVIATIONS IN RESULTS

In this study I experienced the changeability of the Action Research paradigm and explored new possibilities addressing the challenges that arose. Context problems included technical difficulty, for example Wi-Fi connectivity problems, time constraints and the time delay in the roll-out of iPads. The aforementioned challenges were reflected on in my Action Research process and I found solutions, for example buying an extra iPad to continue training as well as a mobile Wi-Fi device. True to the nature of Action Research I intend to continue with my Action Research to transform my mentorship practice as well as transform my teaching practice – acting as role model to my colleagues in a peer mentoring and community of practice setting.

The deviation that I found during the data analysis was the misinterpretation of a few questions on the observation sheet instrument. Most professionals found it difficult to understand; therefore I have to redesign and simplify the instrument to obtain more usable information so that I could reflect on the professional development programme. Fortunately I had databases to base my conclusions on, preliminary interviews, observations and personal reflections made after the one-on-one peer mentoring sessions and workshops, observations of the professionals' teaching practices and the semi-structured interviews. The semi-structured interviews probed for a deeper narrative and the questions posed were based on the preliminary interview questions.

The secondary research question considering the use of an iPad for facilitating Whole Brain® learning has been tested but there is much more exploration (D quadrant) that will have to be done after the completion of this study. This is another new cycle in my visionary Action Research cycle (Du Toit 2009) that will be investigated after the submission of this study.

5.5 RECOMMENDATIONS FOR TRANSFORMATION OF PROFESSIONAL DEVELOPMENT AT WILBERFORCE HIGH SCHOOL

Calhoun (2002:20) uses Action Research to promote professional learning and the observation of learning within the context of the school but also to supplement the action learning that takes place with external knowledge and experiences of the professionals. She further recommends that when Action Research is implemented teachers should familiarise themselves with its inner workings (Calhoun 2002:20) to explore fully its potential regarding professional development. I promote the idea of Action Research to be launched as a flagship at Wilberforce High School and postulate that other private schools that are associated with Wilberforce High School should also adopt it to promote professional development. The afore-mentioned is a new vision that I would like to include in the next cycle of my own Action Research mentorship practice. A scholarly community of practice can emerge at Wilberforce High School, promoting collaboration with other private schools that have established communities that participate in professional development.

Simultaneously I recommend that the Whole Brain® professional development programme be expanded to include more professionals from Wilberforce High School. In the volunteer

professional group we need someone with a primary B quadrant preference, thus as a community of practice we should all focus on extending our thinking preference to the B quadrant. Although most of the professionals' thinking styles do extend to the B quadrant under pressure, we should still be able to be flexible in our B quadrant thinking preference in day-to-day and work-related activities. I advocate Whole Brain® facilitating of learning to transform the teaching practice at Wilberforce High School.

A sample of professionals represents a four-quadrant team. According to Herrmann (1995:146) this is essential for creativity. Ideally, according to Herrmann, the groups should include at least one person per quadrant and one or more people who have a triple or quadruple dominance. The members that are triple or quadruple dominant will be able to 'translate' (Herrmann 1995:146-147) due to being flexible in their thinking preference and being able to accommodate at least one thinking preference of someone who is for example double dominant. A professional's thinking preference does not prohibit him/her from being able to adapt a divergent thinking preference in which the scores are lower. Thus a person's thinking preference is a construct (Herrmann 1995:350) for professional development and aiming to become a Whole Brain® thinker.

The results of the HBDI® were used to promote a Whole Brain® community of practice for the professionals. My vision is that all teachers should work towards establishing a Whole Brain® scholarly community of practice. The professionals who were part of this study are now able to deduce the thinking preferences of their learners using the Whole Brain® tick list (Appendix IV), supported by reflecting on the formal and informal assessment tasks as well as observing the learners' response in the teaching practice.

Furthermore I advise professionals to make use of the HBDI® App to establish a community of practice with their learners. The HBDI® App provides a 'Guesstimate' feature where the professional can answer a few questions about a learner and it predicts the learner's profile.

From deductions made from the HBDI® results of my volunteer professionals as well as the one-on-one peer mentoring sessions we could start a Whole Brain® community of practice that may lead to more innovation and creative ideas. Herrmann (1995:248) recommends four strategies to infuse creativity: Firstly that one must learn from children, secondly to encourage oneself through affirmation, thirdly to value one's time and lastly to test a variety of things that interest one.

I envision that as a Whole Brain® community of practice we should use similar strategies when the iPads are rolled out by becoming co-learners with our learners when working with iPads. I am going to continue to motivate the professionals as well as to find more Apps that we can explore and evaluate. The latter two decisions pertain to my own mentorship practice as part of my own Action Research process, but also form part of new cycles in the professionals' action learning processes.

The following considerations (in the left column of the table) for promoting innovative teaching at Wilberforce High School are adapted from Herrmann's (1995:249) recommendations to maintain a positive attitude; recommendations for Wilberforce High School appear in the right column.

Herrmann's recommendations	Application at Wilberforce High School
Be proud of daring to try	Positive encouragement for the professionals from the mentor but also from the other professionals when exploring new Apps and the possibilities of Whole Brain® facilitating learning
Benefit	ICT professional development
Learning is an exploration	Professional self-regulated learning Lifelong learning
Freedom of choice	'No strings attached'
Professional guidance	The iPad coordinator's role My role as mentor
Support from others	Collaboration, cooperative learning and establishing a Whole Brain® community of practice with the vision of leading to a scholarly Whole Brain® community of practice
Use your thinking preference to develop one's least preferred preference styles	As a Whole Brain® community of practice we could explore the possibilities of process storming to generate innovative ideas

Table 39: An adaptation of Herrmann's (1995:249; 1996:129) process storming and recommendations to be more positive to become a Whole Brain® teacher with specific reference to Wilberforce High School

I recommend that professionals who want to join our Whole Brain® community of practice make use of the three modes of attaining a Whole Brain® thinking approach by Herrmann (1995:276) or the Whole Brain® Creative Process (Herrmann 1996:217). Firstly, one should visualise as far as possible every stage to address the 'challenge' in an asset-based approach (Du Toit 2009). The professionals do not necessarily have to focus on the 'visual' but also experience it through sound, kinaesthetically (Herrmann 1995:276) or recalling a smell. I have the vision, as part of my mentorship practice, to incorporate experiential learning when

introducing Whole Brain® facilitating of learning to new professionals who would like to participate.

Secondly Herrmann (1995:276) recommends that ideas should 'incubate'. The incubation begins when the preparation is nearly completed and can be creatively carried out. Consequently two ways to nurture incubation are presented by Herrmann (1995:276), namely to be patient and to encourage the alpha and theta states of relaxation (Figure 43 page 318).

The second mode of attaining a Whole Brain® thinking approach is to record carefully all the ideas that one has. Presumably creative individuals produce more ideas. This is not to say that if one's thinking preference falls in the A and B quadrant that one should stagnate and not write down ideas. On the contrary, one should explore every idea and write these ideas down without judgment (Hermann 1995:277). Thus one must strive to be non-judgmental and open up to the potential of experiential learning.

The 'Zigzag with Gusto' is the third mode of promoting Whole Brain® thinking (Herrmann 1995:278). The objective is to use the characteristics of the A quadrant mode of thinking, for instance analysis, logical approach, systematic processing and then use the characteristics of quadrant D in particular synthesis of knowledge and imagination (Herrmann 1995:278). Herrmann describes the Whole Brain® Creative Process as six main elements that relate to one or more of the quadrants (Figure 43); these elements are interest, preparation, incubation, illumination, verification and application. De Boer et al. (2013:239) postulate that the Whole Brain® Creative Process leads to productive collaboration for information literacy design. I envision that the afore-mentioned process underpinned by Herrmann's Whole Brain® thinking

approach will lead to more innovative ideas for the teaching practice of the professionals at Wilberforce High School.

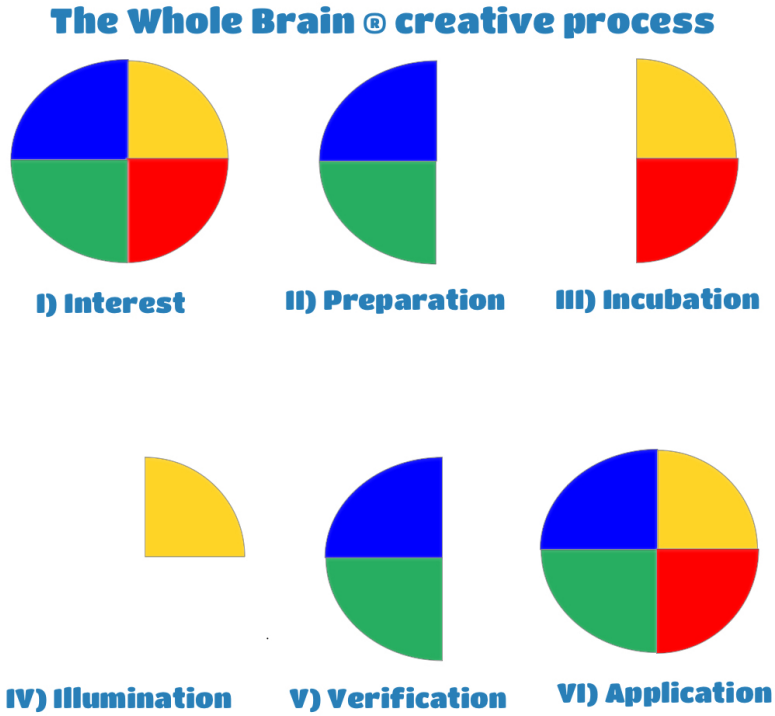


Figure 43: An adaptation of Herrmann's (1996:217) Whole Brain® creative process

I further recommend that Wilberforce High should create a Whole Brain® culture by encouraging all the professionals to complete the HBDI® and attend workshops on the facilitation of Whole Brain® learning as part of their professional development. Although they are encouraged to attend, it should not be enforced lest there be a negative attitude instead of the professionals deciding for themselves to take responsibility for their own learning in a meta-learning fashion and become lifelong learners. Thus, what should be clear from the beginning is that the teachers have a choice. Two human resource basics should be kept in mind: firstly, whether there is an understanding of a person's thinking preference, and secondly, if there is an understanding of the requirements of the work thus the focus should be on setting aside enough time and develop skills needed it would be advisable to align the two with

each other (Herrmann 1996:144). In the case of Wilberforce High School, clear objectives must be set for the professionals and time should be allocated for professional development.

The following table contains some recommendations to motivate professionals to instil a spirit of professional learning.

Herrmann's Recommendations	Recommendations for Wilberforce High School
Provide 'work that turns them on'	All the professionals should take the initiative to create assignments that will challenge the learners, but also accommodate the different thinking styles
Work climate that encourages creativity	Creative atmosphere, for example a creative lounge
Incentives and rewards	Teaching innovation awards, for example iTunes or App store vouchers
Tools, materials and support	Reliable Wi-Fi and ICT support

Table 40: An adaptation of Herrmann's (1996:144) motivation for workers

I further recommend that a creative space (Herrmann, 1995:283) be established at Wilberforce High School. Herrmann (1995:283) describes a creative space as oneself and one's environment (surroundings, in particular the physical, mental and emotional realm) and the interface between the two. The afore-mentioned is a constructivist construct since the world around us is a creation of the mind. Thus we can experience it through perception (Walliman 2011:21-22). For Herrmann (1995:283) the important element is the interface between one's environment and oneself. Reardon (Gravett 2003:36) emphasises the importance of a challenging but respectful, positive and engaging environment. Gravett (2003: 36)

describes this type of environment as a stimulus for risk-taking (which refers to Herrmann's (1995:416) D quadrant). However, the professional learner does have a sense of safekeeping self in this environment. The physical creative space or creative lounge at Wilberforce High School should promote a creative 'free-flow' of ideas. Easy access to a cloud for storage and enough iPads to nurture an environment for positive interaction and promotion of professional development should be available. Herrmann (1996:130) recommends that a 'climate' in which a group would function at its optimum should be supportive, flexible and not officious. Herrmann (1996:130) adds that there should be a 'creative champion or a management champion' to promote innovation.

Herrmann (1995:283-284) describes a few ways to stimulate creativity for example there should be ample space for creativity. The interface needs to be suitable for the culminating of the creative process. Therefore a lounge of some sort that would be welcoming to teachers, but also promote the creative process of planning innovative facilitation of Whole Brain® learning should be ideal. One should strive to claim the space (Herrmann 1995:294) to become more creative and allow the teachers to contribute and decide together what they would like to see in this space. Although the environment might not be constant since many teachers will also work at home, at least there will be a workspace at Wilberforce High School that will provide a platform for creativity, rather than to stifle it by bureaucratic views.

If there is a creative space at Wilberforce High School it may inspire a teacher, described by Herrmann (1995:285) as 'mutual nurturing' where the environment stimulates thought. Lastly Herrmann mentions portability; one should be able to take one's creative

process with one. He sees it as the creative space that one carries with one in one's head. I would recommend that each teacher have an iPad on which he or she can download interesting Apps, including Apps that would challenge their thinking preference. A further recommendation is that an App, for example Notepad+, be downloaded and the teachers instructed to reflect on their week's facilitation of learning with the specific application. A feedback discussion of these reflections can be held at subject meetings. Reflecting on the facilitation of learning and discussing it with peers will become part of another aim, namely to establish a community of practice. Peers could also make use of a cross-platform messaging App for example WhatsApp to share ideas. Table 41 is an adaptation of Herrmann's (1995:296) fixed physical environment in relation to the context of Wilberforce High School.

Creative process	Recommendations for Wilberforce High School
Capture system	iPad use; Apps for example Notepad+, Brainstorming or Grafio to capture ideas
An incubation display	A touch screen where ideas can be displayed
A place to create	A spacious creative lounge, with Wi-Fi access, comfortable seating, music and Apple TV
Affirmative messages	More positive feedback should be given to the professionals

Table 41: An adaptation of Herrmann's (1995:296) idea of a fixed physical environment

Herrmann uses (1995:331) 'community'; however, for the purpose of this study the construct *community* of *practice* is used. He wrote that a community of practice '... creates optimum learning groups where each member, by his or her very nature, contributes to the

learning of other members'. Accordingly the idea of a Whole Brain® community of practice, combined with experiential knowing, motivates individuals to bond into a new group with incredible ease and speed. Thus I postulate that if more professionals complete the HBDI® they will have a better understanding of their own thinking preferences and be able to show understanding of their colleagues and promote collaboration and cooperation with colleagues.

An adaption of Herrmann's (1995:332-333) idea of a Whole Brain® community of practice:

- Each member's uniqueness is recognised.
- One's uniqueness is a resource for professional self-regulated learning (Du Toit 2012).
- Professional development is an asset, fitting the notion of an asset-based (Du Toit 2009) approach to Action Research.
- Members should recognise individual contributions.
- Whole Brain® thinking is part of an asset-based approach.
- Promote participation and involvement.
- 'Teach one another,' in other words, cooperative learning.

During the fieldwork it became apparent that my thinking preference was different from the professionals', thus when we started to collaborate; we would brainstorm innovative ways to facilitate Whole Brain® learning in each professional's teaching practice. Herrmann (1996:55) argues that when a group of people with diverse thinking styles work together more creative ideas come about than with a group that shares the same thinking preferences. I envision that if we use Herrmann's (1996:129) process storming (Figure 32 page 220), working collaboratively as a Whole Brain® community of practice we would be able to generate more creative and innovative ideas.

A platform must be established, for example Brainstorming, iBrainstorm or iBrainStormer where professionals will be able to share their ideas and the facilitation of Whole Brain® learning with the community of practice. It could also be shared by using Dropbox. Herrmann (1996:240) recommends the creative management of ideas by using some means of capturing the data. According to Herrmann the ideas should recognise the creator of the ideas by attaching the person's name to it. If an App is used to brainstorm or record some ideas and they are shared, the person who created the idea should be acknowledged as the creator. The following criteria are essential for capturing innovative ideas: a user-friendly system; available categories; easy access of information; regular review of the system and reward for the person who came up with an idea (Herrmann 1996:242). Most of these criteria are met by the user-friendly interface of the iPad and the Apps. A decision must be made regarding which App should be used. If a platform such as Google Drive or Dropbox is used to share the information it can be done in real time, thus continuously updating new and innovative ways to facilitate Whole Brain® learning.

The professionals should also claim their own personal creative areas. Herrmann (1996:272) refers to this phenomenon as creative space and he recommends that one should have an area where one has freedom to go through the creative process. The professionals, should, however, not feel confined to a physical space, but extend their creativity to cyber space or a cloud, for example by using an App with which they could store their ideas in Dropbox, iCloud or Google Drive. Herrmann (1996:274) notes that by creating a creative space to work in one could extend one's thinking preference and become more productive.

5.6 RECOMMENDATIONS FOR FUTURE RESEARCH

From the Action Research design a variety of new cycles emerged indicating other possible studies that may follow the completion of this study. Firstly collaboration with a scholarly professional was established at another private high school. We have a WhatsApp group and share documents via Google Drive. Furthermore we also included three primary school teachers from our feeder schools in order to share the learning objectives. Thus, this new cycle may lead to Whole Brain® professional cooperative learning and a study may be conducted to determine to what extent Whole Brain® facilitating of learning can be effectively implemented within the participating primary school's History departments as well as our high school's History departments. Secondly I would like to explore the applications of Google classroom and how it may be used as a tool for facilitating Whole Brain® learning. Google classroom may also be used as a platform for Whole Brain® cooperative learning and therefore adding to the Action Research cycle of the professional Whole Brain® cooperative learning initiative.

Thirdly, a probe into the facilitating of Whole Brain® learning with minimum resources will compliment this study. As an example, Lana's Saturday teaching practice where she makes use of games and experiential learning for learners at disadvantaged schools. As stated earlier in this study, Action Research does not require expensive resources. She is already using action learning to reflect on her teaching practice and the learners also have to write reflections about their experience of the learning that took place. Therefore there are already data sets that can be utilised and I recommend to probe further into this Action Research cycle would be to evaluate how effective the facilitation of Whole Brain® learning

was to convey the content that the learners had to study by noting their results in the end of the year examination. Similarly I recommend that the professionals that took part in this study should apply action learning for their students as well by introducing reflections. As a Whole Brain® community of practice we should observe our learner's progress to evaluate to what extent Whole Brain® learning was effectively used. As stated earlier in this study, De Boer et al. (2013) observed a 30% increase in the marks of the students of the Toothmorphology course. Thus it will be noteworthy to see if this observation can also be observed with the high school students. One could for example implement Whole Brain® learning at Grade 8 and Grade 9 level and then continue with the action learning process in the FET phase if it is found to be effectively introduced in Grade 8 and Grade 9.

Lastly, I noted that a further probe to determine to what extent the iPad can be used to establish a learning centred Whole Brain® learning community of practice in which dialogic facilitating learning takes place that will prompt the learners to explore; to look at a construct from a different view; to establish a cooperative inquiry and to promote exchanging Whole Brain® innovative ideas among learners and professionals. With regard to the further probe of the use of the iPad to facilitate Whole Brain® learning the action learning processes of the professionals and learners should be gathered as datasets to be analysed in a further study and to compliment the findings of this study.

