CHAPTER 3

CONCEPTUAL ORIENTATION

Figure 3.1 Chapter 3 conceptual orientation

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		Technicist-behaviourist paradigm
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Compiled by the researcher

1 Introduction

Section 1	Introduction

Self-directed air traffic control teams are viewed as self-organising, social systems. These teams need to cope with increasing complexity and the dynamics of a continuously changing environment in order to ensure that aviation safety needs are satisfied. Self-directed air traffic control teams act as learning agents for the air traffic control community, responding to changes in the internal and external environment of the community, by detecting and correcting errors in the team's theory-in-use, and embedding the results of their inquiry in private images and shared maps (Argyris & Schön, 1978: 29). How do they do it?

Greater understanding relies upon a process of inquiry that involves thinking about questions, making interpretations and reflecting upon data, while stretching the limits of my own understanding and ability to respond. My challenge is to explore, interpret and present my own understanding in response to the research questions, thus creating a whole system of thought.

2 Philosophical departure

Section 2	Philosophical departure	Humanist paradigm
		Progressive paradigm
		Technicist-behaviourist paradigm
		Broad philosophical assumptions • Ontological assumptions • Epistemological assumptions • Anthropological assumptions • Methodological assumptions
		Paradigmatic perspective

In order to explain the foundation and basic structures that will act as lenses through which I will attempt to understand phenomena, events and realities in this research study, it is essential to explain my points of "philosophical" departure:

- I accept that personal development is an aim of adult education, thus the individual is central in the learning experience. However, practice towards this end emphasises *process* over *content* (Darkenwald & Merriam, 1982: 49). It is the responsibility of the individual to learn what he/she

wants to learn in the manner desired (Darkenwald & Merriam, 1982: 48-49). Rogers (Darkenwald & Merriam, 1982: 49), supports group activities as an instructional technique in bringing about individual growth. Lindeman (Darkenwald & Merriam, 1982: 50), states that *if adult learners want their "intellectual alertness" to count for something, they will be as eager to improve their collective enterprises, their groups, as they are to improve themselves*.

- I acknowledge that adult learning depends on the readiness and responsibility to grow and develop that exists in individuals and effective teams. McKenzie (Darkenwald & Merriam, 1982: 49) and Brookfield (1985: 14 & 15), state that once the individual accepts the responsibility for individual growth (interpreted from both an individual and group learning perspective), a readiness for self-directed learning, which addresses cognitive and affective domains, is signalled. McKenzie (Darkenwald & Merriam, 1982: 49) cautions those who value individual growth and development of constraints involved in transforming this ideal into effective practice, with reference to the application of these ideas in a complex real world.

- It is not possible to ignore environmental and societal influences when analysing the role of the adult learner. Dewey, Lindeman and Bergevin (Darkenwald & Merriam, 1982: 57) agree that education stimulates interaction with the environment, whilst society simultaneously influences the individual's needs, desires and motivation to learn. Apps (Darkenwald & Merriam, 1982: 51) views these influences as instrumental in helping people to acquire the tools for psychological, physical and social survival, and helping people to learn how to learn.

- Organisational/workplace effectiveness is closely linked to environment and society influences, and the development of human resources has thus become one of the aims of adult education. The tension between individual and organisational needs is described by Argyris (Darkenwald & Merriam, 1982: 68) as *the foundation for increasing the degree of effectiveness of both*. I take cognisance of the need to triangulate individual, team and organisational dynamics in order to fully comprehend phenomena.

My challenge is to determine what theories of knowledge air traffic controllers hold regarding self-directed team learning and the impact thereof. Theories of knowledge are not static reflections of the environment, but dynamic constructions achieved by human relationships and interactions. I assume that knowledge is constructed by the subject or group of subjects in order to adapt to their environment and that construction of knowledge is an ongoing process at different levels; psychological and social. These ongoing processes

are the result of individual and collective changes of consciousness due to constructive efforts by the subject/subjects. I expect to discover factors internal to the subject's point of view and factors external, which in turn, will allow me to understand how knowledge structures were/are formed, nurtured and maintained within a defined learning situation and learning environment.

I decided that the experiences, perceptions, views and feelings of air traffic controllers will need to be studied in a holistic and integrated manner in order to address the research questions formulated for this study. This decision poses the question to the researcher which paradigm or which group of paradigms should be followed. I realised that when adopting a paradigm or group of paradigms for my research that my decision would literally permeate every act even tangentially associated with the research inquiry (Lincoln, 1990: 81). Realising that research results no longer have to only claim absolute truths or absolute insights allowed me to consider a multiparadigmatic approach.

2.1 Humanist paradigm

Hiemstra (Brockett, 1988: 184) states that the **humanist paradigm** subscribes to reality that is found in the acknowledgement of human potential, which, in turn, depends on educational methods comprising self-directiveness and teamwork — as research focus areas. The humanistic paradigm facilitates a deeper learning approach that places emphasis on self-directed learning, reflection as a learning stage and the overall development of the learner.

2.2 Progressive paradigm

According to Hiemstra (Brockett, 1988: 183) the **progressive paradigm** enables the researcher to discover "truths" by studying people's needs, experiences and perceived realities by taking cognisance of interrelationships and collaborative extensions as a result of these relationships — also research focus areas. The progressive paradigm encourages performance-based learning approaches.

2.3 Technicist-behaviourist paradigm

Darkenwald and Merriam (1982), and the University of the Witwatersrand (2000) agree that the **technicist-behaviourist paradigm** will allow the researcher to view reality from an occupational skills perspective, where such skills are governed by external forces (including social forces) that lead to workplace conditioning and associated behaviour changes — thus supporting the notion that learning is a reasonably

permanent change in behaviour brought about by experience(s). Occupational skills in the air traffic control environment are described in terms of desired and correct outcomes. Learning, viewed within the technicist-behaviourist paradigm, may be directed by superficial learning approaches.

I accept that individual and team-actualisation objectives **(humanist)** will facilitate personal and social improvement **(progressive)** that contributes to organisational effectiveness **(technicist-behaviourist)**, as described by Darkenwald and Merriam (1982), and the University of the Witwatersrand (2000). The humanist, progressive and technicist-behaviourist paradigms were utilised to trace the impact of self-directed team learning in the air traffic control environment.

This personal view of philosophy will allowed me to investigate phenomena within its real life contexts in order to explore views, meanings, experiences, accounts, actions and events that occur in self-directed team learning.

2.4 Broad philosophical assumptions

I accept that research is concerned with understanding the world and that such understanding is informed by how I view the world, what I take understanding to be, and what I see as the purpose of understanding (Cohen, Manion & Morrison, 2000: 3). I have attempted to link ontology, epistemology, anthropology and methodology in order to provide shared assumptions about the nature of the phenomena I wish to study, a vocabulary for presenting such phenomena, and a criterion for evaluating my research (Orlikowski & Gash, 1994: 176).

2.4.1 Ontological assumptions

Guiding my thoughts and assumptions regarding the nature of "reality" within an individual and team context I had to make provision for individual and shared consciousness as well as individual and shared cognition.

Humans create reality by learning from others, teaching others, and by reflecting on their own understanding. This individualistic and humanist view supports the notion of nominalism by acknowledging that individuals do construe their own realities. Realities are also developed by shared language and common practices within a community of practice, thus providing a realist glimpse of reality. Social reality can thus be understood from both an external point of view and within levels of individual consciousness (Cohen, Manion & Morrison, 2000: 5). To allow for a rich understanding of social reality within the scope of

my research study, I needed to include individual, team and environmental forces/influences, and debate their roles and contributions.

2.4.2 Epistemological assumptions

My epistemological assumptions are challenged by the grounds and nature of knowledge and the view held regarding truth. These assumptions are listed below.

- Knowledge is acquired by transactional means, which implies that it can be acquired by interacting with the source in a bi-directional manner. This implies a readiness to learn from one party and a readiness to teach from the other party. This transactional view indicates that knowledge can be viewed as hard, objective and tangible, which, in turn, posed a challenge to me to consider the use of quantitative methods in my research study (Cohen, Manion & Morrison, 2000: 6).

- Knowledge can also be created by personal experiences that result in individual cognition. These experiences require a deeper qualitative approach in order to discover the personal, subjective and unique nature of translated interactions and intra-actions.

- Collective knowledge can be the product of collaborative cognitive interactions. These interactions allow for a qualitative approach in order to discover interdependent, interactive and holistic forms of cognition.

Epistemological assumptions stated above favour an investigation that considers both quantitative and qualitative inquiry. However, a predominant qualitative approach allowed me to acquire a deeper understanding of the phenomena.

2.4.3 Anthropological assumptions

All facets of the environment influence human behaviour. However, the environment is by and large a product of human effort and influences. I do agree that human beings and their experiences are also a product of the environment. However, I propose a shift in focus. In this research study I am curious to learn how learning takes place and how learning impacts upon a community of practice. Ultimately humans are initiators of their own actions, which, in turn, impact on the status of the environment. This line of thought

allows me to focus more on issues synonymous with a softer, personal and more humanly created view of the social world.

2.4.4 Methodological assumptions

Abovementioned assumptions impacted on my methodological choices and, in turn, demanded consideration of different research methods (Cohen, Manion & Morrison, 2000: 6). I found that my principal concern is understanding the way in which the individual and team create, modify and interpret the world in which he/she/they function. According to Cohen, Manion and Morrison (2000: 7) such a research approach will take on a qualitative as well as quantitative aspect. The cited assumptions made it clear to me that my proposed study will need to make use of both quantitative (positivist context) and qualitative (phenomenological context) methods (resulting in a mixed-method approach) and associated techniques in order to discover reality and then to understand such reality.