5.7 SYNTHESIS

'I became instantly religious, positive that divine intervention had taken place. This role for me was not a career move. This role was freedom: Freedom to create, experiment, learn ...' – Johnny Depp,

after receiving the roll of Edward (Salisbury 2006: xi) in *Edward Scissorhands* (Burton: 1990). In Chapter 5 I used the metaphor of a star unfolding the previous metaphors, starting with James Dean, the original teenage rebel and in this chapter Johnny Depp, a rebel who did not want to conform to the idealistic Hollywood big star image of being a teen icon. Similar to Johnny Depp's emancipation from his mundane *21 Jump Street* (Cannell & Hasburgh 1987-1991) television personality, I saw myself stunned into submission, following a traditional career using action learning to envisage change and pick up on a concept that I had in 2006, namely to foster a professional development programme and establish my professional practice through Action Research. After a variety of experiences and new knowledge gained I could evaluate my professional practice, reflect and envisage another approach or stance. True to the nature of Action Research my final conclusions show that my Action Research will continue after the submission of this study. I want to underscore and share with Johnny Depp the feeling of emancipation, exploring creativity, but above all lifelong learning.

CHAPTER 6
META-REFLECTION

6.1 INTRODUCTION

Aut viam inveniam aut faciam (Latin Phrases 2005) translates to I'll either find a way or make one. I often felt this way about work, family life as well as my art. I also experienced *aut viam inveniam aut faciam* during the exploration of this study. In this chapter I took a voyage to find the origin of my original vision to conduct this peer mentoring study underpinned by Action Research and my own construction of meaning, using the constructivist lens and thus not going back to a *tabula rasa* but to a slate already filled with ideas.

Many creative thoughts, innovative actions in my own teaching practice and challenges featured during my travels to get to this closing chapter of my Action Research process. I had to evaluate the actions that I took, envision new actions to be taken, attend the PhD support sessions and winter schools, so generously planned and organised by Dr Finestone, attend iPad workshops and an iPad summit, overcome challenges by capitalising on an asset-based (Du Toit 2009) approach and extend my flexibility to my least preferred B quadrant and firstly organise, plan, act and reflect to transform my peer mentorship practice. I realised that, in order to construct meaning form the gathered data sets and to immerse myself fully in the literature I needed to have a holistic view and I capitalised on my primary thinking preference, the D quadrant and all I needed was a mode of transportation.

The Time Machine (Pal 1960) was adapted from H.G. Well's 1895 novel (1995) by the same name. H.G. Wells's (played by Rod Taylor) ambition was to build a time machine and explore different realities at different points in time. Similarly, I wanted to explore

my role as mentor in my mentorship practice, being accountable and as stated by Zuber-Skerrit (1996: 85) making the results of an enquiry public, firstly by submitting this study and secondly by writing an article on my findings. I also realised that accountability is based on 'external values and evidence' (Zuber-Skerrit 1996:86), taking the realities and knowledge of my participants into account. We were all learners in the mentorship practice. Thus, to initiate the vision I had to reflect in my visionary Action Research cycle (Du Toit 2009) I had to capitalise on my primary thinking D quadrant preference to conceptualise opportunities and explore hidden possibilities, improving my mentorship practice by taking new innovative actions. Coincidentally Apple's backup device is also called the Time Machine (See Figure 44) and I was thankful for this device; despite Gauteng's thunder storms, load shedding and many other gremlins creeping in, I did not lose any of my data, data analysis or reflection.

Figure 44: The Time Machine icon on an Apple Mac OS X

Chandler and Torbert (2003:136) argue the importance of time with regard to Action Research. They emphasise that research is

conducted in the past, present and future. Thus, metaphorically speaking, one has to move back and forth in a 'Time Machine' to reflect and analyse the actions taken. Chandler and Torbert (2003:136) further stipulate that time in the Action Research construct is seen as three-dimensional. Thus, the past can be labelled as t^1, the present as t^2 and the future as t^3.

Chandler and Torbert (2003:136-137) stipulate that t^2 refers to presenting one's own experiences and one's own thoughts and feelings. Thus action is taken in t^2 and the experiences lead to data collection that is cognitively analysed in order to write up the study that will happen in t^3. Data was collected from the participants and in the mentorship practice for analysis and interpretation for the completion of this study. However, since Action Research is an ongoing process, planning for innovation and transformation in t^2 is constructed to be applied in t^3, which will lead to further actions being taken, and so forth.

Chandler and Torbert (2003:138) describe t^3 as the envisioning of future innovation, acknowledging the 'undeveloped potential' that emerges from our experiences and it may lead to multiple outcomes. I am aware of the multiple realities and constructs that emerged in the course of this constructivist study.

6.2 META-LEARNING AND META-REFLECTION 

Slabbert et al. (2009:16) describe meta-learning as taking control of one's own learning. Meta-learning will contribute to becoming more structural, managing, assessing and monitoring one's own learning. It is envisaged that effective meta-learning ultimately

leads to lifelong learning. The authors state that meta-learner will reflect throughout the learning process.

Synonymous with the afore-mentioned, and underpinning the nature of the visionary Action Research cycle (Du Toit, 2009) I continuously reflected on my professional practice and the actions that I took, travelling back to obtain a holistic view and similar to Wolvaardt's (2014:347) 'scholarly reflections' I conclude this study from a meta-reflective stance. To 'think critically and analytically around salient features' as suggested by Hagström and Scheja (2014: 244) about major events in my life would ultimately lead to t^3. Zuber-Skerritt's (1996:85-86) CRASP model includes the importance of the reflective nature of the Action Research process, emphasising self-critical reflection. Greyling and Du Toit (2008:971) state that one must also be 'receptive to critical-reflective analysis' that would lead to an 'improvement-seeking approach' (Greyling & Du Toit 2008:971). I concur with Du Toit's (2009) asset-based approach rather than the construct 'improvement-seeking approach'. Although I showed the raw data of the interviews to the professionals for interrogation, none of them responded critically to the data nor to the findings that I made. Figure 45 (page 329) is an adaptation of the CRASP model, where I highlight my mentorship practice and innovative actions that were taken, leading to the self-evaluation of my scholarly reflections using meta-reflection. I am a lifelong learner and I envision (t^2) innovative actions for the secondary spirals (t^3) of my Action Research cycle to probe the different realities of my *memory time machine*.

The first stop was to travel back in time to $t^{1,}$ the formative years when I took up the responsibility for my own learning to become a lifelong learner and to apply Action Research and Whole Brain® learning to my teaching practice.

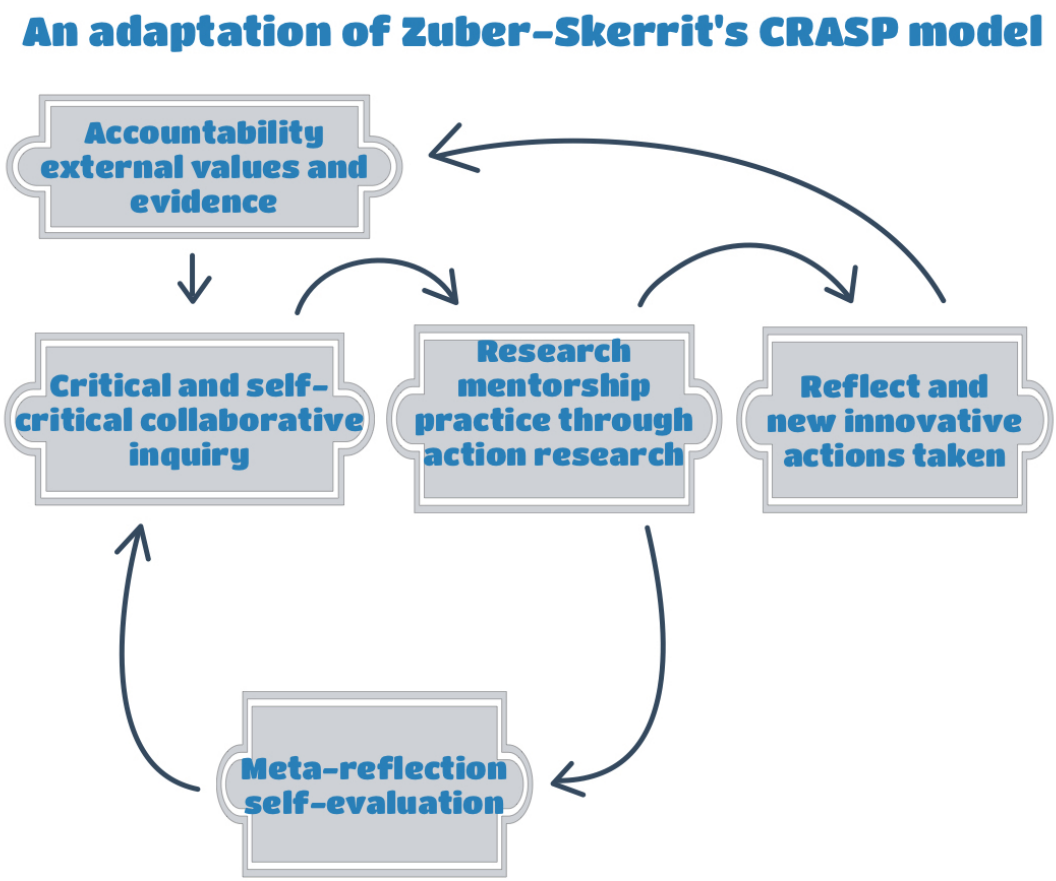


Figure 45: An adaptation of Zuber-Skerritt's (1996:86) CRASP model

6.2.1 Back ⏮ t^1

Reflecting on the supposition of this study relates to A quadrant cognition (Figure 46), sequencing of thought in the B quadrant and affect of the C quadrant, and lastly to a holistic overview as characterised by quadrant D. Related to the construct of meta-reflection is the construct of higher order reflection that forms part of critical Action Research. It is a continuous process of spiralling overlapping cycles, indicating the beginning of the next steps toward re-planning, implementing, reflecting and critical analysis (Davis 2004:6).

A stroke of misfortune initially devastated me in 2007; my friend Thalia narrowly escaped death during a burglary. My computer, a friend's wedding photographs and all my photographs, including all

the backup files of my work as well as my camera were stolen. Having no idea what to do next (C quadrant emotional), my brother-in-law (A and B quadrant) and sister (B and D quadrant) decided to buy me an Apple Mac computer. Although I did not realise it at the time, it was a profound moment in my professional development and action learning practice. Originally the two competing computer companies, IBM and Apple Mac represented firstly a left mode company and secondly a right mode company (Herrmann 1996:93). The fact that I was able to explore new possibilities (D quadrant) on an Apple Mac that accommodated my thinking preference (2111) generated and inspired innovative thoughts to design a professional development programme for my previous employer by introducing a mentorship practice. Within my teaching practice I would, for example, obtain permission to use the school hall and instruct the learners to run a propaganda campaign to convince their peers of the leadership skills of a dictator (they could choose the dictator they wanted to represent). I recall that the oral presentations were some of the best that I had assessed in my teaching career and I was confident that I was on the right track to incorporate innovative learning.

The learners were challenged to get out of their thinking preference and plan a campaign for a villain. This task included thinking through ideas (A quadrant), planning and organising the campaign (B quadrant), rallying supporters or 'renting a crowd' (C quadrant) and showing spontaneity and experimentation (D quadrant). I capitalised on my primary D quadrant thinking preference with my key descriptor 'imaginative'. Reflecting on t^1, I did make more use of my imagination and artistic skills, but I was also intuitive, underpinning my deep spiritual nature (C quadrant) and my love for symbolism that was clearly visible in my visual source material that I created (D quadrant) for the learners to simplify the work. Thus

with regard to my secondary C quadrant thinking preference and the success that I observed from incorporating a hands-on activity such as the dictator propaganda campaign (C and D quadrant) I envisioned a proposal to introduce mentorship at the school.

I wanted to share the new knowledge that I had gained during my 2005 PGCHE programme with my colleagues at the time. I wrote a *detailed* (descriptor that I chose from the B quadrant in the 2005 HBDI®) proposal, suggesting that we should implement a mentorship programme that underpins Action Research and Whole Brain® thinking; however, the context that I was in at that stage did not provide me with the opportunity to explore this venture further but the innovative seed to establish a mentee practice had been sowed. While *reflecting* and *analysing* (descriptors that I chose for the A quadrant in the 2005 HBDI®) I realised my mentorship proposal had been misinterpreted – a typical *rashōmon* effect – thus I needed to be prepared by defining a clear purpose with concrete objectives immersing myself in scholarly sources (A quadrant) and drafting a research proposal for this study, finalising and defending it.

6.2.2 To ⏸ t^2

As mentioned above, I wanted to explore the possibility to design a professional development programme that would implore an asset-based (Du Toit 2009) approach to learning. Since the dreaded house break-in and nearly losing my best friend, Thalia, I have changed jobs and the new context, Wilberforce High School, provided me with the opportunity to probe and explore the possibility of taking up my role as facilitator of professional development, keeping in mind that I would also be a participant and

learner, underpinning my quest for lifelong learning and to become a Whole Brain® thinker.

Establishing a Whole Brain® community of practice was one of the aims of this study. We have core professionals in our Whole Brain® community of practice and in future, I would like to incorporate more professionals to become part of this community, in other words, not only other colleagues at Wilberforce High School, but 'third persons' or peers at other private schools. Chandler and Torbert (2003:145) point out that third-person Action Research can be conducted with many third-persons whose actions are not connected. A peer-professional (third-person) and I started an inter school collaboration (Figure 33 page 223) group. Thus far we have maintained regular WhatsApp communication as well as shared ideas and held meetings. This scholarly collaboration is very productive and will add to the new cycles of my action Research process. Similarly, I have a WhatsApp group for the Whole Brain® community of practice at Wilberforce High School. After trying paper-based and email communication I decided to simplify the communication mode and make it instant, thus the idea of establishing the WhatsApp group followed, leading to more than just communication but collaboration and a support network. The WhatsApp group is inclusive and any of the professionals at Wilberforce High School may join. Therefore I had to relinquish my B quadrant detailed-based thinking and simplify the communication, making it more visual.

As stated in Chapter 4 Lana was involved in another teaching practice that was not related to her Wilberforce High School. She could capitalise on the experimental, free-flow and experiential opportunities (C and D quadrant) that she designed and shared with her colleagues to challenge them to explore hidden possibilities.

Lana's simplification of difficult content and as she stated, 'taking it back to the basics' made me go back and reflect on my own teaching practice, realising that the change in my thinking preference from 2111 to 1211 had a significant impact.

There was a slight decline in my D quadrant preference from the 2005 analysis and I could see that I was hovering between my 'new' secondary A quadrant thinking preference of providing logical, fact-based evidence and providing sequential detailed information (B quadrant) with a few pictures (D quadrant). Lana's words underpinned what my teaching practice was lacking, namely going back to the basics. I first had to simplify the content, re-introduce word searches and use the keywords from the word searches to show a holistic (D quadrant) view of historical events. Thus, relinquishing my independence-driven self I realised that I was truly a co-learner within my mentorship practice and I was finally 'getting it' as stated by Herrmann (1995:417) describing the D quadrant.

In my 2015 HBDI® analysis I chose *artistic* as my Key descriptor, a talent that came to the fore when creating the figures for this study. Similar to the 2005 HBDI® findings I am still *holistic* and *intuitive* but now I use *integration*, *conceptualisation*, *creativity* and *innovation* in the workspace. The afore-mentioned are all descriptive of my peer mentorship practice as well as my own teaching practice, forming the foundation of this study. My C quadrant descriptors are similar to the 2005 HBDI® findings, namely *spiritual* and *intuitive*. I capitalised on the C quadrant by providing not only technical support to the professionals but also having empathy for the challenges that they faced. My C quadrant thinking preference provided me with an understanding of the professionals' needs and when they steered away from a question during the interviews, I was able to guide them in a gentle manner

to the narrative at a later stage of the interview or during another interview to obtain an interpersonal understanding. Thus, I utilised my feelings-driven self.

As an extension of my C quadrant I made scholarly friends, one of which is not part of this faculty. My scholarly friends are achievement-driven (A quadrant) and task-driven (B quadrant), therefore good motivators. According to my 2015 HBDI® profile the descriptors that I chose from the A quadrant are *logical*, *critical*, *rational* and *factual*. As mentioned earlier, I postulated that this change in my thinking preference related to the expectations at Wilberforce High School and to this study. Everything culminated from the conceptualisation of this study in 2006 and the sequence of events that ensued, leading to this point in time for me to realise that I have to extend and become even more flexible in the A and B quadrant and immerse myself in scholarly reading and attend the PhD support sessions.

I found all of the PhD support sessions and winter schools adding positively to my own construction of knowledge and an interview with Professor M.M. Bergman[12] helped me to delineate the four dimensions of Wilberforce High School. As soon as I realised that I could use the four dimensions as scaffolding for this study, I was out of my research slump. The support sessions also underpinned my passion for learning in the sense that I did more than the required twenty days that proved that I was a lifelong learner. At the moment I am planning my next Action Research cycle and what to study next.

[12] Professor Bergman is affiliated with the University of Basel in the Department of Social Sciences and one of his subject areas include mixed method research.

6.2.3 The Future [13] ⏭ t^3

I concur with Davis's (2004:10) 'creating living educational theory' when she conducted Action Research for her thesis. Her Action Research was expanded to a collaborative Action Research project. Thus initially she was theorising about educational change and after the completion of her thesis that formed a foundation for the next cycle in a broader collaborative perspective of educational change. Similarly my thesis is part of the scaffolding for Wilberforce High School's living theory of professional development and my experience as a peer mentor.

In writing a narrative about my experiences I wanted to review the understanding of my role as a peer mentor of Whole Brain® learning. Davis (2004:13) describes this mode of inquiry as a 'meta-reflective narrative' that is used in 'critical ethnography'. With regard to my background in Anthropology, Archaeology and Cultural History, I can identify with this method, aiding in reflecting on the study. Thus, by capitalising on my memory time machine I can conceptualise innovations, aim to become more flexible in my thinking preferences and truly become a Whole Brain® thinker (Figure 46 page 336), implementing more ideas in our Whole Brain® community of practice and making use of process storming (Herrmann 1996:129) to motivate and generate innovative ideas. Ideally collaboration and cooperative leaning together with my colleagues and peers at other private schools will continue. Thus, this visionary Action Research cycle (Du Toit 2009) is far from over, it is just the beginning.

[13] The titles refer to the *Back to the future* (Zemeckis 1985, 1989, 1990) trilogy where Marty McFly (played by Michael J. Fox) with the help of Doc (played by Christopher Lloyd) travels back in time in the first film, and travels to McFly's future in the second film. It is synonymous with the meta-learning and meta-reflection that I conclude this study with.

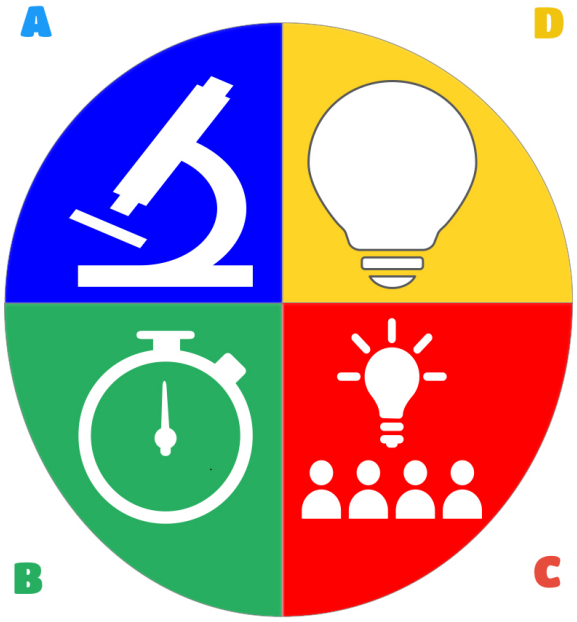


Figure 46: An adaptation of Herrmann's Whole Brain® thinking model

6.3 SYNTHESIS ⏏

In Chapter 6 I reflected on my Action Research journey by using my memory time machine. Unfortunately Nicola Tesla is not my contemporary; otherwise my time travels might have been reality. Thus, I will have to suffice with science fiction and the constructivist theory that underpins multiple realities and multiple outcomes. As seen in Chapter 1, I used *Rebel without a cause* (1955) as a metaphor for being the original teenage rebel who broke away from confinements and the expectations. Similarly, H.G. Wells explored hidden possibilities (D quadrant) through his novels, for example *The Time Machine* (1995), that also boasts a future vision (D quadrant). Thus, using my memory time machine (D quadrant) I endeavoured on my quest for enlightenment to become a Whole Brain® thinker (Figure 46) and to go back to find the roots of my original vision, to pause and conduct this study in the context of Wilberforce High School and to look towards my future to plan my next destination in my Whole Brain® Action Research paradigm. *Carpe diem!*

7. REFERENCES

Åge, L. 2011. Grounded theory methodology: positivism, hermeneutics, and pragmatism. *Qualitative report*, 16(6): 1599-1615.

Akutagawa, R. 2006. *Rashōmon and 17 other stories*. New York: Penguin Books.

Alexander, 2014. Exploratory and preliminary interview, interview by T. Rossouw, 19 June, Pretoria. [Digital voice recording in possession of author]

Alexander, 2015. Grade 9 Whole Brain® LO task, email to T. Rossouw, 8 October.

Alexander, 2015. Grade 9 Whole Brain® LO task reflection, email to T. Rossouw, 8 October.

Alexander, 2015. Semi-structured interview, interview by T. Rossouw, 4 August, Pretoria. [Digital voice recording in possession of author]

Allio, R.J. 1977. Interviewing professor Mintzberg's 'Right Brain.' *Planning Review*, 5(2):8-22.

Altrichter, H., Posh, P. and Somekh, B. 2005. *Teachers investigate their work: an introduction to the methods of action research*. London: Routledge.

Armstrong, T. 2000. *Multiple intelligences in the classroom*. Alexandria, Virginia: Association for Supervision and Curriculum Development.

Aróstegui, J. L., Stake, H. & Simons, H. 2004. Music Education for the 21st century: Epistemology and Ontology as bases for student aesthetic education. *Education policy analysis archives*, 12(54):1-14.

Atkinson, T.N. & Pilgreen, T. 2011. Adopting the Transformational Leadership perspective in a complex research environment. *Research management review*, 18:42-63, Summer.

Australian Broadcasting Cooperation. 2014. *Classroom Mabo: teacher notes- the Arts*. [ONLINE] Available at: http://www.abc.net.au/tv/mabo/pdf/Mabo_Arts_TeacherNote.pdf. [Accessed 24 April 2014].

Australian Broadcasting Cooperation. 2014. *Classroom Mabo: teacher notes- History*. [ONLINE] Available at: http://www.abc.net.au/tv/mabo/pdf/Mabo_History_TeacherNotes.pdf. [Accessed 24 April 2014].

Autograph Maths. 2015. Autograph Maths - The Dynamic Classroom Software. [ONLINE] Available at: http://www.autographmaths.com. [Accessed 30 July 2015].

Bedson, C., Wiggs, A. & Kwiatkowski, A. 2010. First Australians, *Humanities alive 3*. Milton: John Wiley & Sons.

Belbase, S. 2011. *Radical versus social constructivism: dilemma, dialogue, and defense*. Wyoming: University of Wyoming. [Course notes.]

Bergman, M.M. 2010. On concepts and paradigms in mixed method research. *Journal of mixed methods research*, 4(3):171-175, July 21.

Bergman, M.M. 2011. Mixed methods. PhD and M.Ed. support sessions. 11 July 2011. Pretoria: University of Pretoria.

Bergman, M.M. 2012. Action Research. PhD and M.Ed. Winter school support sessions. 3 July 2012. Pretoria: University of Pretoria.

Bergman, M.M. 2012. Research design, interview by T. Rossouw on 4 July 2012 Pretoria. [Transcript in possession of the author]

Bergsteiner, H., Avery, G.C. & Neumann, R. 2010. Kolb's experiential learning model: critique from a modeling perspective. *Studies in continuing education*, 32(1): 29-46, March.

Bleach, J. 2013. Improving Educational Aspirations and Outcomes through Community Action Research. *Educational Action Research*, 21(2): 253-266.

Boshoff, A. 2014. Professional development of academic staff in private higher education. PhD thesis, University of Pretoria, Pretoria.

Boshoff, W. 2001. *Blind alphabet*, Seeing Blind exhibition. Pretoria: Pretoria Art Museum.

Bostrom, L. & Lassen, L.M. 2006. Unraveling learning, learning styles, learning strategies and meta-cognition. *Education & training*, 48(2-3):178-189.

Brydon-Miller, M., Greenwood, D. and Maguire, P. 2003. Why action research? *Action Research*, 1(1):9-28.

Brynhildr, 2014. Exploratory and preliminary interview, interview by T. Rossouw, 22 July, Pretoria. [Digital voice recording in possession of author]

Brynhildr, 2015. Animator example graphs, email to T. Rossouw, 13 October.

Brynhildr, 2015. Semi-structured interview Part 1, interview by T. Rossouw, 30 July, Pretoria. [Digital voice recording in possession of author]

Brynhildr, 2015. Semi-structured interview Part 2, interview by T. Rossouw, 6 August, Pretoria. [Digital voice recording in possession of author]

Brynhildr, 2015. Visual source, bird sitting in a tree November examination question, email to T. Rossouw, 13 October.

Brynhildr, 2015. Visual source, hunter standing on a cliff question, email to T. Rossouw, 13 October.

Burke, W., Marx, G.E. & Lowenstein, E. 2012. Leading, leadership, and learning: exploring new contexts for leadership development in emerging school environments. *Planning and changing*, 43(1-2):113-126, February.

Burton, T. 1990. *Edward Scissorhands*. [Motion picture.] Florida: Twentieth Century Fox Film Corporation.

Buzan, T. & Harrison, J. 2010. *The memory book: how to remember anything you want*. Edinburgh: Pearson Education Group.

Buzan, T. 2011. *Buzan's study skills*. Essex: Pearson Education Limited.

Buzan, T. 2011. *The Buzan study skills handbook*. Edinburgh: Pearson Education Group.

Calaprice, A. 2005. *The new quotable Einstein*. Princeton: Princeton University Press.

Calhoun, E.J. 2002. Action Research for school improvement. *Educational leadership*, 59(6):18-24, March.

Campbell, L. Campbell, B. & Dickinson, D. 2004. *Teaching and learning through multiple intelligences.* Boston: Pearson.

Cannell, S.J. & Hasburgh, P. 1987-1991. *21 Jump Street*. [Television series]. British Columbia: 20th Century Fox Television.

Chandler, D. & Torbert, B. 2003. Transforming inquiry and action: interweaving 27 flavors of Action Research. *Action Research*, 1(2):133-152.

Chang, L. 2006. *Wisdom for the soul: five millennia of prescriptions for spiritual healing*. San Francisco: Gnosophia Publishers.

Cicero, M.T. 2015. Latin Phrases on Teaching, Latin Phrases on Learning.[ONLINE] Available at: http://latin-phrases.co.uk/quotes/learning-teaching/. [Accessed 13 July 2015].

Coffield, F., Moseley, D., Hall, E. & Ecclestone, K. 2004. *Learning styles and pedagogy in post-16 learning. A systematic and critical review.* London: Learning and Skills Research Centre.

Cooper, K.J. 2012. An iPad in education? *Diverse: issues in higher education*, 29(3):10-11, March.

Cornelius, S., Gordon, C. and Ackland, A. 2011. Towards flexible learning for adult learners in professional contexts: an activity-focused course design. *Interactive learning environments*, 19(4):381-393, September 2011.

Crane, D. & Kauffman, M. 1994-2004. *Friends*. [Television series]. New York: Warner Brothers.

Crane, D., Kauffman, M., Skloff, M., Willis, A., Sōlem, P. & Wilde, D. 1995. *I'll be there for you*, L.P. Performed by The Rembrandts. Orlando, EastWest Records America.

Craven, W. 1984. *A nightmare on Elm Street.* [Motion picture]. California: New Line Cinema.

Daccord, T. 2015. South African iPad Summit. *iPads in the classroom: from consumption to creation*, Johannesburg, 14-15 March 2015. Dorchester: edtechteacher.

Davis, J. M. 2004. Writing an action research thesis: One researcher's resolution of the problematic of form and process. *QUT Post Graduate Research Conference 2003*. Brisbane: Queensland University of Technology.

De Boer, A. L., Bothma, T., & du Toit, P. 2011. Enhancing information literacy through the application of whole brain strategies. *Libri*, *61*(1):67-75.

De Boer, A. L., Du Toit, P. H., Bothma, T., & Scheepers, D. 2012. Constructing a comprehensive learning style flexibility model for the innovation of an information literacy module. *Libri*, *62*(2):185-196.

De Boer, A., Du Toit, P.H., Scheepers, M.D. & Bothma, T.J.D. 2013. *Whole Brain® learning in higher education: evidence-based practice*. Cambridge: Chandos Publishing.

De Bono, E. 1990. *Lateral thinking*. London: Penguin Books.

De Bono, E. 1993. *Teach your child how to think*. London: Penguin Books.

De Bono, E. 2000. *Six Thinking Hats*. London: Penguin Group.

De Jager, T. 2011. Professional development of beginner teachers: an action research approach to mentoring. M.Ed. thesis, University of Pretoria, Pretoria.

Depp, J. 1994. Foreword. (*In* Salisbury, M. (ed.) 2006), *Burton on Burton*. London: Faber and Faber Limited.

Dryden, G. and Vos, J. 2005. *The new learning revolution: how Britain can lead the world in learning, education and schooling*. Aukland: The Learning Web Ltd.

Du Toit, P. H. 2011. *Reader for postgraduate studies in professional development, facilitating learning and assessment*. Pretoria: University of Pretoria. [Course notes.]

Du Toit, P. H. & Vandeyar, S. 2004. Innovative portfolio assessment – portfolios as performance assessment tools. (*In* Maree J. G. & Fraser W. J. (eds.), *Outcomes-based assessment*. Sandown: Heinemann Publishers (Pty) Ltd.

Du Toit, P. H. 2002. Professional portfolio building – a tool for developing intrapersonal leadership. (In Calitz, L., Fuglestad, O. & Lillejord, S.), *Leadership in education – productive learning cultures*. Sandown: Heinemann Publishers (Pty) Ltd.

Du Toit, P. H. 2012. Using action research as process for sustaining knowledge production: A case study of a higher education qualification for academics. *South African Journal of Higher Education*, *26*(6):1216-1233.

Du Toit, P. H., De Boer, A. L., Bothma, T., & Scheepers, D. 2012. Multidissiplinêre samewerking: 'n noodsaaklikheid vir

onderwysinnovering: navorsings-en oorsigartikel. *Tydskrif Vir Geesteswetenskappe*, *52*(2):236-251.

Du Toit, P.H. 2008. Innovative academic staff development initiatives at FET colleges. *Education innovation quest: a century in the service of knowledge.* Pretoria: University of Pretoria.

Dzubinski, L., Hentz, B., Davis, K. & Nicolaides, A. 2012. Envisioning an adult learning graduate program for the early 21st century: a developmental action inquiry study. *Adult learning*, 23(3):103-110, August.

Ebersöhn, L., Eloff, I. & Ferreira, R. 2010. First steps in action research. (*In* Maree, K. (ed.), *First steps in research*. Pretoria: Van Schaik Publishers. pp. 123-143.)

Edwards, B. 1993. *Drawing on the right side of the brain*. London: Harper Collins Publishers.

Eichenlaub, N., Gabel, L., Jakubek, D., McCarthy,G. & Wang, W. 2011. Project iPad: Investigating Tablet Integration in Learning and Libraries at Ryerson University, *Computers in libraries*, 31(7):17-21, September.

Engward, H. 2013. Understanding grounded theory. *Nursing standard*, 28(7):37-41, October.

Friendship quotes, phrases and mottos in Latin. 2015. Friendship quotes, phrases and mottos in Latin. [ONLINE] Available at: http://www.inrebus.com/friendshipquotes.php. [Accessed 22 August 2015].

Gadd, N. and Graham, R. 2011. *Murundak: songs of freedom*. [Documentary]. Northern Territory: Daybreak Films Production.

Gardner, H. & Hatch, T. 1989. Multiple Intelligences Go to School: Educational Implications of the Theory of Multiple Intelligences. *Educational researcher*, 18(8):4-9, November.

Gardner, H. 1995. *Multiple intelligences: the theory in practice*. New York: Basic Books.

Gardner, H. 2005. Multiple lenses on the mind. *Paper presented at the ExpoGestion Conference*, Bogota, Columbia, 25 May 2005, pp. 1-28. Columbia: ExpoGestion.

Gazzaniga, M. S. 2005. Forty-five years of split-brain research and still going strong. *Nature Reviews Neuroscience*, 6:653- 659, August.

Given, B.K. 2000. *Learning styles: a guide for teachers and parents*. California: Learning Forum Publications.

Graham, T. 1997. *Mabo: life of an island man*. [Motion picture]. National Film and Sound Archive of Australia: Film Australia National Interest Program.

Gravett, S. 2005. *Adult learning: designing and implementing learning events a dialogic approach*. 2nd edition. Pretoria: Van Schaik Publishers.

Greyling, W. J., & Du Toit, P. H. 2008. Pursuing a constructivist approach to mentoring in the higher education sector. *South African Journal of Higher Education: HELTASA 2007: Special Edition 5* (*22)*: 957-980.

Gulati, S. 2008. Compulsory participation in online discussions: is this constructivism or normalisation of learning? *Innovations in education and teaching international,* 45(2):183-192, May 2008.

Hartle, R.T., Baviskar, S. & Smith, R. 2012. A field guide to constructivism in the college Science classroom: Four Essential Criteria and a Guide to Their Usage. *Journal of college Biology teaching*, 38(2):31-35, December.

Hashim, Y. & Yusup, Y. 2014. Erratum to: Preliminary study on teachers' use of the iPad in bachelor of education program at a private university in Malaysia. *TechTrends*, 58(5):102- 103.

Heidi, 2014. Exploratory and preliminary interview, interview by T. Rossouw, 20 June, Pretoria. [Digital voice recording in possession of author]

Heidi, 2015. Face drawing reflection, email to T. Rossouw, 4 October.

Heidi, 2015. Semi-structured interview, interview by T. Rossouw, 27 July, Pretoria. [Digital voice recording in possession of author]

Helena, 2015. Exploratory and preliminary interview, interview by T. Rossouw, 25 June, Pretoria. [Digital voice recording in possession of author]

Helena, 2015. Mind map, email to T. Rossouw, 12 October.

Helena, 2015. Modes of transportation task, email to T. Rossouw, 4 October.

Helena, 2015. Notebook reflections, email to T. Rossouw, 12 October.

Helena, 2015. Semi-structured interview, interview by T. Rossouw, 29 July, Pretoria. [Digital voice recording in possession of author]

Herne, S., Adams, J., Atkinson, D., Dash, P. & Jessel, J. 2013. Technology, Learning Communities and Young People: The Future Something Project. *International journal of Art & Design education*, 32(1):68-82, February.

Herrmann International, 2015. *HBDI: Alexander*. Lake Lure, NC: Herrmann International.

Herrmann International, 2015. *HBDI: Brynhildr*. Lake Lure, NC: Herrmann International.

Herrmann International, 2015. *HBDI: Heidi*. Lake Lure, NC: Herrmann International.

Herrmann International, 2015. *HBDI: Helena*. Lake Lure, NC: Herrmann International.

Herrmann International, 2015. *HBDI: Kypris*. Lake Lure, NC: Herrmann International.

Herrmann International, 2015. *HBDI: Lana*. Lake Lure, NC: Herrmann International.

Herrmann International, 2015. *HBDI: Octavia*. Lake Lure, NC: Herrmann International.

Herrmann International, 2005. *HBDI: Thersia Rossouw*. Lake Lure, NC: Herrmann International.

Herrmann International, 2015. *HBDI: Thersia Rossouw*. Lake Lure, NC: Herrmann International.

Herrmann-Nehdi, A. 2009. *The best of both worlds-making blended learning really work by engaging the Whole Brain®*. Lake Lure, NC: Herrmann International.

Herrmann, N. 1995. *The creative brain*. Lake Lure: The Ned Herrmann Group.

Herrmann, N. 1996. *The whole brain business book*. New York: McGraw-Hill.

Holbeche, L. 1996. Peer mentoring: the challenges and opportunities. *Career development international*, 1(7):24-27.

Holland, B. 2015. South African iPad Summit, *Creating Learning Centres in the iPad Classroom*. 14 and 15 March 2015. Dorchester: edtechteacher.

Holland, B. 2015. South African iPad Summit, *Extending the physical with the digital - QR codes and augmented reality*. 14 and 15 March 2015. Dorchester: edtechteacher

Hubbard, G.T. 2012. Voices from the field: how a project-orientated activity-based media production course effectively employed constructivist teaching principles. *The national association for media literacy education's journal of media literacy education,* 4(2):159-166.

Imel, S. 2000. *Contextual Learning in Adult Education. Practice Application Brief No. 12*. Center on Education and Training for Employment. Columbus: Ohio State University.

Isaacson, W. 2011. *Steve Jobs*. London: Little, Brown Book Group.

Ivankova, N.V., Creswell, J.W. and Stick, S.L. 2006. Using mixed-methods sequential explanatory design: from theory to practice. *Field methods*, 18(1):3-19.

Kelle, U. 2012. The development of categories: different approaches in grounded theory. (In Bryant, A. and Charmaz, K.), *The SAGE handbook of grounded theory*. London: SAGE Publications Ltd.

Kerkorrel, J. 1989. *Sit dit af*, Eet Kreef. Uitgevoer deur Johannes Kerkorrel en die Gereformeerde Blues Band. [Langspeelplaat] Suid-Afrika: Shifty Records.

Kincheloe, J.L. 2004. The Knowledges of teacher education: developing a critical complex epistemology. *Teacher education quarterly*, 31(1):49-66.

Kulowiec, G. 2014. Unleashing Creativity: Greg Kulowiec App Smashing – from Beth Holland. [ONLINE] Available at: http://edtechteacher.org/unleashing-creativity-greg-kulowiec-app-smashing-from-beth-holland/. [Accessed 26 April 2015].

Kypris, 2014. Exploratory and preliminary interview, interview by T. Rossouw, 20 June, Pretoria. [Digital voice recording in possession of author]

Kypris, 2015. ExplainEverything Golden Gate Bridge real life example, email to T. Rossouw, 16 October.

Kypris, 2015. ExplainEverything Parabolas examples, email to T. Rossouw, 16 October.

Kypris, 2015. Semi-structured interview, interview by T. Rossouw, 11 August, Pretoria. [Digital voice recording in possession of author]

Lana, 2014. Exploratory and preliminary interview, interview by T. Rossouw, 11 June, Pretoria. [Digital voice recording in possession of author]

Lana, 2015. Saturday teaching practice reflections, email to T. Rossouw, 24 August.

Lana, 2015. Semi-structured interview, interview by T. Rossouw, 24 July, Pretoria. [Digital voice recording in possession of author]

Latin Phrases. 2005. Latin Phrases. [ONLINE] Available at: http://latin-phrases.co.uk. [Accessed 13 June 15].