2.5 Paradigmatic perspective

The basic paradigmatic point of departure in this research study is that a self-directed team learning approach may contribute to aviation safety within the air traffic control community of practice. This implies that in an effort to understand and to contribute to aviation safety I must be seen to subscribe to a meta-theoretical approach that supports self-directed team learning. In other words, self-directed team learning is understood in terms of the activities of people within a particular community of practice. My meta-theoretical assumptions are based on the significance of collective and collaborative learning. I realise that learning is more than a change in performance of a single individual; learning is the result of the performance of a team of individuals sharing a common purpose or intent or engaged in a common practice (Driscoll, 2002: 59). Collaborative learning essentially integrates knowing with doing.

Considering my epistemological and ontological assumptions stated above, I realise that learning initiatives and associated performances are characterised not just by the processes within an individual but also by the processes shared by and affecting air traffic controllers within a defined team.

My challenge is to understand links between learning and performance — including learning methods, approaches, motives and practices.

3 Conceptualising learning

Section 3	**Conceptualising learning**	• **Learning motives** • **Learning orientations** • **Learning approaches** • **Why do individuals and teams participate in learning?**

A conceptual orientation allows for a framework within which I could consider and understand the issues and principles that structure, guide and shed light upon the focus area of this research study — learning and performance relations.

A conceptual orientation supports the paradigms of inquiry by paying attention to the development of individual and collective learning motives that are supported by dynamic learning approaches and orientations that contribute to organisational learning and performance. The result is the creation of an understanding of the rationale for learning at individual and team level.

3.1 Learning motives

Organisational learning is a term often used to describe workplace learning. Organisations cannot really learn; organisational learning is the result of individual and team learning motives, initiatives and experiences that are not inhibited by specific frameworks or contexts (Thompson, 1995: 85-100). Organisational learning transcends boundaries and such learning is controlled by individuals (Thompson, 1995: 85-100). Meaningful and effective learning are characterised by individuals and teams that continuously aspire to become more effective and efficient in those areas that are regarded as important/critical (Senge, 1994: 18 & 19). Individuals and teams that embark on this route of continuous learning make extensive use of conceptualisation and reflective strategies (Senge, 1994: 18 & 19).

Any major changes in knowledge and increases in demand for knowledge-based workers are bound to have an effect on the education system; and since these workers are adults, these changes will have an effect on adult education (Jarvis, 2001: 5). Significant changes in education are illustrated by Jarvis (2001: 6 & 9) in his overview of the various axes along which education is travelling, as indicated in Table 3.1.

Table 3.1 Overview of the axes along which education is travelling

From initial to adult to recurrent and continuing education.	A statement from the 1960s that refers to post-school education. The term recurrent education was replaced by continuing education, which, in turn, signifies the notion of lifelong education.
From teacher-centred to student-centred education.	A statement from the 1960s that signifies the movement in adult education from pedagogy towards andragogy. The value of student-centred learning became widely incorporated into the educational system, both schooling and adult.
The changing status of knowledge.	Emerging in the 1980s; the premise being that the rapid technology changes convert knowledge into a relative and ever changing phenomenon. Knowledge taught has to be understood critically, thus introducing critical theory to the educational vocabulary.
From curriculum to programme.	Previously curriculum theory was restricted to the classical and the romantic formulation. Pluralism necessitates that curricula be broken down into smaller clusters (modules or short courses).
From liberal to vocational.	Previously a great deal of adult education was liberal. However this state has changed and adult education is placing the emphasis on a vocational orientation.
From face to face to distance.	Traditionally education was conducted in a face-to-face mode. However, the advent of new information technology gave rise to distance education. In effect time and space have been

	transformed in education as a result of the technological interfaces.
From education and training to learning.	Traditional education and training made way for multilevel workplace practical competence. It no longer matters how knowledge was learnt, as long as it was learnt.
From rote learning to learning as reflection.	In the past learners were expected to grasp the truth of scientific discovery and remember it (rote learning). However knowledge has become a narrative and even a discourse; it has to be considered, criticised and reflected upon to ascertain the extent to which it contains any truth.
From welfare needs to market demands (wants/desires).	The idea that education is part of the welfare provision of society is being replaced by a realisation that educational needs have turned into a matter of supply and demand — a market.

Jarvis (2001: 6 & 9)

The workplace relies on the individual, team and organisation's ability to identify and meet workplace demands by means of continuous learning. Adult workplace learning is viewed as a delicate process that relies on active, motivated and interdependent inputs that are presented, debated and reflected upon continuously by learners in order to discover new insights, views and meanings.

Learners consciously and subconsciously select learning priorities and learning approaches considered to be appropriate. The workplace (consisting of technology and team members) provides the dynamics that stimulate and energise the learning process and also serve as the support mechanism for learning to take place. Effective learning transpires as a result of a cyclical reflective and creative process that is characterised by observation, reflection, conceptualising and experimentation (Rogers, 2002: 107-110 and Kolb, 1984: 31).

The most complete form of self-directed learning is present (Brookfield, 1985: 15):

- when self-directed learning intentions and initiatives are allied with the adult's quest for critical reflection; and
- in the creation of personal meaning after due consideration of a full range of alternative value frameworks and action possibilities.

Such a complete form of self-directed learning is synonymous with critical reflection efforts aimed at the contextual and contingent aspects of reality, the exploration of alternative perspectives and meaning systems, and the alteration of personal and social circumstances (Brookfield, 1985: 15).

When adults come together in search of a common objective and they find that they posses the ability to fuse the external workplace dimensions with their individual and collective internal and reflective dimensions then they can effectively reinterpret and recreate their personal and social worlds (Brookfield, 1985: 15). Within the team context, team members integrate diverse individual awareness, insights and understanding into a new collective perspective of autonomous, self-directed learning.

3.2 Learning orientations

Individuals form certain perceptions towards individual and collective learning intentions, learning responsibilities and associated activities (Levey & Levey, 1995: 257-274). These individual perceptions are interpreted as the individual's learning design and development strategies.

Learning orientations at the individual level constitute (Levey & Levey, 1995: 257-274):

- superficial learning approaches (characterised by memorising and reproducing existing knowledge in a familiar format);
- deeper learning approaches (involving construction of new insights and ideas); and
- performance-based learning approaches (emphasising the optimisation of the organising strategies of the learning task).

Learning orientations at the collective level are made up of (Levey & Levey, 1995: 257-274 and Chawla, 1995: 501-508):

- dependent learning approaches that support shared purpose, vision, values and strategies;
- independent learning approaches that allow for wisdom, insight, inspiration and joy of discovery;
- competitive learning approaches that support the emergence of greater business effectiveness; and
- collaborative learning approaches that reflect the quality of systems thinking, performance, efficiency and the depth of wisdom and compassion of a learning community.

Self-directed learning is thus also understood as a continuum that exists to some degree in each person and learning situation. This statement implies that differences and similarities can be expected between individuals and between teams in terms of learner self-direction.

3.3 Learning approaches

A learning approach describes an individual's learning orientation, which, in turn, explains the individual's perception of workplace learning demands (Biggs & Moore, 1993: 315). Individual learning approaches signify a certain predisposition towards learning, held by an individual that is co-determined by personality, personal objectives and workplace strategies found in a specific environment (Biggs & Moore, 1993: 315).

Effective team learning relies on collective collaborative learning approaches that are anchored in deeper and performance-based individual learning approaches (Thompson, 1995: 85-100). The relationship between learning and performance is thus highlighted. Knowledge of individual learning approaches will allow the individual and the team to appreciate and understand individual and collective performance differences and similarities in the workplace. It is also expected that collective collaborative learning approaches support creative conceptualisation of complex issues, reflective behaviours/habits, while also stimulating higher level thought processes (Biggs & Moore, 1993: 309-315).

3.4 Why do individuals and teams participate in learning?

Learning processes and experiences are directed and influenced by (Biggs & Moore, 1993: 309-316):

- learning motives;

- learning strategies; and
- social influences.

Extrinsic motives are linked to superficial, dependent and competitive learning approaches. **Intrinsic** motives are linked to deeper, independent and collaborative learning approaches (Biggs & Moore, 1993: 316).

When learners learn simply to ensure a certain task outcome, rather than focus on the task itself, they are externally motivated and a superficial learning approach is evident (Biggs & Moore, 1993: 316). A learner that is inspired by the opportunity to develop his/her skills in order to perform more effectively/efficiently will be intrinsically motivated and he/she will make use of a deeper learning approach (Biggs & Moore, 1993: 316). If the learner's learning goal is a combination of self-development, self-satisfaction and esteem, he/she may opt for a performance-based learning approach (Biggs & Moore, 1993: 316).

Learning strategies indicate the purposeful planning and implementation of procedures and actions that are essentially of a cognitive nature. In this regard a superficial learning strategy will encompass known actions and the deployment of existing and accepted procedures in the workplace by the learner (Biggs & Moore, 1993: 316). When new information and experiences are combined with existing knowledge structures in order to discover new meanings, more options and to develop theories, a deeper learning strategy is present (Biggs & Moore, 1993: 316). Performance-based learning strategies prevail when the learner becomes involved in all aspects related to successful learning, rather than narrowly paying attention to learning tasks or activities (Biggs & Moore, 1993: 316). Self-directed learning strategies are understood within the context of independent, collaborative and deeper learning approaches.

Social influences impact upon the learners' predispositions towards learning goals and learning initiatives within a specific environment. Social support and cooperation, which, in turn, stimulate and encourage collective learning activities, are synonymous with collaborative learning (Biggs & Moore, 1993: 316). A competitive learning environment supports a negative interdependence (a win-lose situation) that prevails between learners in the workplace (Biggs & Moore, 1993: 316). Competitive learning thus has as its intention to merely learn in order to gain an advantage above others at all costs. When a team member or a team becomes dependent upon someone to assume a position of authority (thus one person supervises/manages learning) before learning can take place, a dependent learning environment is identified (Biggs & Moore, 1993: 316). An independent learning environment supports and empowers team members and teams to utilise own initiative and creativity as part of the learning process (Biggs & Moore,

1993: 316). Critical debates and collective interpretations are characteristics of independent learning in this regard.