Lave, J. and Wenger, E. 2003. *Situated learning legitimate peripheral participation*. New York: Cambridge University Press.

Lazear, D. 2004. *Higher-order thinking: the multiple intelligences way*. Chicago: Crown House Publishing Limited.

Leidenfrost, B., Strassnig, B., Schütz, M., Carbon, C. and Schabmann, A. 2014. The impact of peer mentoring on mentee academic performance: is any mentoring style better than no mentoring at all? *International journal of teaching and learning in higher education*, 26(1):102-111.

Lempert, L. B. 2012. Asking questions of the data: memo writing in the grounded tradition. (In Bryant, A. and Charmaz, K.), *The SAGE handbook of grounded theory*. London: SAGE Publications Ltd.

Lüsted, M. A. 2012. *Mark Zuckerberg facebook creator*. Minnesota: ABDO Publishing Company.

Macualay, D. 1979. *Motel of the Mysteries*. New York: Houghton Mifflin Company.

Maree, K. & Van Der Westhuizen, C. 2009. *Head start in designing research proposals in the Social Sciences*. Cape Town: Juta.

Maree, K. and Pietersen, J. 2010. Surveys and the use of questionnaires. (*In* Maree, K. (ed.), *First steps in research*. Pretoria: Van Schaik Publishers. p. 154-170.)

Maree, K. and Van Der Westhuizen, C. 2010. Planning a research proposal. (*In* Maree, K. (ed.), *First steps in research*. Pretoria: Van Schaik Publishers. pp. 23-45.)

Martell, C.C. 2012. *Making meaning of constructivism: a longitudinal study of beginning History teachers' beliefs and practices,* Vancouver, 14 April 2012, pp.1-54. Boston: Boston University.

McNiff, J. 2002. *Action research for professional development, concise advice for new action researchers*. 3rd Edition. [ONLINE] Available at: http://www.jeanmcniff.com/ar-booklet.asp. [Accessed 13 April 2014].

McNiff, J. & Whitehead, J 2002. *Action Research: principles and practice second edition*. London: RoutledgeFalmer.

McNiff, J. & Whitehead, J. 2005. *Action Research for teachers: a practical guide.* London: David Fulton Publishers Ltd.

McNiff, J. & Whitehead, J. 2006. *All you need to know about Action Research*. London: SAGE Publications Ltd.

McNiff, J. & Whitehead, J. 2009. *Doing and writing Action Research*. London: SAGE Publications Ltd.

Mezirow, J. 2003. Transformative Learning as Discourse. *Journal of Transformative Education*, 1(1):58-63, January.

Mills, 2013. Action Research: *A Guide for the teacher researcher, fifth edition*. New York: Pearson Education.

Morgan, B. & Sklar, R.H. 2013. Sampling and research paradigms. (*In* Maree, J.G. (ed.), *Complete your thesis or dissertation successfully: practical guidelines*. Cape Town: Juta & Company Ltd. pp. 69-95).

Mouton, J. 2004. *How to succeed in your master's & doctoral studies: a South African guide and resource book*.

Murray, A. 2010. Empowering teachers through professional development. *English teaching forum*, 1:2-11.

Murray, O.T. & Olcese, E.R. 2011. Teaching and learning with iPads, ready or not? *TechTrends*, 55(6):42-48, November/ December 2011.

Ngozo, B.P. 2012. Dynamics of learning style flexibility in teaching and learning. M.Ed. thesis, University of Pretoria, Pretoria.

Nieuwenhuis, J. 2010. Qualitative research designs and data gathering techniques. (*In* Maree, K. (ed.), *First steps in research*. Pretoria: Van Schaik Publishers. pp. 123-143.)

Noyce, P. 2002. *Rabbit-proof fence*. [Motion picture]. Perth: Rumbalara Films.

O'Neil, J. & Marsick, V.J. 2009. Peer mentoring and action learning. *Adult learning*, 20(1):19-24, Win-Spr.

Octavia, 2015. Building compounds and reactions task, email to T. Rossouw, 5 October.

Octavia, 2015. Exploratory and preliminary interview, interview by T. Rossouw, 27 July, Pretoria. [Digital voice recording in possession of author]

Octavia, 2015. Semi-structured interview, interview by T. Rossouw, 27 July, Pretoria. [Digital voice recording in possession of author]

Oosthuizen, M.P. 2002. An investigation into facilitating learning via the whole brain model in the Study Unit of Toothmorphology. M.Ed. thesis, University of Pretoria, Pretoria.

Pal, G. 1960. *The Time Machine*. [Motion picture]. California: Metro-Goldwyn-Mayer Studios.

Peluso, Deanna C.C. 2012. The fast paced iPad revolution: Can educators stay up to date and relevant about these ubiquitous devices? *British Journal of Educational Technology*, 43(4):125- 127.

Perkins, R. 2012. *Mabo*. [Motion picture]. Brisbane: Blackfella Films.

Porter, M. 2011. Professional development for the novice teacher: one university's initiative to support the alternatively certified educator. *Journal of the National Association for Alternative Certification*, 6(2):11-30, Fall.

Ray, N. 1955. *Rebel without a cause*. [Motion picture]. Los Angeles: Warner Brothers.

Regan, D. 2015. *ArmoredPenguin.com - Create puzzles and other diversions*. [ONLINE] Available at: http://www.armoredpenguin.com. [Accessed 30 September 2015].

Riveros, A. 2012. Beyond collaboration: embodied teacher learning and the discourse of collaboration in education reform. *Studies in Philosophy and Education* 31(6):603-612.

Robinson, K. 2010. TED Ideas worth spreading. [online] Available: http://www.ted.com/talks/sir_ken_robinson_bring_on_the_revolution.html [29 October 2011].

Robinson, V.M.J., Lloyd, C.A. & Rowe K.J., 2008. The impact of leadership on student outcomes: an analysis of the differential effects of leadership types. *Educational administration quarterly*, 44(5):635-674, December 2008.

Rossing, J.P. 2012. Mobile Technology and Liberal Education. *Liberal education*, 98(1):68-72, Winter.

Rotsey, M., Gifford, P., Hirst, R., Moginie, J. & Garrett, P. 1987. *Beds are burning*, Diesel and Dust. Performed by Midnight Oil. [LP]. New York: Columbia Broadcasting System Inc.

Rotsey, M., Gifford, P., Hirst, R., Garrett, P. & Stevens, W. 1993. *Truganini*, Earth and Sun and Moon. Performed by Midnight Oil. [CD] New York: Columbia Records.

Rowling, J.K. 1997. *Harry Potter and the philosopher's stone*. London: Bloomsbury.

Sai, Y. 2004. *Quill: the life of a guide dog*. [Motion picture]. Japan: Shochiku.

Scheepers, M. D., De Boer, A. L., Bothma, T. J., & Du Toit, P. H. 2011. A mental model for successful inter-disciplinary collaboration in curriculum innovation for information literacy. *South African Journal of Libraries and Information Science*, *77*(1):75-84.

Schenck, J. & Cruickshank, J. 2015. Evolving Kolb: Experiential Education in the Age of Neuroscience. *Journal of experiential education*, 38(1):73-95, March.

Scherman, V., & Du Toit, P.H. 2008. Cooperative learning in postgraduate lectures: Possibilities and challenges. *South African Journal of Higher Education*, *22*(2):423-438.

Shanks, J., Miller, L. & Rosendale, S. 2012. Action Research in a Professional Development School Setting to Support Teacher Candidate Self-Efficacy. *SCRATE journal*, 21(2):26-32, Summer.

Silver, H.F., Strong, R.W. & Perini, M.J. 2000. *So each may learn: integrating learning styles and multiple intelligences*. Virginia: Association for Supervision and Curriculum Development.

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.

Smith, D. 2015. Jacob Zuma under investigation for using hate speech. *The Guardian*: 19 February.

Steyn, T.M. 2003. A learning facilitation strategy for mathematics in a support course for first year engineering students at the University of Pretoria. PhD thesis, University of Pretoria, Pretoria.

Sutinen, A. 2008. Constructivism and Education: Education as an Interpretative Transformational Process. *Studies in Philosophy and Education*, 27(1):1-14, January.

Tarantino, Q. 1994. *Pulp fiction*. [Motion picture]. Los Angeles: Miramax Films.

Taylor, K.L. & Colet, N.R. 2010. 'Making a shift from faculty development to educational development' (*In* Saroyan A. & Frenay, M. (eds.), *Building teaching capacities in higher education: a comprehensive international model*. Sterling, VA: Stylus, 139-167.

Tembe, C.R.C.A. 2012. Exploring professional development interventions for improving the teaching practice of primary school teachers. PhD thesis, University of Pretoria, Pretoria.

Thomas, D.R. 2003. *A general inductive approach for qualitative data analysis*. Auckland: University of Auckland. [Course notes.]

Thomas, Y.A. and Thomas, S.B. 2001. Cerebral lateralization and its effect on drawing. *Education*, 104(1):47-50.

Ültanir, Y.G. & Ültanir, E. 2010. Exploring the curriculum dimensions of theories-based adult education: a sample course of Southeast Anatolian Region. *International journal of instruction*, 3(2): 3-24, July.

University of Pretoria. 2013. *Application for ethics approval of confidential research involving human respondents/ participants.* Research ethics committee.

Van der Watt, M. A. 2008. The integration of critical reflection as a learning strategy of health science practitioners. PhD thesis, University of Pretoria, Pretoria.

Voges, A. 2005. An evaluative analysis of a whole brain learning programme for adults. PhD thesis, University of Pretoria, Pretoria.

Walliman, N. 2011. *Research methods: the basics*. New York: Routledge.

Waters, J. 1990. *Cry-Baby*. [Motion picture]. Maryland: Universal Pictures.

Weisblat, G. and Sell, C. 2012. An exemplar in mentoring and professional development: teaching graduate students

transferable skills beyond the discipline. *Journal of research administration*, 43(1):60-84.

Wells, H.G. 1995. *The time machine*. New York: Dover Publications Inc.

Welman, C., Kruger F. and Mitchell B., 2011. *Research methodology*. 3rd ed. Cape Town: Oxford University Press Southern Africa.

Wilberforce High School. 2012. *Staff manual*. Pretoria: Wilberforce High School.

Winter, R. and Munn-Giddings, A. 2001. *A handbook for action research in health and social care*. London: Routledge.

Wolvaardt, G., & Du Toit, P. H. 2012. Action research-driven professional development: developing transformational health care managers and creating learning organisations. *South African Journal of Higher Education*, *26*(6): 1249-1264.

Wolvaart, J.E. 2014. Over the conceptual horizon of public health: a living theory of teaching undergraduate medical students. PhD thesis, University of Pretoria, Pretoria.

Yilmaz, K. 2008. Constructivism: its theoretical underpinnings, variations, and implications for classroom instruction. *Educational horisons,* 161- 172, Spring.

Zachary, L.J. 2005. *Creating a mentoring culture: the organization's guide*. San Francisco: Jossey-Bass.

Zemeckis, R. 1985. *Back to the Future*. [Motion picture.] California: Universal Pictures.

Zemeckis, R. 1989. *Back to the Future part II*. [Motion picture.] California: Universal Pictures.

Zemeckis, R. 1990. *Back to the Future*. [Motion picture.] California: Universal Pictures.

Zuber-Skerritt, O. 1996. *New directions in Action Research*. London: Falmer Press.

I Workshop and one-on-one peer mentoring sessions observation sheet

iPad workshops and one-on-one sessions observation sheet
Date:_____

Presenter: Thersia Rossouw

Use the following rating scale to rate Question 2 and 3.3.

To what extent have whole brain learning been applied?

1) Whole brain learning has not been used.

2) One/ two thinking styles were used.

3) Three thinking styles were used.

4) Whole brain learning was used throughout the facilitating of learning.

1	2	3	~~4~~

1. Topic: iPad and Whole Brain® learning

2. To what extent was whole brain teaching effectively used?

1	2	3	4

2.1 Provide a short justification for your rating in Question 2.

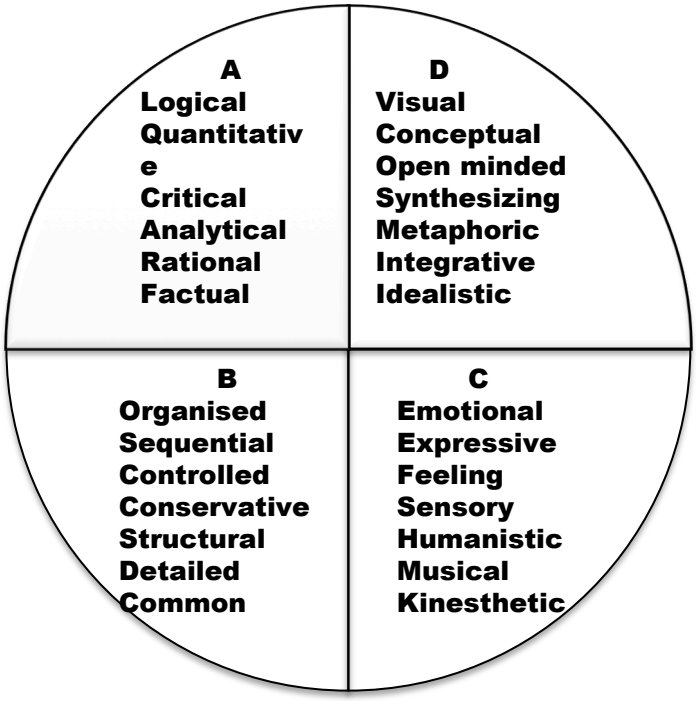
_____
_____
_____

3. To what extent were the brain quadrants incorporated during the facilitating of learning?

Quadrant A	1	2	3	4
Quadrant B	1	2	3	4
Quadrant C	1	2	3	4
Quadrant D	1	2	3	4

3.1 Indicate by using a tick which of the whole brain teaching and learning model concepts were incorporated.

Herrmann's whole brain teaching model



The above model is an adaptation of Herrmann's (1995: 415-417) expanded whole brain teaching and learning model.

4.1 List the actions that were taken for the different quadrants during the facilitating of learning.

Quadrant A: Logical	**Quadrant D: Conceptual**
A	**D**
Quadrant B: Sequential **B**	**C** **Quadrant C: Humanistic**

The above model is an adaptation of Herrmann's (1995:415) universe of thinking styles.

5. What part of the workshop did you find most challenging?

_____
_____

6. What part of the workshop did you find interesting?

_____
_____

7. Do you have any specific needs, requests or suggestions for the next workshop?

_____
_____
_____

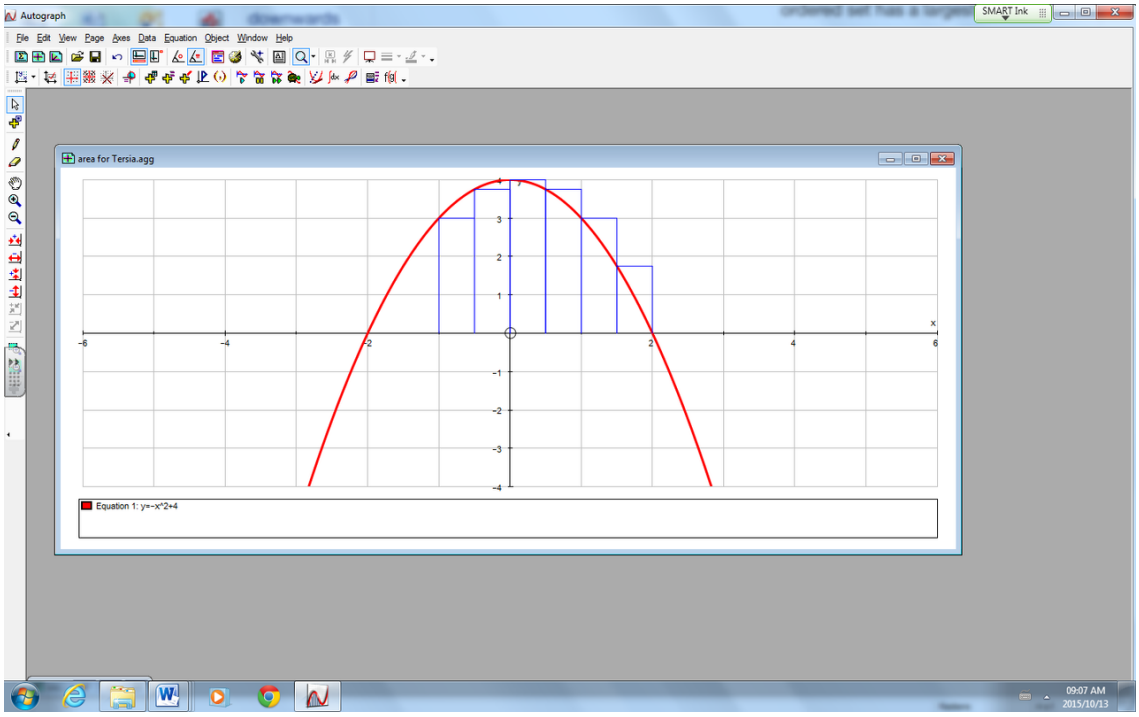
8. Discuss with a partner and visually represent some of the main ideas generated during the workshop.

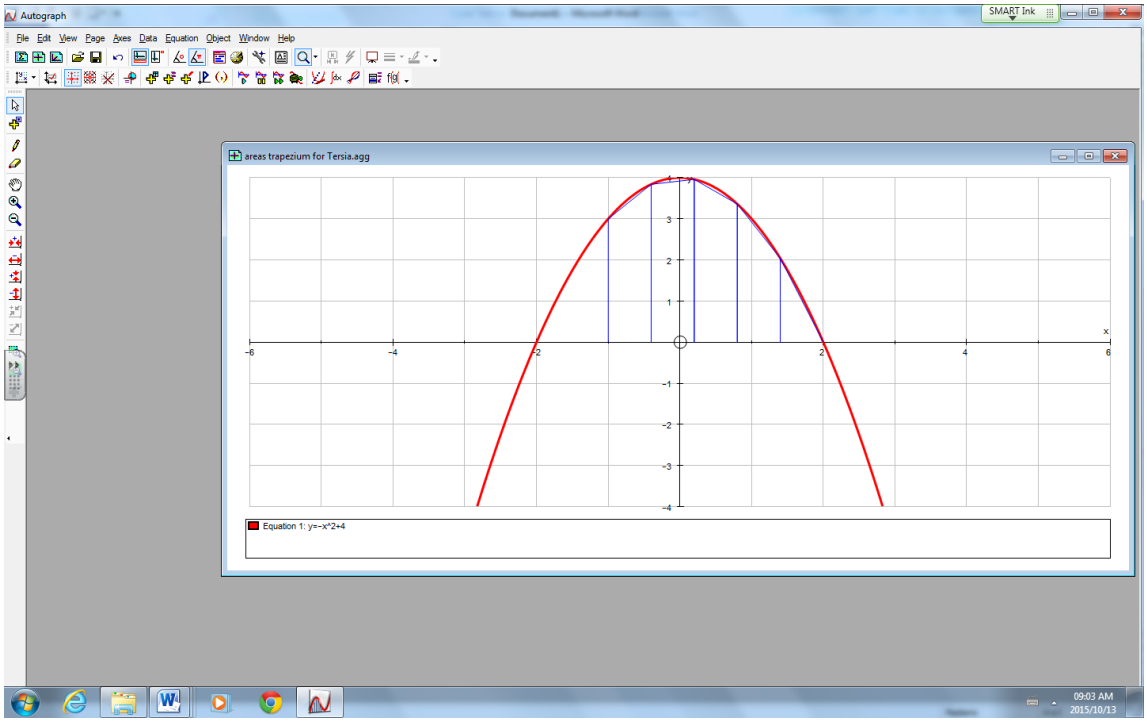
9. General feedback

_____
_____

Reference: Herrmann, N. 1995. *The creative brain*. Lake Lure: The Ned Herrmann Group.

II Brynhildr's examples of Autograph

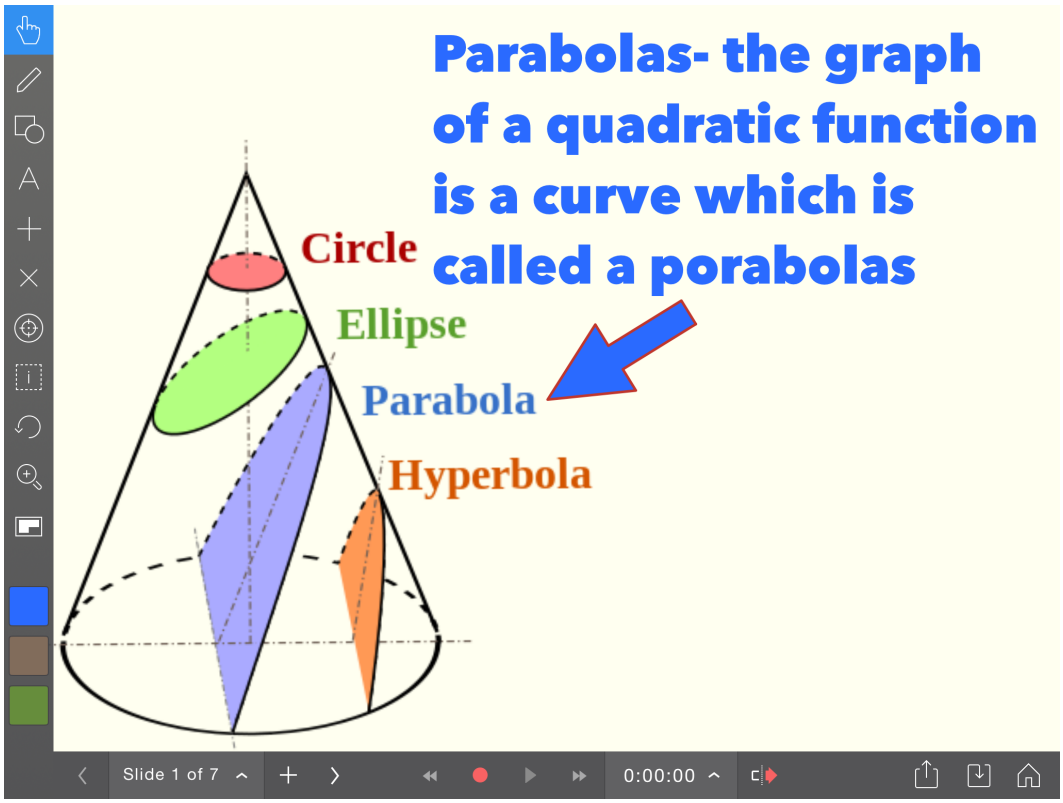


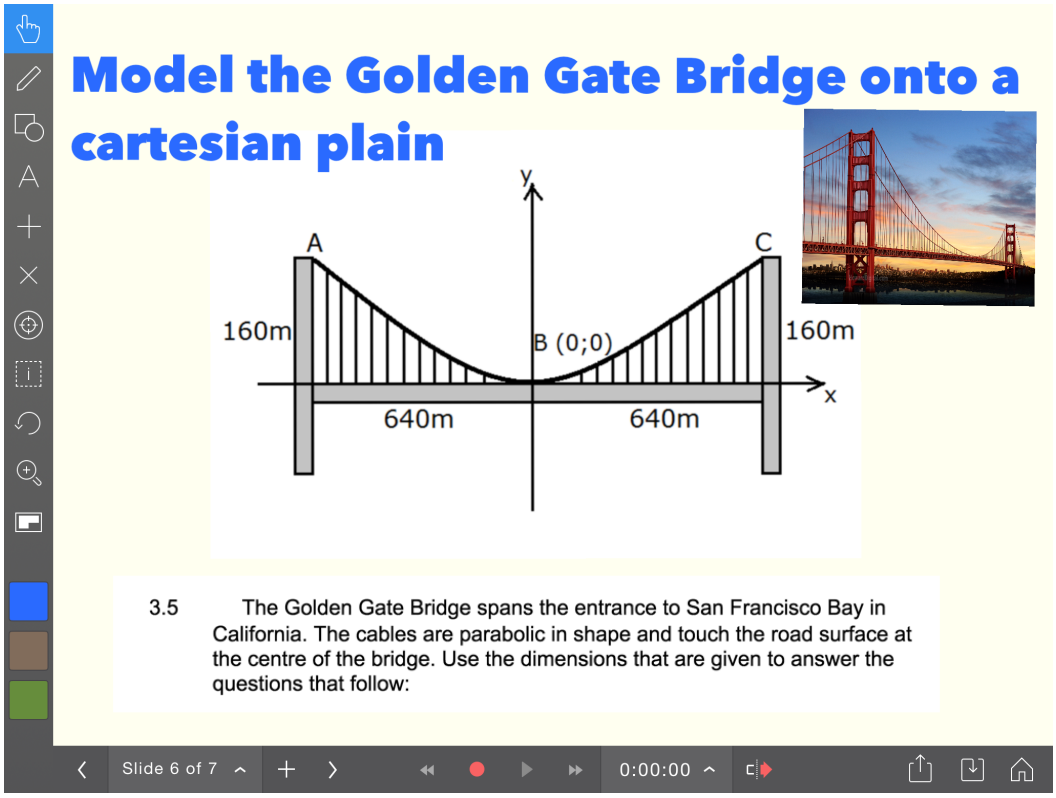


Explanation to AP Math class to find areas underneath curves.

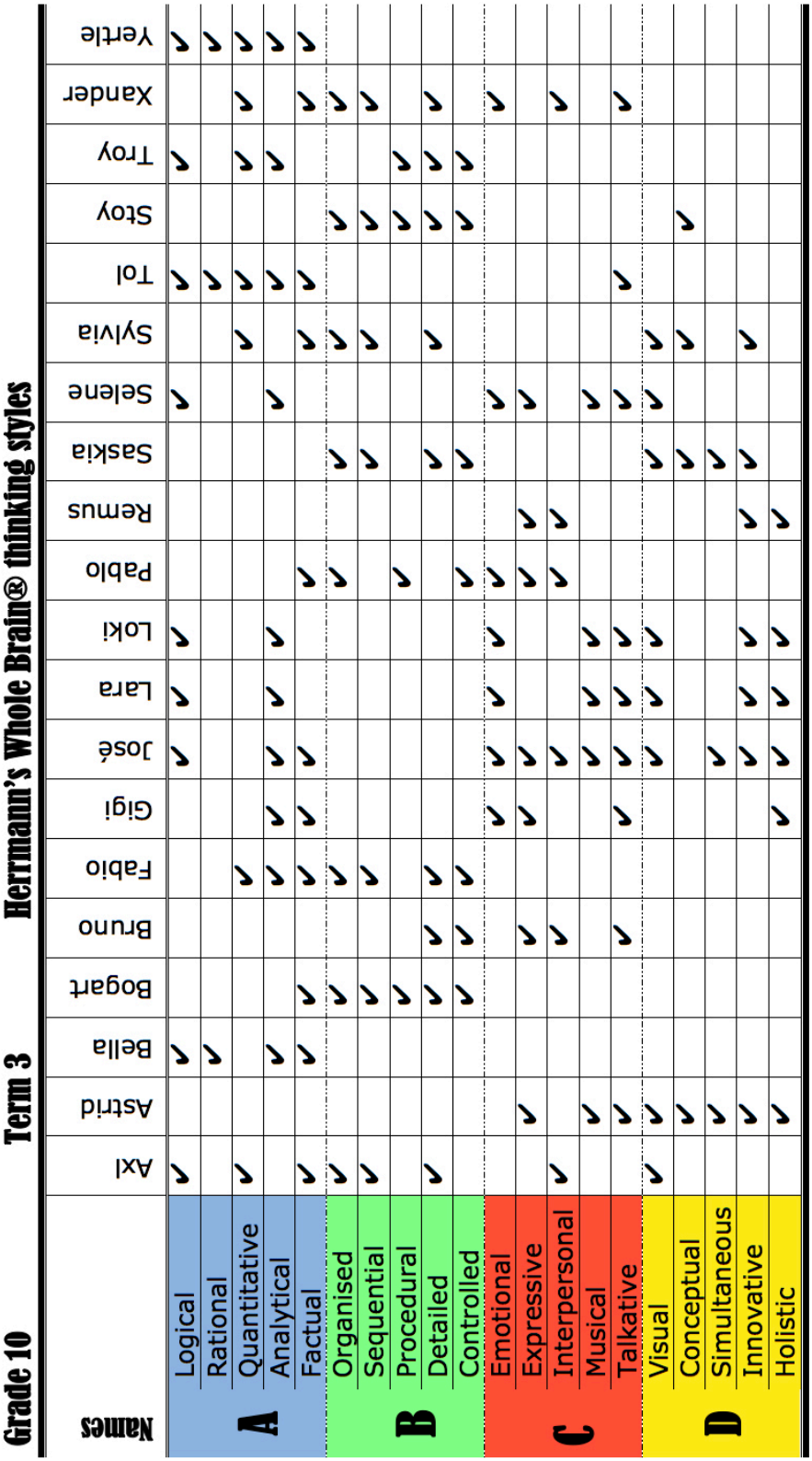
(Riemann sums)

III Screenshots of Kypris's ExplainEverything practical sessions





IV An example of a Whole Brain® thinking mode class tick list



V Alexander's Life Orientation Task

2015 Grade 9 – Life Orientation Project

THE WORLD OF WORK

Establishing a career is a process with many sub-processes. Part of getting your career established is choosing one – which is the most essential part of the process. In grade 8 or sometime in your life, you would have learnt that when choosing a career your personality should be taken into consideration. Knowing your personality is the beginning to knowing yourself and in turn, knowing what you want.

- Your task is divided into 3 sub sections that add up to 70 marks.
- The mark you get out of 70 will be your final term mark.
- Each sub section will be allotted time according to the contact sessions you have with your LO teacher. All in all, you will be given a month to complete this task – best you start with the sections you feel most comfortable with.
- **NB!!!** Note that the contact sessions your teacher has set aside are to give you instructions on what you are to do and to guide you on where you should be; most of tasks will be done out of class (at home).
- Some tasks, however, will need to be handed in earlier as they lead to the next task. You are urged to use the pace template below to determine how far you are from completing the whole project:

Task	Completed
Task 1	
Task 2	
Task 3	

- Life Orientation is an academic subject, note that it will be expected of you to use an academic tone: bearing in mind that spelling, grammar and language form part of academic writing. It will be to your benefit to ensure your work adheres to academic norms (standards).
- Detach the Appendix from this document and attach it to your assignment.

NB!!! You are COMPELLED to reference your work. If you do not have at least one reference for your work it will mean you had not completed the project requirements. Academic theft is a serious offence and [Wilberforce High

School][13] has adopted an anti-plagiarism policy which you obliged to adhering to and signed.

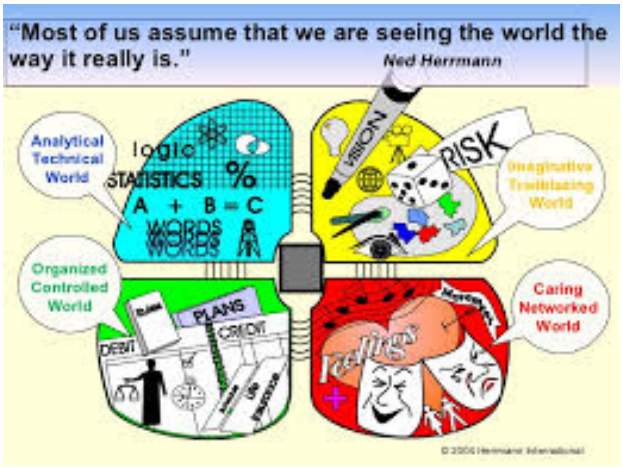
Task 1: Definitions.
[10]

Below is a list of ten key words/terms you need to define. Understanding the definitions of these words will be helpful to ensuring you complete the tasks that follow.

1.1	Academic record	**(1)**
1.2	Thinking preference	**(1)**
1.3	Personality	**(1)**
1.4	Multiple personalities	**(1)**
1.5	Financial prosperity	**(1)**
1.6	Job description	**(1)**
1.7	Tax	**(1)**
1.8	Curriculum Vitae or Résumé	**(1)**
1.9	Objectives	**(1)**
1.10	Career development	**(1)**

TASK 2: Hermann Whole Brain Model
[16]

[13] Wilberforce High School is the pseudonym used for this study, adhering to the prescriptions of the Ethics Committee.



The Herrmann Whole Brain Model has classified all thinking styles/preferences people have into 4 quadrants. Your teacher will go through the definitions of each thinking preference with you in class. Respond to the questions that follow.

2.1 List the subjects that you wrote for your June exam and the exam code you achieved for each subject (use the appendix to help you determine your code if it, that is the symbol, is not on your report card).

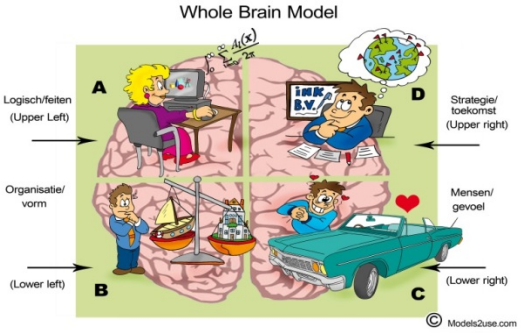
2.2 Classify yourself into the quadrants that best define your thinking preference.
Remember that your thinking preference refers to your preferred thinking patterns and not how you think or that it is your absolute and sole thinking style.

2.3 Using your marks, draw a mind map to substantiate as to why you feel that your chosen thinking style best resembles your thinking preference. Your mind map must: **(16)**

- Describe your hobbies you enjoy;

- Define your strongest thinking preference;

- Show as much innovation as you possibly can show.



Task 3: Creating your Career

[44] *According to research, over 25 jobs did not exist 10 years ago. Research further shows that that number will increase due to technological advances, environmental concerns and [an] aging population (Forbes).*

3.1. Write an essay of no more than 400 words ($1^1/_2$ pages) describing a career (your dream job) that you would undertake that does not exist currently:

3.1.1 Write it down 2 thinking preferences that you need for this dream job(s). **(2)**

3.1.2 Assess how each of them (your personality traits) resonate (link or relate) with the Hermann Whole Brain Model quadrant you classified your thinking preference in question 2.2. **(6)**

3.2. Think about what job deliverables (duties you have to deliver on) you would like to do. What are the fundamental (central) job requirements for your dream job and distinguish (separate) it from the other requirements.

3.2.1 List and describe a minimum of 4 typical deliverables for your chosen job; **(2)**

3.2.2 How long are the working hours you would likely have to labour in a day. Use this amount and calculate the minimum working hours you would be required to spend on the job in a week; **(2)**

3.2.3 Name two companies that would want to adopt your created job; **(2)**

3.2.4 State how much (in Rands) a person in the first year of work would get paid, how much wo they get paid after 5 years of working or in a junior management position and after 10 year working or senior management position or executive position. This should be for a monthly salary, excluding bonuses, benefits and before tax. **(4)**

3.2.5 Convert your monthly salary to any other two country's (besides that of South Africa) currency. Indicate the rate of that currency to the Rand. Be sure to include the date when you viewed the rate. **(2)**

3.2.6 Describe an existing job that is closely related to the job you have chosen. Mention a deliverable of that job that you will be required to do which is a requirement for your selected job. **(2)**

"Hope says: you have reached the heavens, long before your feet have left the ground."

Tshepo Seloane

Age: 25
Country of Origin: South Africa

In 2012, Tshepo was appointed as Advisor to the Nelson Mandela Children's Fund youth initiative called Efeng Bacha. Tshepo is passionate about the African boy child, his programme the ABC (African Boy Child) addresses the issues of male rape in prison/juvenile institutions and it's impact on the community. He is currently the Executive Director of Mbewu, a youth led social organisation which aims to inspire the youth to become active agents of change in their communities. Being selected as a rising star will allow Tshepo the platform to become a voice for others like him, who dream of rising out of poverty and helping those who have hidden behind the scars of abuse to finally lift the veil of shame. If a child from the dusty streets of South Africa whose life was measured no further than ordinary could rise up even with all the odds against him, then the sky is not the limit.

Source: http://www.krugercowne.com/risingstar/shortlist/tshepo-seloane/

Read Tshepo's story and include the following in your job description:

3.2.7 Write a paragraph that will explain: **(12)**

1. The reason why you chose to create that job; using your classification in the Herrmann Whole Brain Model, assess whether your 'created job' is suitable for you or if you should reconsider it;
2. How you will use this job to make an impact on society.
   For 2, remember it must be something appreciable – that will use your skills to help people.

3.2.9 Grammar, Spelling and Content **(12)**

NB! For this section, consult the rubric

THE END

Appendix – Name and Class:

A. Useful websites

Herrmann Whole Brain Model:

- http://www.hbdi.com/WholeBrainProductsAndServices/programs/thehbdi.php
- http://www.ucop.edu/ucophome/businit/boi/presentations/2005/05styles.pdf

Salaries:

- http://www.careerinfonet.org/
- http://www.careeroverview.com/salary-benefits.html
- https://collegegrad.com/careers/all

Careers:

- http://www.careeroverview.com/careers.html
- http://www.myfuture.com/careers/
- http://www.yourfreecareertest.com/index.html (there is information on careers on the left hand margin of the screen)

VI Alexander's reflection on the Grade 9 Life Orientation task

What worked:

Getting the students to introspect into their personalities and think through the possible career paths they would undertake is certainly a highlight. Added to that, would be the fact that they created their own career, and many of them used their creative qualities to come up with a career which is non-existent.

Lowlights:

Many of the students did not reflect extensively on their quadrants, this led to their mindmaps not being exclusive and lacking uniqueness. I feel the mindmaps could be completed better and executed with greater precision.

If I were to be a little more strict, I would say some of the students battled to created new jobs but instead worked on what was already existing. This, howeve, can also be turned around to say that at least they started to think more on a job they would like to do.