4 Reflection

Section 4	Reflection

In this chapter I provided an extensive philosophical argument and orientation in support of the research paradigms of inquiry presented above. These paradigms facilitate my journey of exploration and understanding. I also accept that these paradigms are not fixed, and that they will be refined and extended through use — these paradigms therefore become an object for further articulation and specification during my research efforts (Kuhn, 1972: 23).

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

Figure 4.1 Chapter 4 orientation

Introduction	Aims and purpose of the research
	Orienting decisions
Research constraints	
Research possibilities	
Mode of inquiry	
Research setting	Sites
	Sampling
Data collection plan	
Mixed-method data collection techniques	Individual interviews
	Focus group interviews
	Self-directed Team Learning Questionnaire (SDTLQ)
	Learning Approach Questionnaire (LAQ)
Role of the researcher	
Data analysis	
Data validation	Validity
	Reliability
	Trustworthiness
Conclusion	

Compiled by the researcher

1 Introduction

Introduction	Aim and purpose of the research
	Orienting decisions

This research project constitutes an impact study of self-directed team learning practices found at three South African Air Force Air Traffic Control Centres. The level of discourse/generalisability of this research project is therefore restricted to the self-directed team learning practices at these sites.

This research design and methodology chapter describes the mixed-method design utilised in this study with specific reference to the following highlighted focal points:

- **Research constraints** and considered actions viewed from both a qualitative and a quantitative perspective.
- **Research possibilities** associated with this self-directed team learning study.
- A **mode of inquiry** depicted and described in terms of employed qualitative and quantitative methods.
- Information relating to the three **research settings** where data collection took place.
- A **data collection plan** describing data collection phases and identified activities.
- Four **mixed-method data collection techniques.**
- A description of the **role of the researcher** from a functional and an ethical perspective**.**
- **Data analysis** that allowed for data triangulation.
- **Data validation** that considered validity, reliability and trustworthiness criteria.

An introduction to the research project planning is encapsulated in the aim, purpose and orientation statements and decisions presented below.

1.1 Aim and purpose of the research

The aim of this research is to discover multiple realities that are assumed to be present in the air traffic control self-directed team learning environment. Accordingly I believe that human actions and performances are strongly influenced by the setting in which they occur. The study of human performance in real-world situations is the most complex topic of all in science (Dismukes, 1994: 321). According to Dismukes (1994: 321) many important operational problems cannot be answered decisively because we do

not yet have sufficiently penetrating research methods for evaluating human behaviour. Wilson (1977: 249) provides guidance in this respect by affirming that a study of human behaviour relies on an understanding of the framework within which the subjects interpret their thoughts, feelings and actions.

The purpose of this research project is to understand a team learning situation from the participant's perspective, the team's perspective and the resulting performance influences. According to Brookfield (1985: 13) research designs on self-directed learning tend to treat all learning projects as having equal significance for the learner. Individuals and teams differ in terms of internal characteristics, personal meanings and their significance for the society at large. Therefore it is undesirable to assume such a generalised research approach (Brookfield, 1985: 13). Studies of self-directed learning have also generally relied on structured interview schedules and precoded categories of responses that subject's perceptions of their learning are made to fit (Brookfield, 1985: 13). When the researcher uses only standardised instruments in a self-directed learning study with groups of working-class adults he/she may (Brookfield, 1985: 13):

- overlook the quality of learning that takes place; and
- cause the individuals to regard the researcher with suspicion.

Brookfield (1985: 13) agrees that a crucial area for further self-directed learning research is the congruence or disjunction between adult's own judgements regarding the quality and effectiveness of their learning. Research in this regard primarily necessitates a detailed description of phenomena that facilitates the researcher's recording, interpretation and expression of a deeper/extended understanding (McMillan & Schumacher, 2001: 11).

The aim and purpose of this research signifies the need to assess the merit and worth of self-directed team learning within a defined air traffic control environment.

1.2 Orienting decisions

Orienting decisions are strategic as they set the general nature of the research and establish key parameters of the research (Cohen, Manion, & Morrison, 2000: 75).

Self-directed learning within air traffic control operations was central to this research. This statement implies that data collection was restricted to the South African Air Force's air traffic control workplace environments

and activities. The scope of this research was limited to three air traffic control centres identified and approved within the South African Air Force. Individual and team self-directed learning initiatives/practices, as well as workplace performance impact descriptors were emphasised in this research. Self-directed learning activities were not influenced by the researcher and are thus viewed as usual learning occurrences that took place within a self-directed team. This population constituted all air traffic controllers that functioned within self-directed teams at the three research sites during the data-gathering exercises. Participation in this research was regarded as voluntary. Participant confidentiality was ensured in order to protect the rights of participating air traffic controllers. The benefit of this research may be found in its perceived value to adult educators that rely on self-directed team learning in order to achieve levels of effective workplace performance and to researchers and practitioners that are charged with ensuring aviation safety goals.

The initial feasibility (Cohen, Manion, & Morrison, 2000: 83 & 84) of this research is summarised by acknowledging that:

- the research is regarded as useful in terms of its contribution to adult learning and aviation safety;
- participant contribution was voluntary and shared information is confidential;
- adequate resources existed to carry out this research;
- the purpose and aim of the research was known to the organisation and approved by the organisation; and
- ethical compliance was upheld by the researcher.

Orienting decisions applicable to this research served as the first step in the research planning process that facilitated an authoritative investigation of self-directed team learning within a defined air traffic control environment.

2 Research constraints

I identified qualitatively derived constraints by using the framework provided by Patton (1990, 40-41), supported by Swanson, Watkins and Marsick (1997: 95). These constraints are presented in Table 4.1.

Table 4.1 Qualitative derived constraints of this study

Theme	Constraints
Naturalistic inquiry	The existence of self-managed work teams was restricted to certain air traffic control centres only.
Inductive analysis	Only one person would perform data collection and interpretation.
Holistic perspective	The Hawthorne[1] effect could influence team dynamics, environmental influences and learning dynamics.
Qualitative data	Detail descriptions would be made possible by means of qualitative and quantitative data collection methods. However an individual performed this task.
Personal contact and insight	Findings could be criticised in terms of the Hawthorne effect and personal bias.
Dynamic systems	Continuous changes in the teams being investigated may be due to shift and staff-rostering requirements.
Unique case orientation and Context sensitivity	The context would focus only on self-directed team learning. Environmental influences and differences (intra-centre and inter-centre) that could affect behaviour may not have been known.
Empathetic neutrality	The role of observer and not participant may have been strange to individuals and/or teams and thus influenced behaviour.
Design flexibility	Structural research requirements may have influenced the nature of flexibility associated with this study.

Patton (1990, 40-41) and Swanson, Watkins and Marsick (1997: 95)

In addition I identified the following quantitative-derived constraints by using the framework provided by Swanson, Watkins and Marsick (1997: 90) and Borg and Gall (1979: 162-166). These constraints are indicated in Table 4.2.

[1] Hawthorne effect: the tendency of people to act differently because they realise that they are subjects in a study (McMillan & Schumacher, 2001: 591).

Table 4.2 Quantitatively derived constraints of this study

Theme	Constraints
Neutral and objective inquiry	Quantitative researchers attempt to remain neutral, objective and apart from the reality that they study. Respondents may perceive this approach as cold and threatening, which may have influenced responses.
Hawthorne effect	Research involving human subjects can distort results because of the perceived special attention given to the subjects. The Hawthorne effect may have influenced feedback from respondents.
Demand characteristics	Respondents may be over-sensitive to all aspects of the research environment. In such a case respondents may form conclusions/assumptions as to what the researcher may prefer, what is expected of them (respondent perception), and what the researcher hopes to find (in the respondents' view). Respondents may have directed their responses accordingly.
Selected sample	All air traffic controllers did not have an equal chance of being included in the sample because a non-probability convenient sample was used. This implied that results may not be generalised.

Swanson, Watkins and Marsick (1997: 95) and Borg and Gall (1979: 162-166)

These constraints served as a constant checklist and reminder of potential shortcomings and possible weaknesses in my study. This list was used as an additional measurement of validity, thereby ensuring that proposed delimiters would be monitored throughout my study.

I formulated a checklist (Table 4.3) to remind me of appropriate actions in order to address the above mentioned constraints.

Table 4.3 My checklist

Constraint	My actions
Inquiry	Do not allow own neutrality to influence the data collection. Do not appear distant, show interest in the activities of the centre and do not voice inter-centre comparisons/observations to the respondents during data collection.

Perspective and effect	Do not hint towards sought after or expected data during conversation with respondents. Encourage respondents to be honest and fair when providing data/sharing information. Also encourage respondents to provide examples in order to support responses and awareness.
Data collection task	Realise and be aware that data presented is data presented; do not attempt to manipulate data (only ensure understanding and clarification).
Dynamic sample	View each team from a centre perspective, thus an air traffic control centre was considered to be a virtual team (although team members may change during the data collection). The intention was, however, not to only compare teams but rather to consolidate findings in order to encourage understanding.
Focus/attention	Ensure respondents were aware that observations would not be used to collect data and refrain from providing comments pertaining to air traffic control practices.
Empathy	Ensure that respondents understood what was expected from them in terms of data collection focus areas before commencing with data collection.
Results	I may not generalise the research results.

Compiled by the researcher

The above checklist was also used to obtain feedback from respondents in order to present evidence that the researcher complied with this self-imposed data collection framework.

3 Research possibilities

Research possibilities ←

One of the outcomes of this research was directed at adding to research-based knowledge about a specific practice — self-directed team learning. Acquiring supportive, new or different perspectives about the self-directed team learning phenomenon may also contribute towards the generation of ideas on how to approach workplace team learning practical challenges (McMillan & Schumacher, 2001: 25). Furthermore I am of the opinion that the outcome of this research will contribute to research-based knowledge in a given field —aviation safety.