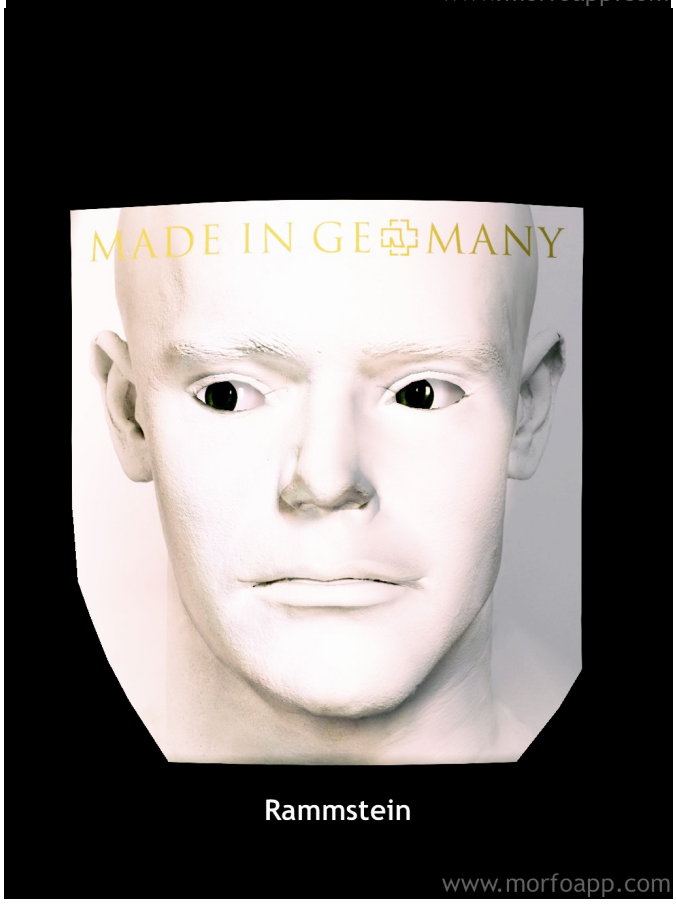
The most dissappointing of the whole task was the fact almost all of the students did not elaborate or justify widely as to why their job/career is best suited for them based on the Herrmann Whole Brain Model quadrants they classified themselves into.

What could be improved:

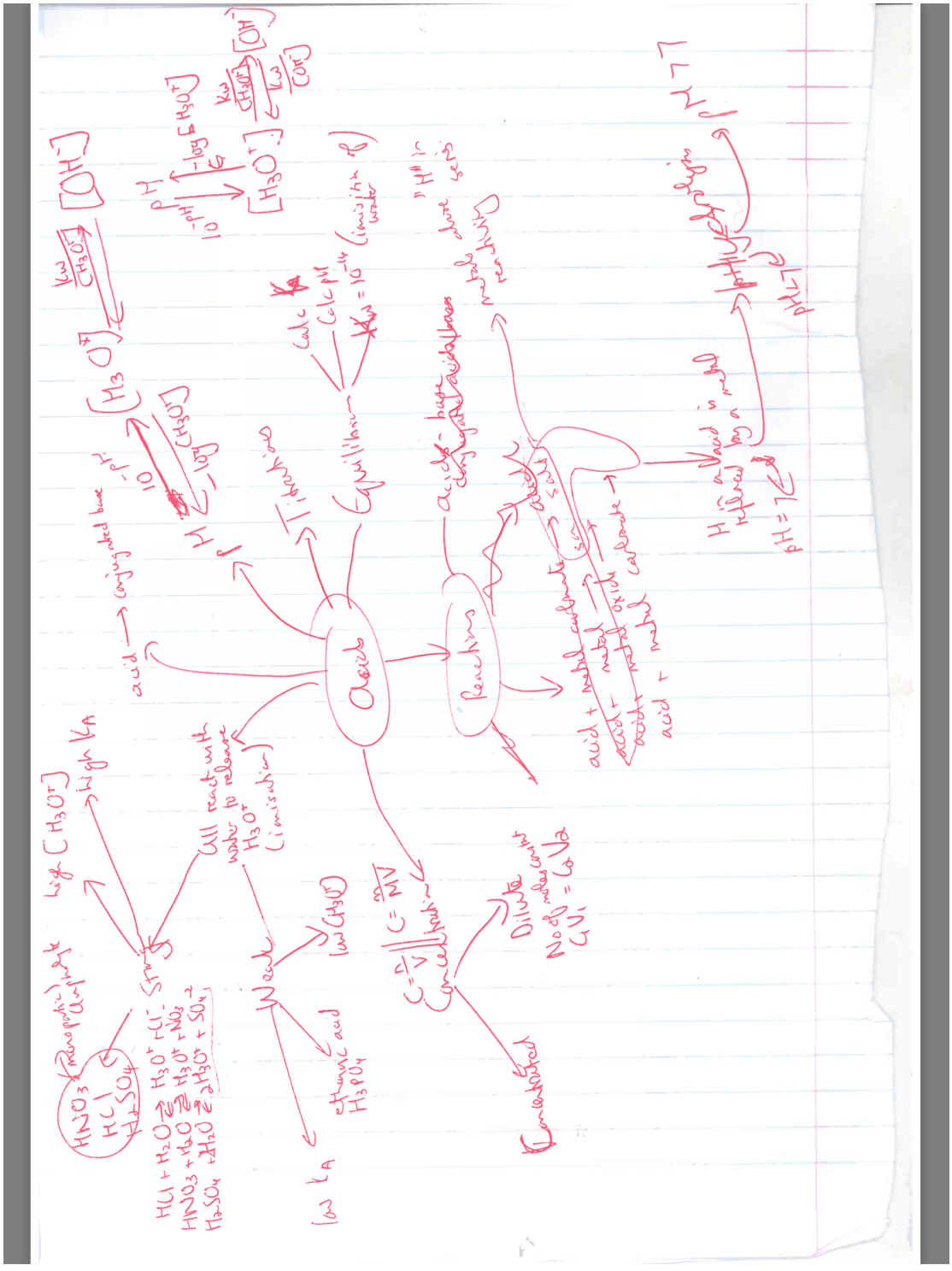
I think the mind maps need better facilitation especially when making the students classify their Whole Brain quadrants.

Added to this, I would probably have different career markets and opportunities for innovation be explored as a build up to creating a new career.

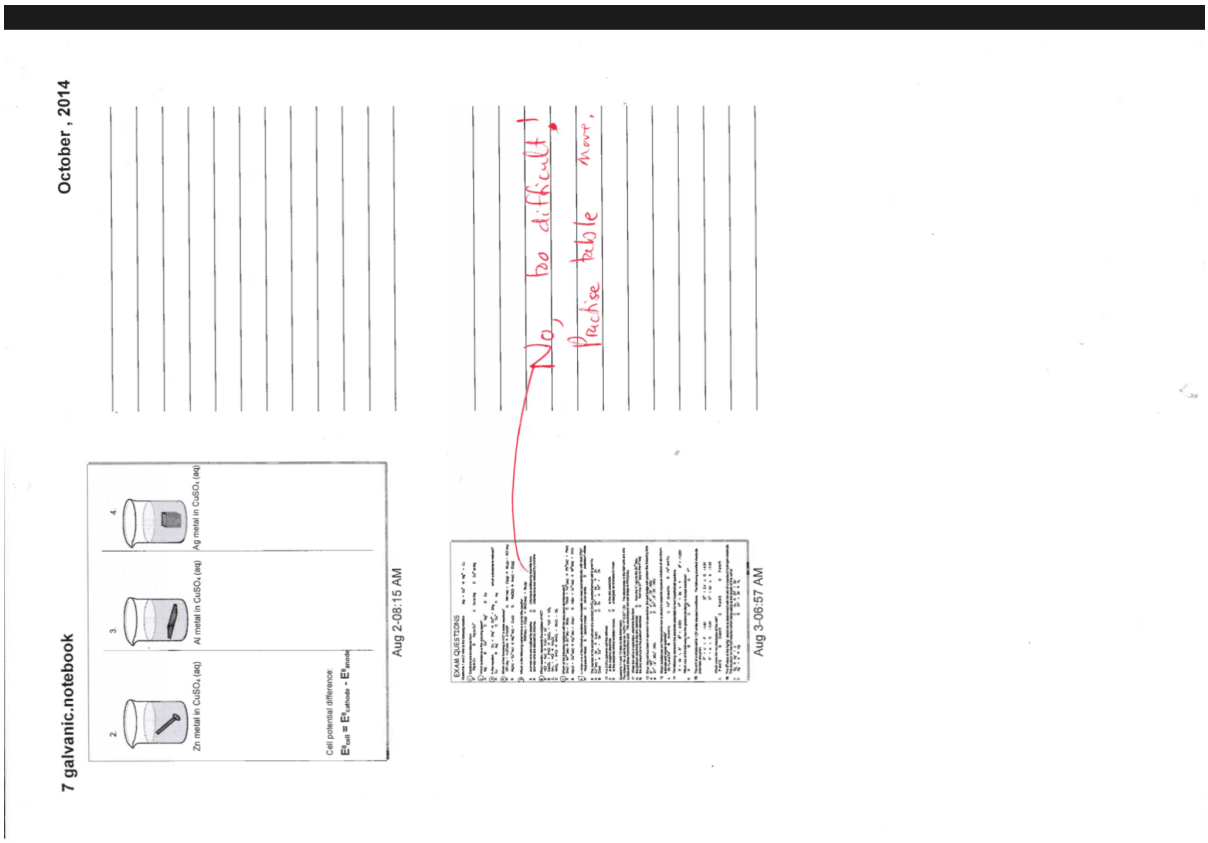
VII Two examples of animations created in Morpho Booth

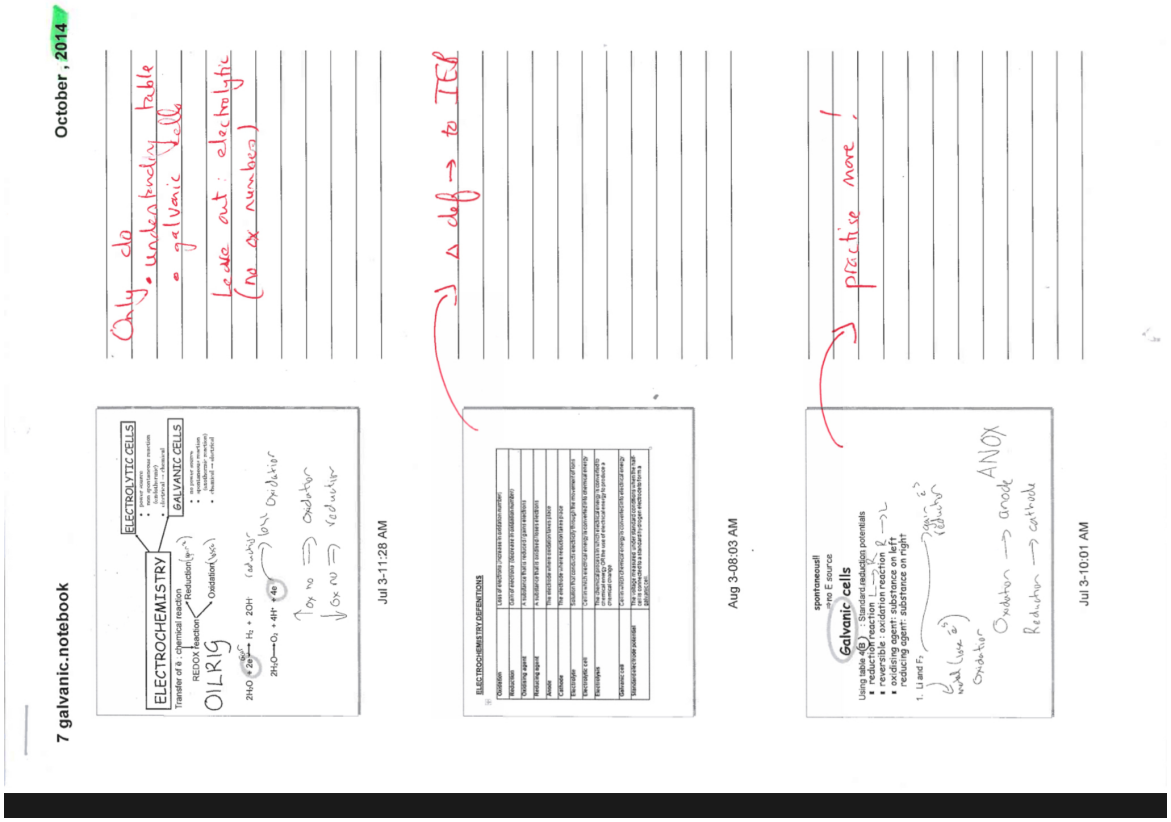


VIII Helena's mind map



IX An example of Helena's Notebook reflections





X Helena's transportation task

GR 10 FORMAL ASSESSMENT TASK: MOTION IN A STRAIGHT LINE
GROUP NUMBER: _____ DATE: _____

TEAM MEMBERS: _____ _____

_____ _____

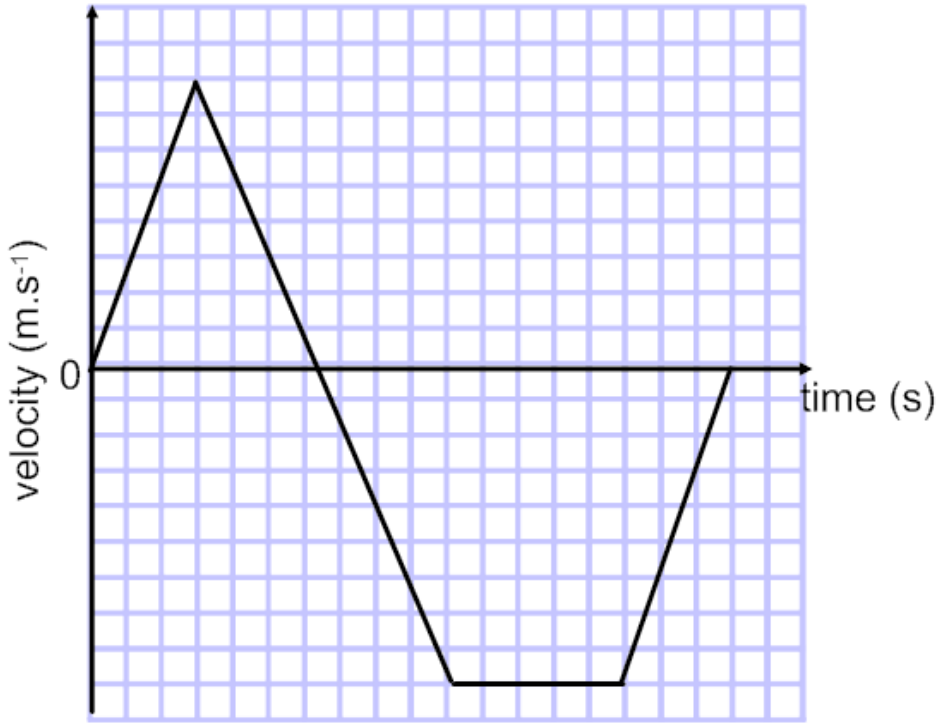
TRANSPORTATION MODE: _____

IN YOUR GROUP:

- **Write a paragraph to introduce the transportation mode used.**
- **Indicate values on the given velocity time graph, corresponding with your transportation mode. Use a relevant scale.**
- **Use your cell phone to record the imitated motions.**

INDIVIDUALLY:

- **Formulate at least EIGHT questions based on your graph. One of the questions must include equations of motion.**
- **The test must be out of 30.**
- **A memorandum must accompany the test.**



Rubric for scientific report

GROUP NUMBER: _____ **DATE: _____**

NAME: _____

TRANSPORTATION MODE: _____

	Yes	No
Introductory paragraph: Wording is clear and makes sense. Relevant data is included.	2,1	0
Velocity time graph: Relevant scale was used.	2,1	0
Test Questions:		
At least 8 questions	8 max	0
Include question based on equations of motion	2	0
Clear mark allocation for every question	1	0
The following words were used: Displacement, starting point, distance, use the graph, acceleration	2,1	0
Questions were clear creative variety of questions	3,2,1	0
Memo:		
Neat	1	0
Correct	1	0
Mark allocation indicated with ticks	1	0
Video:		
Motion correct	1	0
Starting and finishing points correctly indicated	2,1	0
Total mark (25)		

XI The memory palace: an extract from the Grade 8 Study Methods workshop

Method 4: The Memory Palace/ Roman Room/Loci

Buzan and Harrison, *The memory book: how to remember anything you want*. 2010: 77-81.

- Imagine your house or room
- Link objects in the house to something you need to remember
- Create your own memory palace in the space below. Label the objects with the following key words:

➢ Dictators
➢ Idi Amin
➢ Mobutu Sese Seko
➢ Economic
➢ Political
➢ Cultural
➢ Social

© Can Stock Photo - csp3780768

XII An extract from the Aboriginal people of Australia workshop worksheet

The Aboriginal people of Australia

Focus: impact of Social Darwinism and Eugenics

Cultural relativism

Aboriginal Clans

Crown land - land belonging to the British government (the Crown)

Traditional lifestyle

Elders

Deities

Reincarnation

Totemism

Creation beings - created people and the landscape, red, yellow & white

Ancestral beings - shared knowledge - weapon's, food, laws

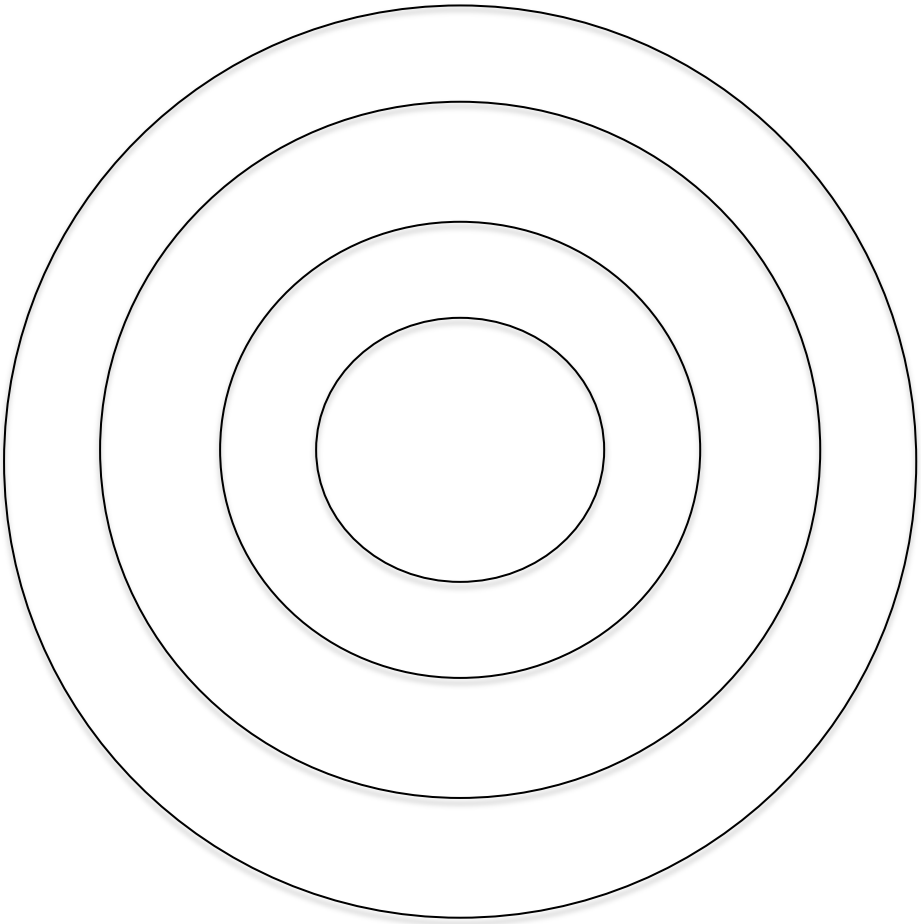
Totemic beings - original form

Dreamtime -information that describes the Dreamtime, explains Aboriginal people's relationship to the land and sets out their traditional rules of behaviour

Funerals

Primary funeral	Secondary funeral

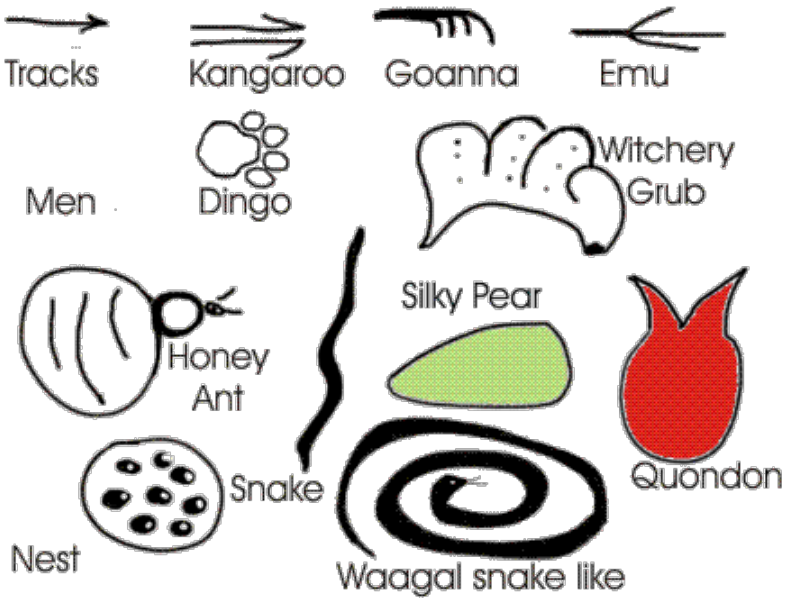
Aboriginal child within the clan

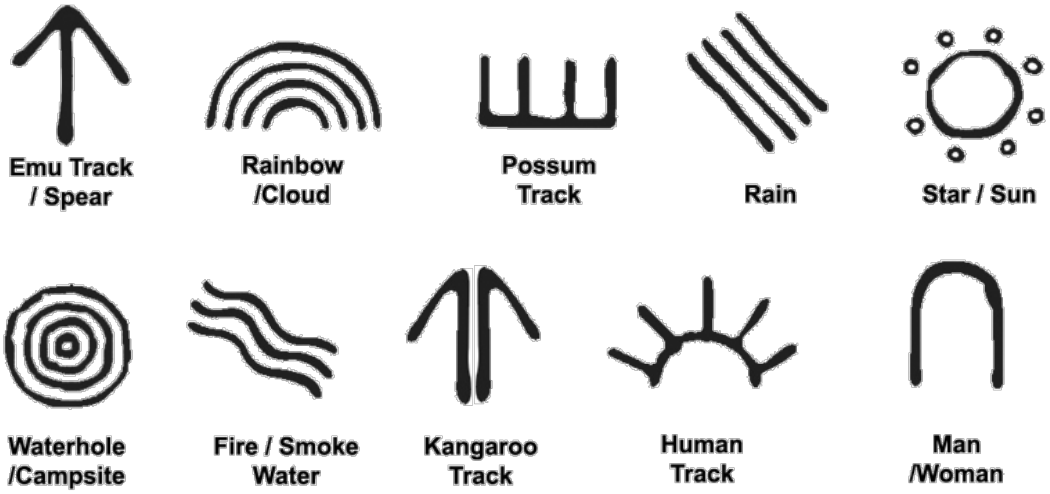


How would an aboriginal child be affected if taken away from his/her clan?