Studying self-directed team learning as practised by members of a self-directed team, charged with the responsibility to safeguard human life, within a technologically sophisticated environment, and with no margin for error is considered to be challenging from both a research and researcher perspective. During this study vocational-centred self-directed learning activities were analysed in a systematic rather than an intuitive manner. Essentially the contribution of this research would be more than a mere extension of understanding of self-directed learning practices; it would also examine associated outcomes of these learning practices. Such outcomes may possibly influence work performance aspects; such as aviation safety.

Aviation safety has as its ultimate goal to manage industry risks at a level as low as reasonably practicable. This management task requires that conditions and circumstances that can endanger human life be identified preferably in a proactive manner. Only once these hazards are identified can the severity and likelihood of incidents and/or accidents be determined. Thereafter reasonable mitigation measures can be designed, implemented and evaluated. There is a need to ensure awareness amongst all role players in the aviation industry in terms of safety management advances. Effective communication, workplace training and learning are regarded as important characteristics within a safety management system.

I realised that this research project corresponds with views held by Janesick (2003: 57) and thus:

- allowed me to concentrate on the larger/holistic picture in order to search for understanding of the whole;
- allowed me to look at relationships within air traffic control teams;
- provided an opportunity to deal face-to-face with air traffic control team members and teams;
- created an opportunity to gain understanding of workplace settings and interpersonal relations;
- permitted me to gather data first-hand;
- allowed me to analyse data; and
- presented an opportunity to question and reflect upon my own biases and ideological preferences.

This narrow focused education-based research project made it possible to gain insight into self-directed learning practices and to determine how these practices influenced and continued to influence aviation safety and aviation performance outcomes.

4 Mode of inquiry

The decision regarding the mode of inquiry was directed by my desire to understand occurrences and effects that take place within the air traffic control work environment. I realised that I needed to study team learning within its natural setting in order to make sense of it. I also accepted that this study within the air traffic control workplace would allow air traffic controllers to present, describe and interpret phenomena in terms of their individual and collective meaning structures. Upon consideration of these factors I initially decided to primarily make use of an interactive qualitative inquiry to collect data from air traffic controllers within their workplace. I acknowledge that data gathering relied upon respondent feedback describing individual learning approaches, descriptions of meaning (focused on learning strategies and performance outcomes) provided by individuals and teams, and reflections associated with known behaviours, preferences and occurrences (also focused on learning strategies and performance outcomes). In this regard Denzin and Lincoln (2003: 5) urge qualitative researchers to deploy a wide range of interconnected interpretive practices in order to gain a better understanding of the subject matter at hand.

Multiple realities are viewed as so complex that one cannot decide *a priori* on a single methodology (McMillan & Schumacher, 2001: 396). I thus realised that a stringent qualitative approach may be restrictive in terms of creating valuable understanding of the self-directed learning phenomena studied. In response to this perceived shortcoming a mode of inquiry was desired that extended the breadth and the range of results. A mixed-method strategy was opted that combined quantitative and qualitative techniques and data analysis in order to add depth and detail to findings (Swanson & Holton, 1997: 93; Tashakkori & Teddlie, 1998: 46 and McMillan & Schumacher, 2001: 542). Such a mixed-method approach allowed for the elaboration, enhancement, illustration and clarification of the results of one method with that of another (Tashakkori & Teddlie, 1998: 46). This mixed-method strategy is illustrated by the typology quan + QUAL. These abbreviations indicate that quantitative (quan) and qualitative (QUAL) methods were used. The upper case denotes the priority given to the orientation (Teddlie & Tashakkori, 2003: 3-8). This mixed-method strategy:

- allowed for the collection and corroboration of data collected and may have enhanced the credibility of the study (McMillan & Schumacher, 2001: 428 & 429);

- from a quantitative perspective (non-experimental) was descriptive and comparative because it allowed me to assess the nature of existing conditions in order to categorise and compare individual and team learning strategies, contributions and outcomes (McMillan & Schumacher, 2001: 33); and
- from a qualitative perspective (interactive) was phenomenological because it allowed me to study and understand the meanings associated with lived experiences and perspectives in order to make sense of the workplace impact and associated learning experiences at individual and team levels (McMillan & Schumacher, 2001: 36).

Quantitative data collection would make use of a psychometric instrument (LAQ) and a questionnaire (SDTLQ), whilst qualitative data collection instruments consisted of individual interviews and focus group interviews. Confirmation and corroboration of data required me to triangulate[2] data (McMillan & Schumacher, 2001: 408).

5 Research setting

Research setting	Sites
	Sampling

Data collection took place at three South African Air Force air traffic control centres that provide Aerodrome, Approach and Ground-Controlled Approach Control services, and where air traffic controllers function within self-managed work teams.

5.1 Sites

Approval was obtained from the South African Air Force to perform data collection at the following sites (these were the only sites that met this study's requirements):

- Langebaanweg Air Traffic Control Centre
- Hoedspruit Air Traffic Control Centre
- Makhado Air Traffic Control Centre

[2] Triangulation is discussed in paragraph 9

5.2 Sampling

The population for this study was defined as all air traffic controllers employed by the South African Air Force that function as a full team (consisting of available Aerodrome, Approach and Ground Controlled Approach Control services at a specific site). This population as reported by the South African Air Force on 18 March 2005 numbered 33 persons.

The purpose of this study was to better understand self-directed team learning. In terms of determining the type and size of the sample, I considered that the aim of this study was to collect exploratory data and not to generalise findings. A subgroup of the accessible population was investigated (25 selected team members within the identified air traffic control centres) by me, which in turn influenced the type of sample drawn – being a non-probability convenient sample. Respondent selection criteria were explained to the three Air Traffic Control Managers at each site. These criteria are presented below.

- Respondents had to be qualified air traffic controllers. Air traffic service assistants were not included as they do not fulfil a controlling role.
- Respondents had to have air traffic control teamwork experience at the specific site.
- Respondent participation was voluntary.
- Respondents had to complete the LAQ, SDTLQ and participate in the individual interviews. From these respondents volunteers were requested to participate in focus group interviews.
- Respondents had to be available over a three-day period in order to allow for data collection.

All available air traffic controllers were subsequently requested by their respective Air Traffic Control Managers to voluntarily participate in this study. No instance of non-participation was noted.

This sampling method allowed for comparison of intra-team, inter-team and the consolidation of results from both a qualitative and quantitative perspective. I acknowledged that limitations did exist in terms of generalising from this sample to any type of population, which implied that findings would be limited to the characteristics of the respondents.

According to Stoker (1981: 13) a sample size of 26 was considered to be adequate for this study. A sample of 25 respondents was drawn/available. Selection of these respondents was deferred to the Air Traffic Control Manager at each site.

6 Data collection plan

Data collection plan

I collected data during deliberately created opportunities at each of the research sites. Each respondent was required to complete the SDTLQ, the LAQ and participate in the individual interview. Focus group attendance was dependent on the availability of these respondents and such allocation was determined by the Air Traffic Control Manager at each site.

I collected qualitative data during one-to-one interviews that allowed me to construct mundane reality in the interview, whilst focus group interviews created opportunities for transactions between members themselves – one-to-one interviewers *constructed* data, whilst participants (focus group interviews) allowed one to *find* data (Miller & Dingwall, 1997: 60-61). Quantitative data collected assisted me in determining relationships between predefined variables as stated in the SDTLQ and measured variables in the LAQ.

Planned data collection activities were influenced by the following three distinct stages that typically represent the dynamics associated with the air traffic control work environment, namely:

- The pre-work shift, when controllers get together and arrange/allocate tasks and review the work schedule. Data collection was possible once this stage had been completed.
- The work shift, when controllers function both individually and within the team context. During this stage I could not collect data, due to safety and work condition limitations, however, controllers were able to assess, evaluate and reflect on their own performance and that of the team during this stage and reported on these after the shift.
- The post-work shift, when controllers disengage from the control positions and complete post-shift duties. Data collection was possible during this stage.

This planned data collection period was subdivided into an introductory phase, a data collection phase and a disengagement phase as presented in Table 4.4. The introductory phase comprised:

- introducing myself to the entire air traffic control team; and
- completing the researcher-respondent agreement (attached as Appendix A)

During the data collection phase attention was drawn to the respondent instructions required for completion of the SDTLQ and the LAQ. These instructions were displayed on the first page of each questionnaire. Qualitative data collection was guided by a researcher task/activity guide for the individual interviews (attached as Appendix B) and the focus group interviews (attached as Appendix C).

Activities conducted during the disengagement phase included an explanation to respondents regarding member-checking requirements and duties. The means of feedback communication in this regard was verbally explained by me. This feedback required from respondents to review typed transcripts that would be forwarded to them and communicate any required changes to me by a specific agreed-upon date. Covering letters explaining this process are included as Appendix D. This phase was concluded by thanking everyone concerned and leaving the research site.

Sequence of data collection, data collection activities, and techniques are summarised in Table 4.4.

Table 4.4 Mixed-method data collection plan

Data collection sequence	Data collection phase	Data collection activity and technique to be used
1st	1	Introduction to this study
2nd	2	Administer SDTLQ
3rd	2	Administer LAQ
4th	2	Conduct one-to-one interviews
5th	2	Conduct focus group interviews
6th	3	Agree on member-checking activities
7th	3	Disengagement conversation

Compiled by the researcher

7 Mixed-method data collection techniques

Mixed-method data collection techniques	Individual interviews
	Focus group interviews
	Self-directed Team Learning Questionnaire (SDTLQ)
	Learning Approach Questionnaire (LAQ)

This pragmatic study posed several questions about learning practices, training strategies, workplace performance results and the relationship between learning and performance. These different levels of inquiry called for data collection techniques that were primarily of an exploratory nature (qualitative), supported by measures of frequency and relationship data (quantitative). Such a study that combines qualitative and quantitative techniques and/or data analysis within different phases of the research process favours a mixed method (McMillan & Schumacher, 2001: 594). In this study these mixed-method techniques complemented each other, although their focus areas (dealing with self-directed team learning, self-directed team performance and learning approaches) may appear to be diverse. This assumed diversity was merged by utilising a mixed method approach to elaborate, illustrate and clarify defined aspects of results of one method with those of another method.

I accepted that multiple realities may have prevailed and for this reason I searched for an understanding of an emerging reality by means of qualitative techniques. Swanson and Holton (1997: 90) confirm that social scientists turn to qualitative research methods and techniques because they are well suited to exploration and discovery in an era of rapid and fundamental change. Patton (1990, 40-41), supported by Swanson and Holton (1997: 95), identifies ten themes that are part of every qualitative design. In Table 4.5, these ten themes are listed against my actions, thus motivating the use of qualitative techniques. Qualitative techniques included in this study consisted of individual interviews and focus group interviews (described in paragraphs 7.1 and 7.2).

Table 4.5 Ten themes that are part of a qualitative inquiry and linked to my actions

Theme	My actions
Naturalistic inquiry with reference to real world situations.	Inquiry took place in the air traffic control work environment.
Inductive analysis that begins with collection of details that lead to generalisations.	Data collection was performed by means of various methods (described above) to establish links between findings in order to gain new insights. Perceived self-directed team learning and

	performance generalisations were reanalysed for context and consistency in order to enhance understanding.
Holistic perspectives where phenomena are understood as complex systems.	Self-directed team learning, as a complex system, was studied from both an individual and team perspective; focusing on team dynamics, environmental influences and learning dynamics.
Qualitative data that imply that detailed description is collected.	Detailed descriptions were made possible by means of qualitative and quantitative data collection methods – the aim and focus was to gain deeper understanding of the impact of self-directed team learning.
Personal contact and insight that requires that the researcher ensure personal contact with participants.	Data collection took place in the air traffic control workplace – this allowed for data collection on site.
Dynamic systems that view the object of study as dynamic and changing during a study.	Change of team members was a reality, members changing roles is a workplace practice, and different teams from different sites were used in this study.
Unique case orientation; resulting in each research case being regarded as unique and special.	Each team and each site was considered to be unique, whilst learning in each team may also have been different.
Context sensitivity that allows for the placement of findings in a social, historical, and temporal context.	The context was focused on self-directed team learning viewed from a results point-of-view.
Empathetic neutrality; although the researcher cannot be completely objective, neither should the researcher use the process to advance personal agendas.	The researcher was not part of any workplace air traffic control team, site or sample and showed no intention to participate in any self-directed team learning activities.
Design flexibility that ensures that the inquiry process is adaptive, potentially changing as the research process is conducted.	This qualitative approach allowed for flexibility in terms of qualitative data gathering.

Patton (1990: 40-41) and Swanson & Holton (1997: 95)

The supportive and descriptive role and aim of the quantitative design were limited to describing and comparing characteristics of the domain being studied (described in Table 4.6) in order to assist in the

discovery of relationships amongst teams and characteristics of individuals and teams being studied (Swanson & Holton, 1997: 70 & 79). Quantitative techniques included in this study consisted of the LAQ psychometric instrument and the SDTLQ.

Table 4.6 Two core questions (quantitative inquiry) and the proposed researcher action

Question	Category	Quantitative techniques
What were the learning and performance characteristics of the three self-directed teams?	Description	SDTLQ LAQ
Were the three teams similar or different on pre-determined characteristics?	Comparison of teams	SDTLQ LAQ

Swanson & Holton (1997: 79)

As supported by paragraph 4 (mode of inquiry) I did not emphasise a need to standardise findings, to seek precision or objectivity, or to ensure replicability and generalisation of findings. The term *trace the impact* communicates a need for more than a quantified debate – it signified the need to facilitate and produce new knowledge, obtained through an orderly mixed-method investigative process (illustrated by the typology quan + QUAL) that resulted in a deeper understanding of the research topic.

7.1 Individual interviews

I emphasised in Chapter 3 that this study challenged me to explore, interpret and present my own understanding in response to the research questions, thus creating a whole system of thought. Furthermore I acknowledged that knowledge is acquired by transactional means and created by personal experiences that result in individual cognition. Kvale (1996: 11) expands on this notion by affirming that knowledge is often generated between humans through conversation. I used individual interviews to allow respondents to discuss their interpretations of the world in which they work, and to express how they regard situations from their own point of view (Cohen, Manion, & Morrison, 2000: 267).

In-depth, face-to-face interviews enabled me to gather self-directed team information from air traffic controllers in the workplace. I designed and utilised these individual interviews as a means of exploring to what extent team members and teams observe or do not observe self-directed team performance and team learning practices identified in the literature review (Chapter 2). Extensive use was made of open-ended questions to impose no limitations on the interviewee's responses. Open-ended questions allowed for

opportunities to elicit underlying information and feelings/opinions. Free-narration questions (Du Plooy, 1995: 143) were used in order to allow the respondent to formulate feedback in terms of a story/structured recollection.

These individual interviews specifically attempted to gain a deeper understanding of the role of the individual in the team learning initiative, levels of intentional and unintentional learning, contributions from other team members with reference to learning, and the impact/value of self-directed team learning.

Appendix B and D provide insight into the interview protocol used while Table 4.7 presents formulated questions, focus areas and the value of these individual interview questions.

Table 4.7 Formulated interview questions, interview focus areas and the value of these interview questions

Question	Question 1	**Focus**	The impact/influence of teamwork on workplace performance outcomes[3]
Question			**Value and relevance to this study**
Explain with the aid of examples how teamwork influences the outcome of the air traffic control service provided by your centre?			Allowed the teams to explain to me how self-directed teams plan learning, use resources to learn, and what learning strategies were employed. Allowed me to identify whether a self-directed work team approach had resulted in: • improved quality, productivity and service; • greater flexibility; • reduced operating costs; and • faster response to technological change. Allowed me to identify benefits associated with effective self-directed teamwork that included: • Presence of a growing awareness of the importance of resource management skills related to decision-making, team coordination, and planning, especially in organisations where

[3] Refer to Chapter 2 pages 32, 55, 62, 74, 86, 91, 92, 112, 119, 121, 128 & 131 and Table 2.16.

	work teams perform complex, time-constrained, and critical tasks. • Open lines of communication, cooperation, listening, and speaking one's own mind. The single most important factor in maximising the excellence of a group's product is the degree to which the members are able to create a state of internal harmony, which lets them take advantage of the full talent of their members. Many things people do at work depend on their ability to call on a loose network of fellow workers; different tasks can mean calling on different members of the network. This creates an opportunity for ad hoc groups, each with a membership tailored to offer an optimal array of talents, expertise, and placement. • Positive, supportive interpersonal communication amongst team members. Solution-focused teams accept the important role of continuous learning and development, therefore learning includes imparting of information, interpersonal learning, developing socialising techniques and imitative behaviour. • Effective informal networks that typically consist of at least three varieties: communication webs - who talks to whom; expertise networks, based on which people are turned to for advice; and trust networks. These networks rely on effective coordination of efforts in teamwork, being leaders in building consensus, being able to see things from the perspective of others, persuasiveness, and promoting cooperation while avoiding conflicts. Allowed me insight into other performance skills displayed by team members that may have included: • taking initiative; • being self-motivated enough to take on responsibilities above and beyond their stated job; and • self-management in the sense of regulating their time and work commitments. I was able to explore team dynamics found in air traffic control teams

			and identified benefits and disadvantages reported by teams and determined the impact of these on team efforts.
Question	Question 2	**Focus**	The impact/influence of teamwork on the individual's performance[4]
Question			**Value and relevance to this study**
Explain with the aid of examples how learning from air traffic control teamwork experiences influences your own performance?			Presented me with an opportunity to determine individual practices and consequences achieved, as a result of continued evaluation of learning goals, learning activities, personal demands and concerns, and perceptions. Provided me with an opportunity to explore each individual's involvement in self-directed team learning, including: • individual self-directed learning dynamics; • individual learning approaches; and • the role and impact of individual self-directed learning contributions within the self-directed team learning effort. Provided me with an opportunity to explore influences of the following aspects on learning that took place in the work environment, being: • authority structures internal and external to the team; • learning support structures; • workplace experiences (viewed as an input and output of learning); • informal learning opportunities; • intentional and unintentional learning occurrences; and • environmental characteristics. Provided me with an opportunity to trace and explore: • expectations and agendas which adult learners brought to their learning experience; • how knowledge was constructed by individuals as a result of

[4] Refer to Chapter 2 Tables 2.10, 2.11 & 2.23.

			learning; • the role of interaction with others as a means that directed own learning and assumed responsibility for own learning; • the individual's level of willingness to accept responsibility for his/her own learning; and • reported learning locus of control. Allowed me to understand how analysis of experiences (based in problem-solving and decision-making), reflection as an evaluation technique, and experimenting by recalling knowledge from memory contributed towards self-directed adult learning results. Presented me with an opportunity to record and analyse occurrences reported that provided insight into different individual information processes, as initiated by non-routine occurrences. Allowed respondents to explain to me their use of self-esteem techniques, self-efficacy beliefs and self-concept statuses. Provided me with an opportunity to consider the role and influence of: • the work, learning and social environments; • the work climate; and • the complementary extended social settings.
Question	Question 3	**Focus**	The impact/influence of learning from experience on teamwork[5]
Question			**Value and relevance to this study**
Explain with the aid of examples how learning from experience influences air traffic control teamwork?			Allowed me to assess dynamics, associated with self-managed work team activities and workplace learning, in the air traffic control environment. Allowed me to describe air traffic control teams' shared decision-making tasks, their need for effective communication, respect for individuality, and their mutual striving towards safety, orderliness and

[5] Refer to Chapter 2 page 36 and Tables 2.2, 2.6, 2.10 & 2.23.

	efficiency in terms of quality service delivery. Provided me with an opportunity to explore each individual's involvement in self-directed team learning; thus allowing me to understand: • individual self-directed learning dynamics; • individual learning approaches; and • the role and impact of individual self-directed learning contributions within the self-directed team learning effort. Presented me with an opportunity to explore team dynamics found in air traffic control teams and identify benefits and disadvantages reported by teams and determine the impact of these on team efforts. Allowed me to understand how self-directed team learning incorporated the team member's description of his/her critical analysis processes and outcomes, reflection habits and practices, and how he/she responded creatively to situations (learning opportunities). Allowing me insight into individualised learning agendas.