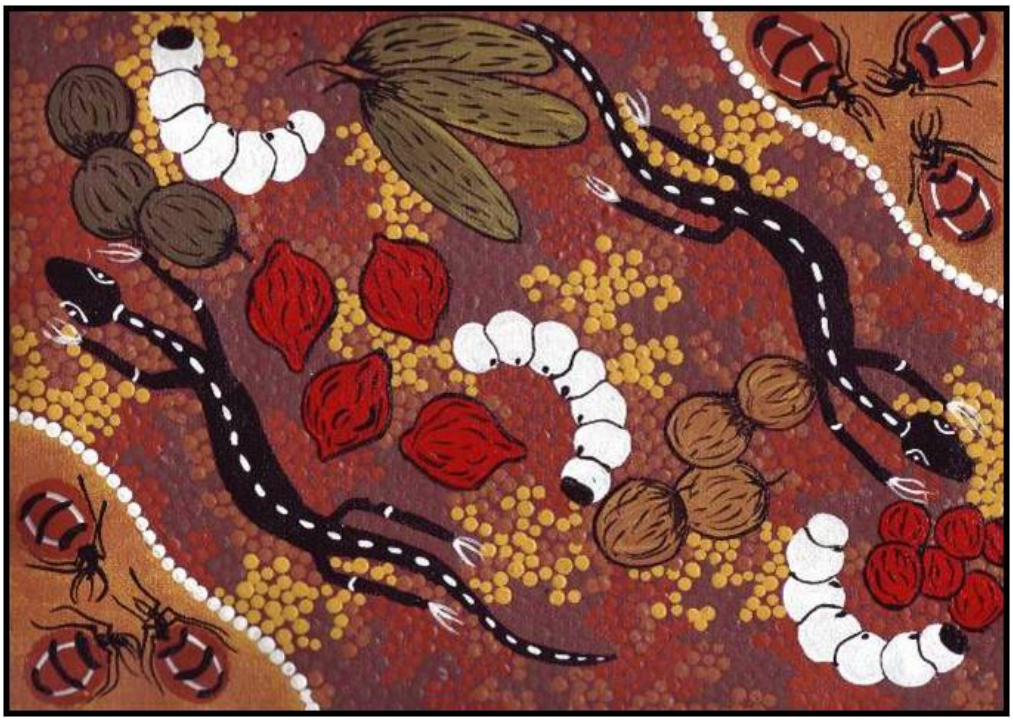
Bark painting

Dot painting





Using the explanations of the symbols on the previous pages, explain what the artist is depicting in the following dot paintings.



Source: Anon.2012.AHREN.*Aboriginal artwork*. (Online) Available: http://www.risen.org.au/Indigenous/indigenous_Lifeart.asp [22 October 2014]

Plan a dot painting to indicate your life journey thus far:

Identify this landform and explain why it is so significant for the Aboriginal people.

Source:Anon.2014. *Peter Pan's Adventure Travel*. (Online) Available: http://www.peterpans.com.au/peterpanstravel/uluru [22 October 2014]

Melbourne Gaol

Death row

Describe the conditions for an inmate in Melbourne Gaol

Bob and Jack - Social Darwinism?

Ned Kelly - Social Darwinism?

Bushranger

Phrenology - study the shape and size of the cranium

Tasmania

Van Diemen's land

The Black Line

Port Arthur

Dog Line

Truganini

Doomed Race theory - Aboriginals 'doomed to extinction' because they are 'primitive' hunter-gatherers

Stolen Generations	Migration of British children
National Sorry Day	Apology, airfares back to Britain

XIII Bonus questions in the Grade 11 November 2014 Examination

BONUS QUESTIONS: Choose only 1 of the following and complete it on the Bonus Question page in the answer booklet.

Topic 1: Aborigines in Australia

1. Jake Gordon (Source 1D) wants to revisit his roots and heritage. Make a drawing using traditional dot painting symbols to show Gordon how his ancestors lived off the land. Write a brief explanation for him. (3)

Topic 2: Nazi experiments

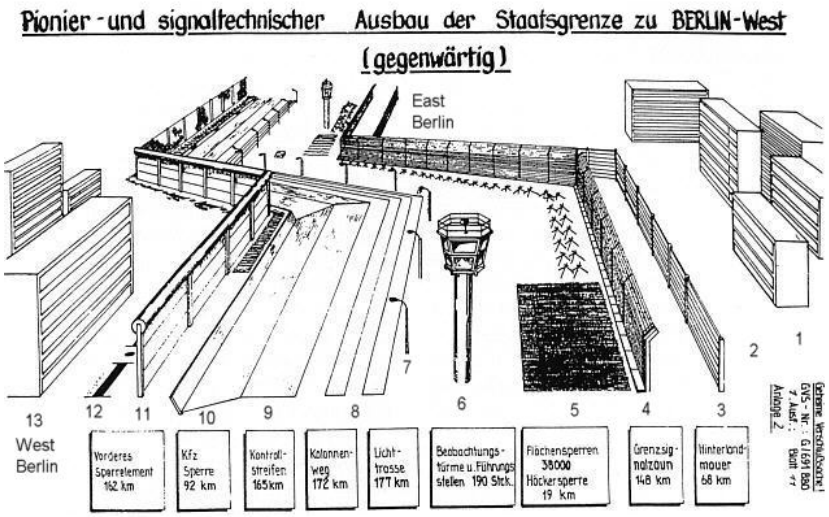
2. Raoul has watched a documentary on Cuban cable about the Nazis. His new medication confused him so much that he is now marching up and down the old age home saluting and shouting 'Heil Hitler.' Draw a concept map, with keywords and pictures to explain to Raoul why Eugenics and Social Darwinism contradicts his socialistic beliefs. (3)

Topic 3: National identities and apartheid

3. A prominent Afrikaans musician has fallen in love with one of President Jacob Zuma's daughters. Draw up an action plan explaining to the President why the Afrikaans musician will not be paying the traditional Lobola to marry his daughter, without offending the Zulu tradition. (3)

Topic 4: The Cold War

4. You are trapped in East Berlin in 1963. You are desperate to go to West Berlin and join your family. Draw up a visual plan to plot your escape. (3)



XIV An extract from the Grade 11 November 2014 History Examination

French tourist did a striptease on Uluru


A French tourist who strip-danced on top of Uluru says she was paying tribute to indigenous culture. Alizee Sery, 25, who was filmed performing the raunchy act on the World Heritage-listed rock in the Northern Territory, said it had been a life-long dream to visit the site.

"So, if I do it, I have to do it in a way I am going to remember," she told the Sunday Territorian.

"I do not mean in anyway to offend the Aboriginal culture."

"What I did is a tribute to their culture in a way."

"It's entertaining but also ... I did it as a tribute to the way it used to be, how they were living naked back in the days, so I am doing a return to the land."

Source: Anon.2010.The Sunday Morning Herald.

Read Source 1A and use your own knowledge to answer the questions.

1.1 Analyse the dot painting in Source 1A. Provide a detailed explanation of what this painting means. (2x2= 4)

1.2 Use your own knowledge to explain:

1.2.1 Creation being (2x1= 2

1.2.2 Dreamtime (2x1= 2

1.3 Use your own knowledge and discuss why Uluru is important to the Aboriginal people. (2x1= 2

1.4 Imagine that you are an elder from the Aboriginal clan living at Uluru. Explain how you would deal with Alizee Sery (Source 1A). (2x2= 4

1.5 Do you believe that Alizee Sery did her striptease to pay tribute to the Aboriginal people? Justify your answer. (1x2= 2

XV Grade 11 2011 History Research Task

Grade 11 **Heritage Assignment** **Total: 75**

Key Question: What influence does heritage have on your life?

Instruction: Do research about one of the following topics and brainstorm your main ideas.

Hand your planning in on the 19th of September 2011.

Your planning will count 10 marks.

Choose one of the topics:

1. Research your family history (genealogy).

Your research must include family stories, family tree, family pictures, information about your culture.

The objective of this assignment is to do primary research and gather oral evidence from family members.

Length: 6 written pages.

2. You visited two museums last term.

If you were the curator of a museum how would your museum be different from the traditional museums?

Be creative, you must draw up an action plan and illustrate what the exhibits will be like at your museum. Remember to also clearly state what type of museum you have.

Length: 6 written pages.

3. The Boom Years in the USA

You must film your performance and hand it in with your final assignment.

You may work together in pairs or as a group, however, each student will receive individual marks.

Written component (3 written pages): Evaluate how much the American culture has influenced (and still is influencing) South Africa.

Choose one of the following topics:

3.1 Dance e.g. Black bottom, Tango or the Charleston

3.2 Act out a silent movie scene (at least 10 min)

3.3 Make an animation film (think 1920s) for Walt Disney

3.4 Choose a typical Jazz song from the 1920s and you can either make a remix or a mash-up of the song

XVI Grade 11 2014 History Research Task

Instructions:

- Choose ONE of the topics.
- Write a research essay of 5-6 pages long.
- Use the PEEL writing frame.
- Use the Harvard method of referencing.
- You have to use information from Google Scholar to find supporting evidence for your argument.
- Use at least 7 different sources.
- A typed essay must adhere to the following:

I. 4-5 typed pages
II. Veranda size 12 font
III. 1,5 spacing
IV. Text must be justified.
V. Submit a hard copy and a soft copy.

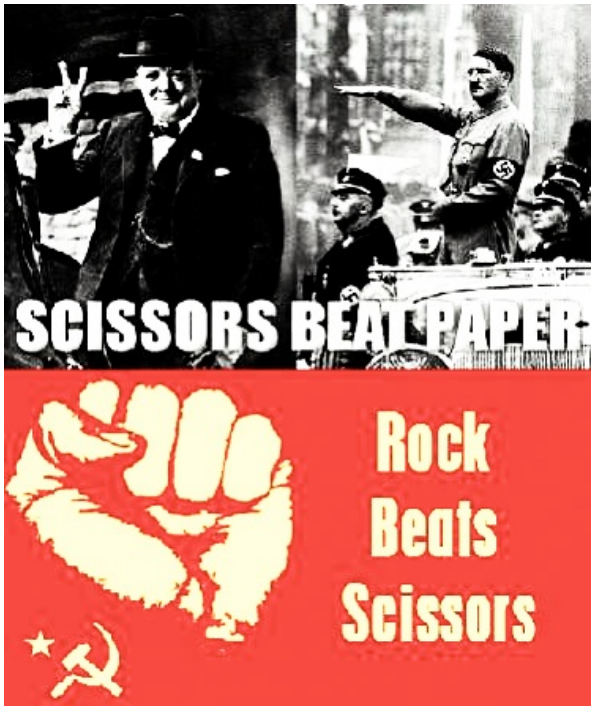
Time management

Dates	What you have to complete	Check
20-24 August	Initial source investigation Read through the sources and make notes	
25-31 August	Plan your argument In-depth analysis of the sources Structure your argument Ensure that you have enough factual evidence to support your argument Ensure that you have +/- 2 pages per sub-topic	
1 September	Finalise planning and sources	
2 September	Submit your planning Please note that this will only be handed back after the Research Tasks have been marked.	
3-7 September	Write first draft	
8-12 September	Write second draft	

	Finalise argument and factual evidence	
13-15 September	Final editing	
16 September	Print Task	
17 September	Submit the final Research Task	

Mark allocation

	Marks
Planning	10
Concept map	10
Harvard Referencing	10
Research essay	50



Concept Map

The concept map must be a synthesis of the written information. You may include pictures or you may draw it or use a computer program to generate the final draft. This will count for 10 marks and the objective is to see if you can simplify a complex analysis into an easy and understandable concept map. Think in terms of explaining it to a 7 year old or think about poor old Raoul.

Harvard Referencing Method

You have to use the Harvard in-text referencing method. You will loose 10 marks if you do not use the Harvard method correctly.

A simple and user-friendly version:

http://www.monash.edu.au/lls/llonline/writing/science/3.2.xml

Alternatively you can download the App: Easy Harvard Referencing

Choose ONE of the following topics for your Research Task:

Topic 1: Politics

If you are a logical, critical and factual thinker, this will be the topic for you.

The Middle East Peace Process 'For too long, the citizens of the Middle East have lived in the midst of death and fear. The hatred of a few holds the hopes of many hostage. The forces of extremism and terror are attempting to kill progress and peace by killing the innocent. And this casts a dark shadow over an entire region,' President George W. Bush in his June 24, 2002 address to the nation.

Assess to what extent you agree/ disagree with the above statement by referring to the conflict in the Middle East.

Focus on the following in your argument:

- Palestinian and Jewish perspectives
- Cold War and the Middle East conflict
- Possible solutions to the conflict

OR

Topic 2: Science

If you are organised and focus on detail then this topic is for you.

'Nicola Tesla's inventions were purposefully kept from the proletariat by capitalist profiteers.'

Critically evaluate to what extent the above statement is true by referring to the inventions by Nicola Tesla and why these inventions were not always given recognition.

OR

Topic 3: Social Studies

If you are a visual person who likes to see the whole picture in order to understand the dynamics of history, this topic is for you.

Source: http://www.dontpaniconline.com

Critically analyse the effectiveness of protest art in order to bring about social change, by making reference to protest art from the following protests movements:

- Anti-Apartheid protest art
- Anti-nuclear protest art/ Nuclear disarmament art (Cold War)
- Animal rights protest art e.g. Peta, Greenpeace or Animal Liberation Front

OR

Topic 4: Civil Society Protests

If you are a people's person and like to see the dynamics of group work and fighting for the same cause, this topic is for you.

Source: http://kenanmalik.wordpress.com

'Nothing in the world is more dangerous than sincere ignorance and conscientious stupidity.' Martin Luther King, Jr.

Analyse to what extent the above statement would be true by comparing and contrasting how effective popular protests were in achieving their objective of civil rights.

The comparisons must be done on:

I. Civil Rights Movement in the USA
II. Civil disobedience and passive resistance in South Africa
III. Aboriginal civil society protests in Australia e.g. Black Armband

XVII A few extracts from the Communism workshop worksheet

Grade 11 Communism Worksheet

SOURCE 1

Source: http://thefederalist-gary.blogspot.com/2012/04/socialist-obama-attacks-job-creating.html

Examine Source 1 and answer the following questions:

1.1 How would this board game contradict capitalism?

2 x 2 =(4)

1.2 Give an explanation for the following:

1.2.1 Residence Castro 1 x 1 = (1)

1.2.2 Square of heavenly peace 1 x 1 = (1)

1.2.3 Red Square 1 x 1 = (1)

1.2.4 Class Struggle 1 x 1 = (1)

1.3 Evaluate if this board game would be accurate with the principles of communism? 2 x 2 = (4)

2.1 You were involved in Cuba's literacy programme and you visited an old age home every afternoon to teach a group of three elderly

people how to read. One of them suffers from Alzheimer's, thus you need to simplify the concept of communism so that Raoul will be able to understand it.

Use a mind map/ concept map/ graphic representation to remind Raoul why he was part of the liberation movement in Cuba in order to reach the final phase, Utopia. 3 x 2 = (6)

2.2 You need to explain to a Cuban pre-schooler the 10 tenets of communism. Look at each of the words and make a drawing of each tenet to explain it to the young communist.

1 x 10 = (10)

Source 4

The father of communism, no relation to Darth Vader.

4.1 Identify who this man is. 1 x 1 = (1)

4.2 What is the name of the famous book that he wrote? 1 x 1 = (1)

Source 5

The Three Stooges?

Source: http://people.howstuffworks.com/communism.htm

5.1 These three gentlemen have very little in common with the Three Stooges. Identify each one of them and indicate what role they played in History. 3 x 2 = (6)

Source 6

Source: http://perspectivos.blogspot.com/2008/05/marxism-aint-dead-yet.html

6.1 Explain the meaning of the hammer and sickle. 2 x 2 = (4)

6.2 Would this poster be an accurate representation of communism? 2 x 2 = (4)

6.3 Identify each of the jolly gentlemen. 5 x 1 = (5)

Source 7

Political systems explained by Carsten Cumbrowski referring to 2 cows.

The fundamental principles of the different types of political and social systems explained via a simple example using two cows. If you know what a cow is and are aware of the fact that they produce more than just steaks for your dinner, such as milk, you are good to go and should have no problem to understand it.