Compiled by the researcher

7.2 Focus group interviews

I stated in Chapter 3 that collective knowledge can be the product of collaborative cognitive interactions. In order to elaborate on this statement in a pragmatic manner I decided to generate and evaluate data from different subgroups of this population. My challenge was to ensure that respondents interacted with each other rather than with me, the moderator, thus allowing the views of respondents to emerge (Cohen, Manion, & Morrison, 2000: 288).

Focus groups are suggested as a means to create a social environment in which individual members are stimulated by the perceptions, opinions and ideas of each other, which in turn, increases the richness of data (McMillan & Schumacher, 1989: 410). A focus-group technique was introduced to gather qualitative

data and to gain deeper understanding of learner behaviour, to test preliminary information, and to test ideas (Du Plooy, 1995: 118). Lewis (1992: 413-421) adds that focus group interviews can generate a wider range of responses than in individual interviews. Focus groups thus enabled me to capitalise on the group interaction around a topic (Swanson & Holton, 1997: 98).

Focus groups offered me exposure to the typical learning processes, experiences and perspectives of the air traffic controllers within their workplace. I designed, introduced and facilitated the three focus group interviews as a means of exploring to what extent team members and teams observe or do not observe self-directed team performance and team learning practices identified in the literature review (Chapter 2). Focus groups provided access to: shared individual and team learning experiences; techniques used to learn; comments relating to the role of the team in terms of intentional and unintentional learning; value and contributions from different team members and team roles; and the perceived value of the learning focus.

These focus group interviews relied on the following steps and my listed actions, as suggested by Vaughn, Schumm and Sinagub (1996: 120-125):

- Delineate the general purpose – The research aim was communicated by means of a purpose statement to the group (refer to Appendix C).
- Designate a facilitator – I assumed the role of facilitator, in order to maintain a supportive and non-evaluative environment.
- Refine the research goal – The general scope of discussion was presented as described in Appendix C.
- Select the participants – This activity was dealt with by means of the sampling technique described in paragraph 5.2.
- Determine the number of focus group interviews – Three focus groups were used.
- Arrange for the focus group facility – Air Traffic Control manager's office at each site was used.
- Develop an interview guide – Appendix C served as the interview guide, thus providing an outline for the focus group interview procedures and a general idea of the questions that were asked.
- Conduct the focus group interview.
- Analyse the focus group data – Transcribed and coded data were utilised as stated in paragraph 9.

Appendix C and D provide insight into the focus group interview protocol used while Table 4.8 presents formulated questions, focus areas and the value of these focus group interview questions.

Table 4.8 Formulated focus group interview questions, interview focus areas and the value of these focus group interview questions

Question	Question 1	**Focus**	Reflecting on team characteristics[6]
Question			**Value and relevance to this study**
What can a team member, joining the air traffic control team, expect from the team?			Allowed me to assess teamwork skills, the team's ability to share knowledge and the team members' attitudes. Provided me with an opportunity to explore whether self-directed teams possessed the following characteristics: • An open and supportive social environment, with a focus on learning, without authority-directed problem-solving. An underlying commitment to team performance rather than individual performance. • A variety of people with different experiences and areas of expertise. Strong interpersonal relationships that allowed the team to function more openly, sharing knowledge and experience. • Effective communication between team members and those outside the team. • Participative practices and evidence that all ideas were listened to without domination by a strong team member, thereby keeping the team open to creativity and thinking everything through thoroughly. • Clearly defined goals to which all team members were committed and to which they aspired. • Leadership was viewed as a shared group responsibility, not a delegated position. Because team members have different skills and abilities, the leadership role would probably change as the goals and dynamics of the team changed. Presented me with an opportunity to explore team dynamics found in air traffic control teams.

[6] Refer to Chapter 2 pages 36, 45, 55, 59, 60, 62 & 130 and Tables 2.4, 2.6 & 2.16.

			Assisted me to identify and explore benefits and disadvantages reported by teams and determine the impact of these on team efforts.
Question	Question 2	**Focus**	Individual and collective learning strategies[7]
Question			**Value and relevance to this study**
How are individual and collective learning planned and executed at your air traffic control centre?			Providing me with an opportunity to determine whether collective mental models were also explained by investigating outcomes associated with self-directed team learning (including the cognitive, affective and connotative outcomes and associated communication forms). Reminded me to check for use of learning contracts. Allowed me to investigate learning agreements that contained details about what was learned, how it was learned, by when, and what assessment criteria were used to determine competence/evidence of accomplishment. Allowed me to check for learning contract/agreement framework elements.
Question	Question 3	**Focus**	Reflecting on team learning opportunities[8]
Question			**Value and relevance to this study**
How can air traffic control team learning at your centre be improved?			Allowed me to explore the: • manner in which self-directed teams managed their own continuation training; • the team's continuation training phase; • the focus areas and impact of air traffic control continuation training; • occurrence and aim of continuation training from both an individual and team perspective; • the manner in which self-directed learning influenced continuation training; and • cases of incremental learning and unlearning.

Compiled by the researcher

[7] Refer to Chapter 2 pages 86, 94, 95, 114, 118, 123 & 124 and Tables 2.10, 2.25 & 2.28.
[8] Refer to Chapter 2 pages 44, 51, 52, 116, 118-121 & 123 and Tables 2.11 & 2.26.

7.3 Self-directed Team Learning Questionnaire (SDTLQ)

I designed the SDTLQ as a means to explore to what extent team members and teams observe or do not observe self-directed team performance and team learning practices identified in the literature review (Chapter 2). The SDTLQ allowed me to progress from a generalised point-of-departure to specific data focus areas. The primary objective of the SDTLQ was to allow me to accumulate qualitative data such as descriptions of experiences from controllers and quantitative data that allowed for measurement of self-directed team performance data and self-directed team learning data. Self-directed team performance and self-directed team learning were thus identified and documented as subsidiary topics that related to the primary objective of this questionnaire. I clustered all relating information requirements as questions under these two subsidiary topics during the planning of the SDTLQ. Specific subquestions/indicators were finally formulated for each question. This process allowed for sequencing of questions in a logical and coherent manner. From a quantitative perspective it was necessary for this questionnaire to describe and compare phenomena. Table 4.9 lists performance and learning aspects of the various teams that were questioned by means of the SDTLQ which, in turn, allowed for categorical data and continuous data (Swanson & Holton, 1997: 79). Data collected also allowed for intra-team and inter-team comparisons (Swanson & Holton, 1997: 80).

Table 4.9 SDTLQ performance and learning aspects

Self-directed Team Performance	Self-directed Team Learning
Team work characteristics	Individual learning preferences
Self-efficacy	Learning participation
Team performance activities	Individual workplace learning orientation
Individual reflection	Workplace training design
Teamwork performance measures	Workplace training implementation
Team performance dynamics	Workplace training evaluation
	Operational training characteristics
	Continuation training characteristics
	Workplace learning environment
	Team learning facilitation
Opportunity for individual feedback	

Compiled by the researcher

Use was made of open-ended questions (assisting with, amongst other things, perception and opinion gathering) and structured questions (assisting to determine categories, characteristics, preferences and timelines associated with occurrences). Responses were primarily managed by means of Likert scales, thus providing for a range of responses to each subquestion/indicator.

The SDTLQ is presented as Appendix E. Table 4.10 presents SDTLQ focus areas and their value and relevance to this study. This presentation excludes SDTLQ questions 1 to 6, as these addressed biographical data.

Table 4.10 SDTLQ focus areas and their value and relevance to this study

Questionnaire	Question 7	**Focus**	Team work characteristics[9]
Value and relevance to this study			
Allowed me to explore the disadvantages of teamwork for learning that included: • pressures to conform; • the status offered by the team – this may become restrictive (an individual may become typecast by other teams into a set role and may thus find it hard to break out and adopt another role); • the closeness of the team, as each member who engages in the activities, may become a threat to some of the more individualistic learners (the group may be strong enough to deter experimentation by those who are less confident); • coping strategies – some members may thus find it difficult to cope with the wide range of experiences and views that others see as the richness of the adult learning group; and • the pace set by the team – such a pace may not meet or satisfy the needs of an individual member (teams may be intolerant of those members who are felt to move too fast or too slow). Allowed me to explore the following problems or mega-traps that may have contributed to ineffective team performance and team learning within a self-directed team context. • Strategic blunders imply that no organisation structure is immune to the strains and pressures of changing conditions, threats and management. Teams could thus not cover up for organisational strategic blunders. • Collision of work cultures means that changes to a team's charter and membership will likely lead to a regression			

[9] Refer to Chapter 2 pages 39, 40, 46, 60, 63, 66, 78-82, 85, 99, 101, 102, 111, 118, 122 & 129 and Tables 2.10 & 2.28.

in its overall operating and learning effectiveness.

- Inability to transfer learning refers to the tendency to dismiss what is often significant achievement that hampers both the credibility and assumed relevance of team member involvement.

Presented me with an opportunity to explore model 1 and 2 theories held by team members. (Model 1 tells the individuals to craft their positions, evaluations, and attributions in ways that inhibit inquiries into them and tests of them with other's logic. The consequences of Model 1 strategies are likely to be defensiveness, misunderstanding, and self-fulfilling and self-sealing processes. Model 2 theories are, at the outset, espoused theories. The challenge for individuals is to transform their espoused theories into theories-in-use by learning a new set of skills and a new set of governing values.)