Political system	Instructions about the cows
Feudalism	You have two cows. Your lord takes some of the milk.
Pure Socialism	You have two cows. The government takes them and puts them in a barn with everyone else's cows. You have to take care of all of the cows. The government gives you as much milk as you need.
Bureaucratic Socialism	You have two cows. The government takes them and put them in a barn with everyone else's cows. They are cared for by ex-chicken farmers. You have to take care of the chickens the government took from the chicken farmers. The government gives you as much milk and

	eggs as the regulations say you need.
Fascism	You have two cows. The government takes both, hires you to take care of them and sells you the milk.
Pure Communism	You have two cows. Your neighbors help you take care of them, and you all share the milk.
Russian Communism	You have two cows. You have to take care of them, but the government takes all the milk.
Cambodian Communism	You have two cows. The government takes both of them and shoots you.
Dictatorship	You have two cows. The government takes both and drafts you.
Pure Democracy	You have two cows. Your neighbors decide who gets the milk.
Representative Democracy	You have two cows. Your neighbors pick someone to tell you who gets the milk.
Liberation Capitalism:	You have two cows. You sell one and buy a bull.
Bureaucracy	You have two cows. At first the government regulates what you can feed them and when you can milk them. Then it pays you not to milk them. Then it takes both, shoots one, milks the other and pours the milk down the drain. Then it requires you to fill out forms accounting for the missing cows.
Pure Anarchy	You have two cows. Either you sell the milk at a fair price or your neighbors try to take the cows and kill you.
Surrealism	You have two giraffes. The government requires you to take harmonica lessons.

Source: http://vimeo.com/7196917

7.1 Choose one of the political systems that you would follow.

Explain why you would support this system. 2 x 2 = (4)

XVIII Aboriginal Cycle Test Reflection

Grade 11 **The Aborigines in Australia Cycle Test**

4 September 2014

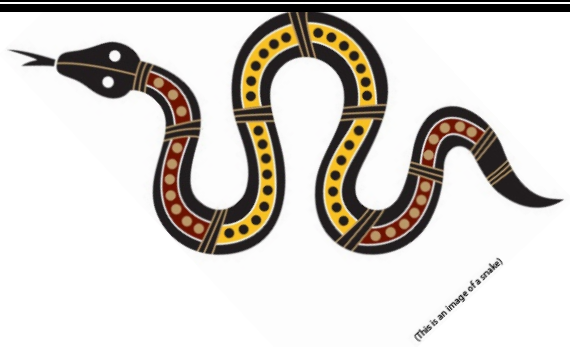
Name:_____

Aboriginal name:_____

Grade 11: _____

Historical understanding rating scale

Skill	Level 1 Attend the workshops and do extra work. Hand your work in to be marked. Review your study method. Read more.	Level 2 Attend the workshops and do the extra work. Review your study method and manage your time better. Read more.	Level 3 Attend the workshops or speak to Miss Rossouw for extra support.	Level 4 Well done, young Historian! You are on your way to become a diplomat/ interpreter/ world leader/ mentor for your peers.
Cultural relativism	Shows little understanding of cultural relativism.	Shows limited understanding of cultural relativism.	Shows an understanding of cultural relativism.	Shows insight, understanding and objectivity regarding cultural relativism.
Source analysis and interpretation	Shows little understanding of the sources and with relation to the work.	Shows a limited understanding of source analysis and interpretation.	Shows an understanding of the sources. A few basic misinterpretations.	Shows excellent understanding and interpretation of the sources.
Argument linked to Historical facts	Weak argument or no argument.	Weak argument or argument not supported with Historical facts.	Good argument and amiable Historical evidence used to support it.	Excellent argument and shows rigour with regard to the use of Historical factual evidence.
Cause and effect of Pseudo- Science	Shows little understanding of the impact of Pseudo-Scientific racism.	Shows limited understanding regarding Pseudo-Scientific racism.	Good understanding of Pseudo-Scientific racism and the impact it had on the Aboriginal people.	Excellent understanding of Pseudo-Scientific racism and the impact it had on the Aboriginal people.
Paragraph: Stolen Generations	Shows little understanding of the source and the reasons given for taking Aboriginal girls.	Shows a limited understanding of the source and the reasons given for taking the Aboriginal girls.	Good understanding of the source and the reasons why Aboriginal girls were taken. Good analysis of the various reasons.	Excellent understanding of the source and the reasons why Aboriginal girls were taken. Shows insight and rigour in the analysis of the reasons given.



(This is an image of a snake)

XIX June Exam Reflection Sheets

Grade 8 June History Exam reflection I received %		
Written comment	**Tick if applicable ✓**	**Marks lost**
Focus on question		
Explain better/ vague		
× (incorrect answer)		
∧ (more information/ Historical evidence needed)		
Source analysis and comprehension		
☹ (left out an answer)		
Quote		
Paragraph L1/ L2 (Refer to the types of labour)		
Other:		
Other:		
Refer to your research		
Time management		
Other:		
		TOTAL

June History Exam Mark:	**95**

Enrichment Workshops to attend (or collect the notes):

Workshop Theme	Date	Tick ✓
Time management and study methods		
Source analysis and comprehension		
Paragraph writing skills and academic writing		
Media analysis		

Parent's signature _____

Matric June History Exam reflection

I received %

Written comment	Tick if applicable ✓	Marks lost
Source-based questions		
Focus on question		
Explain better/ vague		
✕ (incorrect answer)		
Λ (more information/ Historical evidence needed)		
Λ Be specific		
Source analysis and comprehension		
Did not quote from the source, as instructed by the question.		
Did not refer to the source/s in the answer		
R (repeat answer)		
☹ (left out an answer)		
Paragraph L1/ L2 Why?		
Paragraph: no source reference		
Lack of Historical terms		
Time management		
Essay question/s		
Did not give a direct answer to the question (Introduction)		
Chronological order		
Did not focus on the timeframe		
Irrelevant information		
Argument not clearly stated		
Link to topic/ argument		
Argument not linked to the statement		
Focus on the question		
Lacking Historical information		
Lacking an academic tone		
		TOTAL

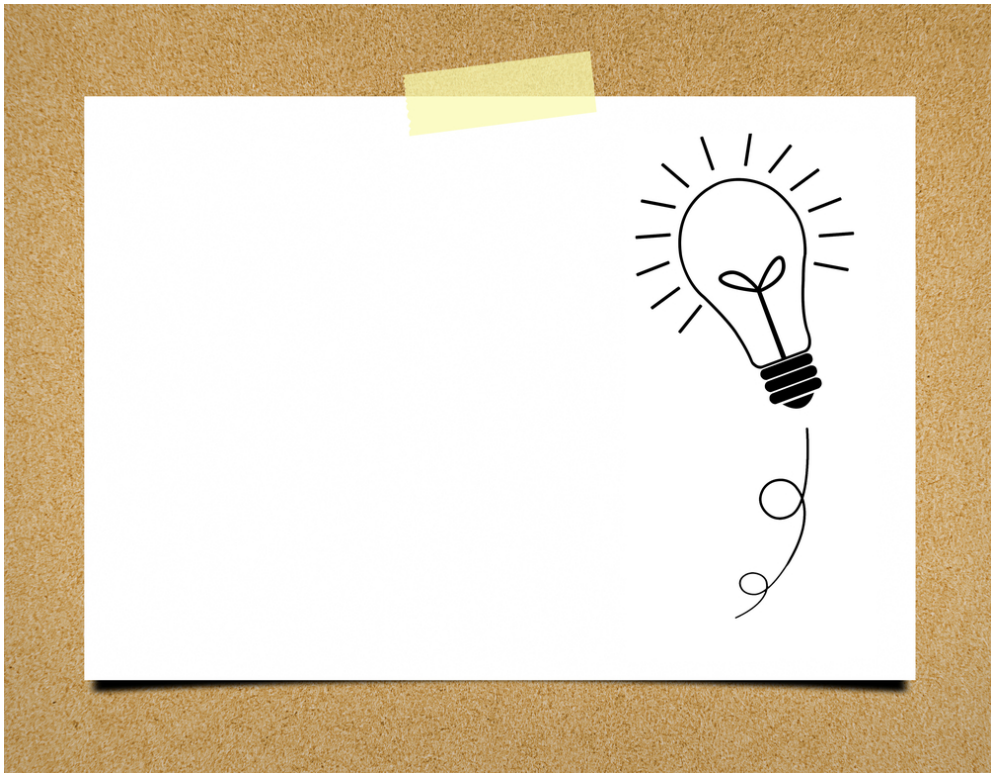
June History Exam Mark: ____ / **150**

Workshops to attend:

Workshop Theme	Date	Tick ✓
Time management and study methods: • Time management during the exam • Study timetable • Summaries/ flashcards/ timeline • Old exam papers • Extra reading		
Source analysis and comprehension: • Practical session • Sources and typical questions • Old exam papers		
Paragraph writing: • Skills • Academic writing		
Essay writing: • Formulating and maintaining the argument • What content needs to be included? • Chronology • Academic writing • Historical terms		

Your signature _____

NOTES:



XX A sample of Lana's reflections on her Saturday teaching practice

7-11 April

What a start to the TEN teaching programme this year!!! Let me begin by saying how happy I am with the group that I teach. They are super eager and willing to learn to the extent that they motivated me to do so many new things with them, that I haven't attempted with another group before. I had 33 students on day one and 34 every day after that....and not once did I have to tell them to come into the class or call them back after break...It was most odd...I simply walked into class and they would follow....talk about the Pied Piper...

I noticed I have many more *[14] kids than * kids, maybe that has something to do with the change in dynamics in the class.

We started our sessions with Vertical projectile motion, and I quickly noticed that the students have the same problems as other students particularly with the drawing of displacement time graphs and frame of reference. But they got me to explain it in every way possible (at one point I was lying on the floor looking up to the starting point of the projectile to try and make them understand frame of reference) and I am super proud to say THEY GOT IT!!! I feel they will do well in any projectile motion question which is incidentally what I saw in the Physics baseline assessment. I feel we should have written the baseline assessments first (we only got them on day 3) because during my explanations of this section I also touched on momentum etc and this was asked in the baseline assessment. I could clearly see when I started marking that it was going to give us skewed results because they did horribly in section B and C, but they did very well in Section A....therefore it will seem like they had prior knowledge of this work??? Also why is there Gr 12 work in the baseline test?

I have included photos from our 4 days together. On the first batch you will see we practically went and determined the height of the door frame or notice boards in class by using stopwatches and equations of motion. We turned this practical into a LO1 type question with tables and graphs and conclusions etc. It was interesting to note the students all realised on their own they would have to repeat the experiment a few times to get accurate results, however they struggled to convert the milliseconds on the stop watch into seconds to use and then they got heights of 80 m (for a door) and didn't question the validity of their answers. Also when I said each group must now actually go and measure the height to see who got the closest to the real answer....I was shocked to see they then asked how many rulers go into a meter. They battled to convert from cm to m....the basics.

After doing vertical projectile motion thoroughly we moved on to Newton's laws in order to do work, energy and power. I will only be able to finish with this section this coming Saturday. It is worth mentioning the games we played in class. I took the time to devise a treasure hunt of sorts, where they had to solve a riddle or question that had to do with

[14] Adhering to the prescriptions of the Ethics Committee the identity of the two schools are omitted in Lana's reflections.

Newton's laws. This would then lead them to somewhere in the school where they would get clue 2, and so forth. We had gr 12 kids running around the school like a bunch of gr 1's....they enjoyed it sooooo much. They couldn't wait to get the next sum, solve it and run for the next clue. It was just sad for me when a lot of them wrote their reflections and I realised they did not even know what a treasure hunt was. They kept referring to " we played a game called a treasure hunt..." I will have to think up a few more. I have included photos of them solving clues etc.

Had so much fun....can't wait to teach them again!!!!

18 April

First of all, my apologies for not handing in my planning on the new official document. Completely forgot….promise to do so next time. However I did state in my previous feedback what I was planning and I managed to stick to that.

Saturday was cold and I was so please to see the grade 12's made an effort to get up and join us for Science. Also there was a sport day on at Kriel which would ordinarily decrease number substantially but there were 30 students present…and most importantly THEY STAYED!!!! Only one student, Alex excused himself after lunch, but he very proudly came and showed me his report from term one and what he achieved in science, and the headmaster gave him a stamp….he was super proud.

I am also proud of myself…….I learnt all their names!! They were so surprised that I knew them and could call on them individually. Then the realization dawned upon them that I could call you out if you were busy with nonsense…and the whole atmosphere became just a bit more serious. They did not want me to be able to join their name with a bad performance…

We did work and energy and I decided to turn it into a practical outside. We took three of those loooong desks and turned them into incline planes outside. They had to measure the angle of the slope which incidentally gave them sooo many issues. Because it is so much easier just getting the angle than a real life scenario to generate the numbers you need to do the calculation. I will what's up all the photos of this practical. They were asked to calculate the final velocity of the object down the ramp. They had a tremendous amount of fun and very innovatively tried all sorts of ways to get the angle and measure the distance of the slope. For this practical I divided the class into three groups and after the practical I marked each write up produced by the group. We established a winner and they had to compete in these groups for the rest of the day doing questions etc. For the last five minutes of the day we did something NOT SCIENCE related. I gave each person 1 sheet of paper. They had to as a group come up with various designs using ONLY THAT ONE sheet of paper to make a structure that could support the most nr of books. Luckily we are in the English class and had plenty of books to work with….this turned out to be one of the highlights of their day….could not get them out of the class to go home. I will send pictures of the amount of books they managed to balance…..YOU won't believe it!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

24 May

We had a very productive session in which we finished vertical projectile motion and bouncing ball graphs. Unfortunately there were only 21 students that attended due to some or other sporting event. The students that missed this session missed out on a lot. Once I had finished explaining the different types of motion associated with vertical projectile motion, I handed out a worksheet I compiled which contains past paper questions on this section. We managed to do the majority of them and the rest is for homework for next time. It is imperative that the students see the way these questions are asked in past exam papers as that is the only way to truly prepare yourself for the exam at the end of the year. We did these past papers by incorporating exam skills. \for instance if the question was 16 marks they had aprox 18 min or so and then they had to be done. We then marked it together the way it will be marked at the end of the year, so that they could see where they will lose marks. We continued doing this question after question. So they worked very hard on Saturday. We also summarised the graph shapes. I feel confident that they should be able to cope with any vertical projectile question thrown their way. Perhaps we should give them a short test next time. Just 15 min to consolidate and verify where they are in terms of this section.

XXI Heidi's face drawing reflection

In a previous lesson, student were taught the different body parts in German.

At the beginning of this lesson, the body parts are repeated and recapped. Each student receives a blank piece of paper, sticks it somewhere in the class against the wall and has a pencil in hand.

Then all students walk in the class. When they get told to stop, they face a person and look at each other. They get a definitive command to look at the shape of the face, go to their piece of paper and draw just the shape of the face of that person.

Then they walk around the class again. When they get told to stop, they have to face another student, but it may not be the same student as before. Now they have to look at the hair, go to their paper and draw just this persons hair.

They walk again, stop in front of anther person, look at the persons eyes and draw just the eyes of that person.

This continues until the whole face has been drawn. Every time they had to stop in front of another person and look a specific body part and draw just that body part.

Since the students get to draw each other, but not a specific person, they have a lot of fun. They cannot say it is Ben or John. Even though some students are not artistic, they enjoy the task, because they simply draw specific parts of the body and practice their vocabulary in a visual manner.

Students get time to look at each others pictures and discuss them.

XXII Octavia's building compounds task

NATURAL SCIENCES

Grade 9

PORTFOLIO TASK

Building compounds and reactions

Name: _____

Date issued: _____ Date due: _____

Declaration: I declare that this is my own, original work.

I agree that if it is determined that I have engaged in any fraudulent activities, and then I shall forfeit completely the marks gained for this assessment.

_____
Student's signature

ASSESSMENT SHEET

Question	Mark allocation	Student Mark
Question 1	**14**	
Question 2	**16**	
TOTAL		_____ **30**

QUESTION 1

Using the jelly tots and toothpicks, build each of the following and then draw them in the space provided. Also indicate whether they are compounds or elements.

Molecule	Diagram of molecule	Element or compound
H_2O		
NaCl		
HCl		
CH_3COOH		
Br_2		
$Ca(OH)_2$		
S_8		

QUESTION 2

Balance the equations and then using the jelly tots and toothpicks, build each of the following equations and then draw them in the space provided.

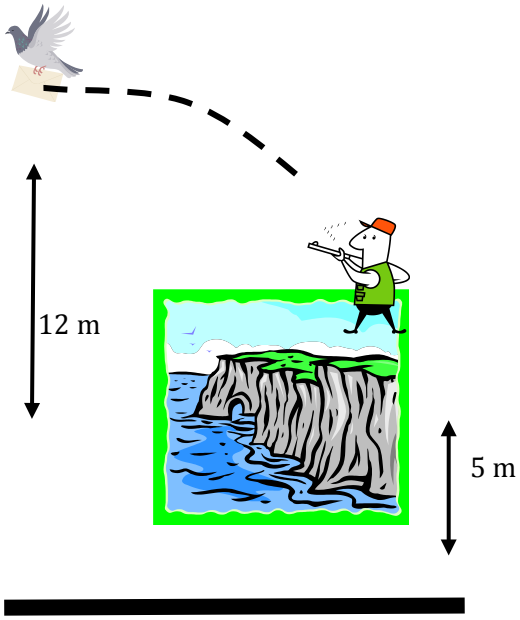
Reaction	Diagram showing reaction
$H_2 + O_2 \longrightarrow H_2O$	
$CaO + H_2O \longrightarrow Ca(OH)_2$	
$C_5H_{12} + O_2 \longrightarrow CO_2 + H_2O$	
$(NH_4)_2CO_3 \longrightarrow H_2O + CO_2 + NH_3$	
$CO_2 + H_2O \longrightarrow H_2CO_3$	

Provide labels and a key for all your diagrams

XXIII Two visual and real-life examples used by Brynhildr in assessment tasks

1.3

Refer to the diagram and Question 1.1 and 1.2:



A hunter is standing on a 5 metre high cliff.

He shoots an arrow at a bird flying 12 meters above the ground.

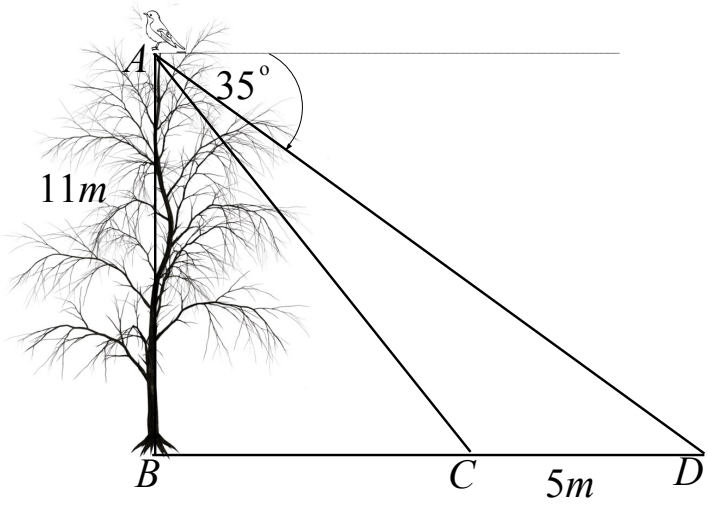
The height of the arrow above the ground (in meters) for the time that the arrow is in the air (in seconds) is given by

$h = -t^2 + 6t + 2$.

Is it possible for the hunter to hit the bird? Show all working.

(2)

QUESTION 5 9 MARKS



A bird is sitting on top of a tree with height AB = 11m. The bird is observed by two bird watchers

standing at points C and D. They are 5 *m* apart.

The angle of depression of D from the tree top at A is $35°$.

5.1 Calculate the length of AD. (3)

5.2 Calculate the length of AC. (3)

5.3 Calculate $C\hat{A}D$. (3)

XXIV Brynhildr: A real life example of parabolas superimposed on graph paper using App smashing