Allowed me to gain insight into learning objectives and learning outcomes. (Learning objectives provide the focus and means in order to realise learning outcomes. Types of outcomes from effective team-directed learning can be categorised as (1) informational, (2) affective and (3) behavioural. Essential to the learning process is the ability to communicate; therefore a greater understanding of the way knowledge is coded will increase the power to communicate.)

Provided me with an opportunity to describe learning environments found during this study. This was considered to be significant because adults become increasingly more self-directed when given appropriate learning resources, experiences and encouragement. A conducive self-directed learning environment is characterised by the presence of these characteristics.

Allowed me to determine whether organisational dialogue:

- provided team members with accurate and complete information;
- confirmed other's personal competence;
- made reasoning explicit;
- allowed the members to voice their perspectives;
- allowed for reconsideration of one's own position when confronted with convincing data;
- regarded own assertions and those of others as hypotheses to be tested; and
- challenged errors in others' reasoning or data.

Presented me with an opportunity to understand self-regulated learners as those who are metacognitively, motivationally and behaviourally active participants in their own learning. These three universal aspects of the process are summarised below.

- Metacognition as the component that directs planning, organising, self-monitoring, and self-evaluating.

- Motivation that relates to high efficacy and attribution, as well as to an intrinsic interest in the learning task.
- Behaviour that supports the process for selecting, structuring, and creating an environment that is considered to be optimal for learning.

Questionnaire	Question 8	**Focus**	Self-efficacy beliefs and associated impact upon performance[10]

Value and relevance to this study

Allowed me to determine self-efficacy viewpoints because the team's social state and joint competence influences individual and team self-efficacy beliefs. It can thus be expected that high levels of espoused and/or observed competence and social synergy will support greater levels of self-efficacy.

Questionnaire	Question 9	**Focus**	Team performance activities[11]

Value and relevance to this study

Allowed me to determine whether learning opportunities were found in the following team activities:

- advising — gathering and reporting information;
- innovating — creating and experimenting with ideas;
- promoting — exploring and presenting opportunities;
- developing — assessing and testing the applicability of new approaches;
- organising — establishing and implementing ways of making things work;
- producing — concluding and delivering outputs;
- inspecting — controlling and auditing the working of systems;
- maintaining — upholding and safeguarding standards and processes; and
- linking — coordinating and integrating the work of others.

Allowed me to gain insight into accessible meaning structures and learning cycles. In this regard I paid attention to the four steps listed below.

- Step 1. Encouraging the generation of information. This is the responsibility of all team members.
- Step 2. Integrating the generated information into the team context.
- Step 3. Collectively interpreting the information.
- Step 4. Authority to take responsible action based on the interpreted meaning.

Questionnaire	Question 10	**Focus**	Individual reflection upon performances[12]

Value and relevance to this study

Presented me with an opportunity to investigate individual's reflective practices. I considered it to be important because reflection promotes self-awareness and social awareness, supports adult education principles, improves

[10] Refer to Chapter 2 pages 49, 50 & 71 and Table 2.11.
[11] Refer to Chapter 2 pages 68, 69, 84 & 89 and Table 2.16.
[12] Refer to Chapter 2 pages 30, 45, 48, 50, 58, 67, 90, 93, 96, 98 & 100-106 and Tables 2.4, 2.11 & 2.23.

learning, links theory to practice, and stimulates self- and peer-evaluation. This investigation was directed by the objects of reflection, as listed below.

- Behaviour. The most usual area of self-reflection (What actually happened? What did I actually do? What else might I have done?).
- Capabilities. People tend to engage in those behaviours for which they are best prepared. Reflection can, however, lead to a heightened awareness of one's existing capabilities and a plan to strengthen or develop new ones that would expand the repertoire.
- Beliefs. Focus is on influences and experiences as mediated by the social context.
- Purpose. Reflecting on what one tries to accomplish, thus reflecting on the purpose of effort.
- Values. Refers to those values that a person holds above all others.
- Environment. Reference to norms and expectations of the organisation, department, field, discipline, industry standard, or one's own standards. Contemplating these norms — how they are represented in espoused values and how their reality is experienced with colleagues.

I realised that experience alone could not suffice as the only self-directed learning influencing factor. I had to consider reflection. This decision allowed me to study self-directed learning principles and practical activities associated with both intentional and unintentional self-directed learning (emphasising the ability to reflect on performances and learning). Also allowed me to investigate levels of internal regulation held by individuals that encouraged them to relate and structure information.

Questionnaire	Question 11	**Focus**	Teamwork performance measures[13]

Value and relevance to this study

Allowed me to identify indicators that the desired air traffic control operational and organisational outcome had been met. Indicators considered by me were:

- no collisions occurred;
- no aircraft proximity situations/risk of a collision occurred;
- safety-related enhancements were employed whenever necessary;
- air traffic control actions did not unnecessary delay flights;
- no excessive use of airspace that resulted in low levels of productivity;
- traffic occurrences were handled in an orderly manner and sequenced;
- control of traffic was in compliance with specific operational practices, rules, instructions and procedures; and
- air traffic controllers worked effectively as a team whilst on shift.

Allowed me to recognise indicators that the desired air traffic control personal outcomes had been met. In this regard I

[13] Refer to Chapter 2 pages 52, 107, 108, 112, 114, 115, 119, 121 & 134 and Tables 2.3, 2.11 & 2.24.

considered whether:

- no violation of minimum separation standards had occurred;
- no deviations from standard operating procedures had taken place;
- no disorders were experienced which may have resulted in cognitive work overload; and
- no unnecessary requests were made to pilots.

Allowed me to investigate cognitive and behavioural skills associated with teamwork performance. The following eight cognitive and behavioural skills that were identified as being important for air traffic control team performance were considered in this regard.

- Self-regulation of stress. The ability to monitor one's own stress level, and to plan and employ effective strategies for dealing with stressful performance conditions. This includes awareness when one's personal limits have been reached.
- Team-supporting behaviour. Interaction with others in the air traffic control team which enhance their ability to perform the tasks required of their positions. This includes providing backup when needed as well as avoiding actions which hinder the efforts of controllers working other positions. Additionally, effective supporting behaviour involves requesting assistance when needed.
- Boundary spanning. Interaction with other entities in the air traffic control system which enhance the controllers' ability to perform the tasks required of their positions. This includes both taking actions which help, and avoiding actions which hinder the efforts of these entities.
- Information exchange. The ability and willingness to seek and to pass information which promotes a shared awareness or "mental model" of the team's internal and external environment. This includes using concise, standard phraseology, offering information before having to be asked, active listening and inquiry.
- Team feedback skill. The ability to provide, seek, and receive feedback from other team members in a direct and specific manner, while not becoming hostile or defensive.
- Flexibility. The ability and willingness to adapt one's behaviour quickly and appropriately in accordance with environmental demands.
- Team self-correction skill. The ability to diagnose team coordination problems, resolve conflicts, develop solutions, and to energise or motivate team members toward achieving performance goals.
- Problem-solving skill. This includes the ability to quickly determine optimal task redistribution in order to preserve safety and efficiency in response to high-workload, time-pressured, or emergency situations.

Questionnaire	Question 12	**Focus**	Team performance dynamics[14]
Value and relevance to this study			
Allowed me to determine how learning within the team was influenced by: • judgement, problem-solving and decision-making; • situational awareness; • sensory and perceptual differences; • personality and attitude differences; • communication; • knowledge, skill and ability differences; • leadership and teamwork dynamics; and • physiological and psychological differences (example – stress management).			
Questionnaire	Question 13	**Focus**	Individual learning preferences[15]
Value and relevance to this study			
Allowed me to determine how situational influences and team learning initiatives were influenced by: • routine/expected (skill-based) behaviour; • familiar or trained-for problems (rule-based behaviour); and • novel, difficult or dangerous problems (knowledge-based behaviour).			
Questionnaire	Question 14	**Focus**	Learning participation[16]
Value and relevance to this study			
Afforded me the opportunity to identify initiative(s) that provided work performance information/feedback for personal self-evaluation. These initiatives included, but were not limited to: • individual self-directed learning; • team self-directed learning; • learning approaches; • learning environment; • learning agreements (including encouraged co-operative work between team members); and • lifelong learning preparation.			

[14] Refer to Chapter 2 page 33 and Table 2.5.
[15] Refer to Chapter 2 pages 128 & 129 and Table 2.28.
[16] Refer to Chapter 2 pages 37, 68, 91, 93 & 94 and Tables 2.10, 2.11 & 2.23.

Questionnaire	Question 15	**Focus**	Individual workplace learning orientation[17]
Value and relevance to this study			
Allowed me to determine to what extent effective self-directed adult learning was linked to an external locus of control that favoured dependency.			
Questionnaire	Question 16	**Focus**	Workplace training design[18]
Value and relevance to this study			
Allowed me to determine who assumed responsibility for workplace training design. I understood that when identifying learning objectives the impact and role of team leaders and workplace experts on the generation of learning objectives was considerable.			
Questionnaire	Question 17	**Focus**	Workplace training implementation[19]
Value and relevance to this study			
Allowed me to determine who assumed responsibility for workplace training implementation. I understood that team leaders and workplace experts may also have constrained or supported the pursuit of learning issues. Expert-driven learning strategies and preferences could also have resulted in clashes between team members, and between team members and experts.			
Questionnaire	Question 18	**Focus**	Workplace training evaluation[20]
Value and relevance to this study			
Allowed me to determine who assumed responsibility for workplace training evaluation. I understood that feedback from experts may have contributed information that the team member(s) used to evaluate the relevance learning and to measure success in learning. Team discussions and feedback could have provided ongoing sources of information for self-evaluation in order to allow the team members to keep up with the team's overall learning. Self-directed evaluation could have been integrated in both expert driven and team-driven experiences. However it is significant to note that the social milieu had a major impact on the way that the individual self-evaluated his/her progress and performance.			
Questionnaire	Question 19	**Focus**	Operational training characteristics[21]
Value and relevance to this study			
Adaptability and shared mental models were considered by me to be key requirements for the members of an air traffic control team. This question allowed me to investigate air traffic control team knowledge, skills and attitudes. • Air traffic control team knowledge			

[17] Refer to Chapter 2 page 47 and Table 2.11.
[18] Refer to Chapter 2 pages 30, 33, 37-39, 47, 77, 78, 83, 86-88, 91, 92, 94, 118-120 & 131 and Tables 2.10 & 2.23.
[19] Refer to Chapter 2 pages 39, 72 & 91 and Tables 2.10 & 2.23.
[20] Refer to Chapter 2 pages 30, 37, 47, 48, 73, 79, 82, 87, 91, 93, 95-97, 103 & 105 and Tables 2.10, 2.11.
[21] Refer to Chapter 2 pages 30, 32, 59, 111-116, 119, 122 & 134 and Tables 2.6 & 2.24.

- Inter-positional knowledge
- Knowledge about the components of ATC teamwork
- Knowledge about the signs of performance-related stress
- Knowledge about team-mates' task expectations
- Knowledge of team-mate characteristics

- Air traffic control team skills

  - Flexibility
  - Information exchange
  - Supporting behaviour
  - Team feedback skill

- Air traffic control team attitudes

  - Belief in the importance of teamwork
  - Collective orientation
  - Collective efficacy
  - Mutual trust
  - Team cohesion

Questionnaire	Question 20	**Focus**	Continuation training characteristics[22]

Value and relevance to this study

Information regarding air traffic control continuation training provided me with a different view relating to self-directed team learning. I realised that within a systems perspective individual and/or collective learning needs can be addressed by a team's concerted effort to ensure competence of all team members. Continuation training characteristics investigated by me are listed below.

- Information exchange. Involves passing relevant data to team members who need it, before they need it, and ensuring that the messages sent are understood as intended.
- Supporting behaviour. Involves offering assistance and means to request assistance in an effective manner both within and across teams in the air traffic control system. Supporting behaviour has two primary components: (1) requesting and accepting assistance and (2) providing assistance. Providing assistance refers to the need to identify the need to assist others and the resulting actions that will take place. Requesting assistance involves monitoring oneself for signs of performance deficiency and then requesting help from other team members before it is too late.

[22] Refer to Chapter 2 pages 31, 51, 52, 116 & 118-123 and Tables 2.11 & 2.26.

- Team feedback skills. Refers to an environment that supports and encourages team members to communicate their observations, concerns, suggestions, and requests in a clear and direct manner without becoming hostile or defensive.
- Flexibility. Involves the ability to learn and adapt performance strategies quickly and appropriately to changing task demands.
- Team-mate generic knowledge competencies.
- Team-mate specific knowledge competencies.
- Team-mate-generic attitudes.
- Team-mate-specific attitudes.
- Team situational awareness.

Questionnaire	Question 21	**Focus**	Workplace learning environment[23]

Value and relevance to this study

I realised that a functional self-directed adult learning environment needed to support:

- a supportive learning environment;
- an enabling learning climate; and
- a complementary extended social setting.

I had to investigate whether functional self-directed adult learning environments were dependent upon intentional/formal and/or unintentional/informal learning interventions.

Questionnaire	Question 22	**Focus**	Team learning facilitation[24]

Value and relevance to this study

Allowed me to explore how individual and team learning was influenced by the following interfaces:

- S – Software
- H – Hardware
- E – Environment
- L – Liveware
- L – Liveware (in the middle)

Allowed me to determine how team learning was influenced by:

- operating environment;
- attitudes;

[23] Refer to Chapter 2 pages 44, 46, 50, 51, 97, 106 & 122 and Tables 2.11 & 2.23.
[24] Refer to Chapter 2 pages 126-128 and Tables 2.5 & 2.28.

• communication; and • trust.			
Questionnaire	Question 23	**Focus**	Individual feedback[25]
Value and relevance to this study			
Provided me with insight into voluntary feedback invited from respondents regarding: • individual's impact upon performance; • team's impact upon performance; • individual self-directedness; and/or • team self-directedness			

Compiled by the researcher

7.4 Learning Approach Questionnaire (LAQ)

I stated (in Chapter 3) my assumption that knowledge is constructed by the subjects in order to adapt to their environment and that construction of knowledge is an ongoing process at different levels; psychological and social. My challenge was to discover and categorise dynamic learning approaches and orientations associated with individual knowledge construction in order to support my own understanding of factors internal to the subject's point of view and external factors. The purpose of such an investigation was to discover how knowledge structures were formed, nurtured and maintained within a defined learning situation and learning environment.

I could not overlook the value and importance of learning approaches as applicable to this study. This point of view is shared by Schaap (2000) who acknowledged that the way an individual views the process of learning influences the individual's approach to a learning opportunity and the effectiveness of the learning process concerned. This statement warranted further investigation because it allowed me to consider the use of a valid and reliable measure to determine learning approaches of air traffic controllers.

The Self-directed Learning Readiness Scale (SDLRS) was considered in this regard. However, Brockett (1984: 1) pointed out that the SDLRS may be suited to measure the readiness for self-directed learning of adults who have an average or above-average level of formal education and who rely on books and periodicals for information. Brookfield (1985: 13) concluded that the SDLRS is a questionable measure of

[25] Refer to Chapter 2 Tables 2.3-2.6, 2.10, 2.11, 2.16, 2.23, 2.24, 2.26 & 2.28. In this regard adult learning, learning within teams, self-directed learning, air traffic control operations, air traffic control training and human factors responses were contemplated.

self-directed learning readiness for adults who use fellow learners as the primary source of information in their explorations of knowledge and skills areas. I decided to make use of the Learning Approaches Questionnaire (LAQ) (Schaap, 2000).

The LAQ consists of two sections; learning approaches in terms of learning content (LAQc) and learning approaches in terms of social orientation (LAQs). These two dimensions dealing with relations between learning approaches and the situational nature of learning had been identified as variables/impact elements to consider during this study. The LAQ allows for measurement of learning approaches in terms of learning content, consisting of deep approaches, achievement approaches, surface approaches and self-efficacy. The LAQ also integrates dependent, independent, cooperative and competitive learning approaches in terms of social orientations. These dimensions were also aligned to the focus areas of this study, being team-directed learning and self-directed learning.

The LAQ was subjected to the following questions in order to motivate use, value and applicability of the instrument in this study (Borg and Gall, 1979: 157):

- *Question: What reliability data are available?*
  Response (Schaap, 2000): *Alpha*-reliability coefficients calculated for the LAQ illustrated acceptable reliability (varying between 0,744 and 0,928). Reliability statistics confirm acceptable reliability coefficients for all LAQ dimensions. Research results also support the reliability of the LAQ.

- *Question: What validity evidence is available?*
  Response (Schaap, 2000): LAQ factor validity was determined by means of factor analytical methods, intra-dimensional correlation coefficients, reliability coefficients, congruency coefficients of factor structures of different data sets and factor comparisons between culture groups. Factor analytical results support factorial validity of the LAQ. Factor validity of the various LAQ dimensions for different context groups was also confirmed. Content validity of the LAQ was evaluated by means of item correlation values and Cattell and Tsujioka's statistic used for factor validity. Research results also support the factor and construct validity of the LAQ.

- *Question: Is the measure appropriate for the sample?*
  Response (Schaap, 2000): The LAQ is aimed at adults who have at least completed Grade 12. The LAQ specifically focuses on informal and formal learning situations found in organisations.

The LAQ examines learning approach constructs in terms of learning content and social orientations. Research results support the stability (for a business learning context) of the LAQ. Constructs measured by the LAQ are reported as being suitable for use in an organisational context. The LAQ thus allows for the measurement of learning approaches in a specific situation (such as the air traffic control work environment).

- *Question: Are test norms appropriate?*
  Response (Schaap, 2000: 556): A generic set of norms was developed for the LAQ. Ipsative interpretation was also possible. Ipsative and normative interpretation guidelines were provided by Schaap (2000: 556).

I used the LAQ (attached as Appendix F) results in conjunction with the traditional qualitative data collection techniques and the SDTLQ in order to describe measured characteristics. Further discussion in this regard is presented in paragraph 9.

8 Role of the researcher

Role of the researcher ←

My role as researcher was purposefully chosen to empower me to enter into a collaborative partnership with the respondents in order to collect and analyse data, with the aim of creating understanding. I fulfilled the role of a sensitive observer and recorded phenomena as faithfully as possible. This role allowed me to raise additional questions, check out hunches, and move deeper into analysis of the phenomena (McMillan & Schumacher, 1989: 393).

My functional researcher role, ethical considerations and future post-research actions were presented in the Researcher-respondent agreement (Appendix A).

My functional role as a researcher included:

- obtaining permission from the South African Air Force to conduct this research;
- compiling the SDTLQ;
- administering the SDTLQ;

- administering the LAQ;
- preparing and structuring interviews;
- conducting interviews;
- preparing focus group interviews;
- facilitating focus-group interviews;
- analysing data;
- triangulating data.

I complied with ethical issues (Du Plooy, 1995: 45-46, 65, 85, 169) by:

- protecting the rights of human subjects including not causing emotional harm, not infringing on their rights to maintain self-respect and human dignity;
- providing all information without distortion or misrepresentation;
- avoiding being biased in the interpretation and presentation of data;
- using measurements that were suited to the research problem;
- not knowingly ascribing greater confidence than the measurements warranted;
- reporting conflicting evidence; and
- reporting any flaws or limitations in the research.

No reasons could be cited as necessary for disclosing the identity of participants, therefore:

- I ensured confidentiality by not disclosing the identity of respondents; and
- I made use of numbers in order to protect sites and individuals.

I visited the air traffic control sites after obtaining consent from corporate and centre management. The importance of air traffic control safety needs and requirements were fully realised by me – these were respected at all times. No unprofessional behaviour was required from participants.

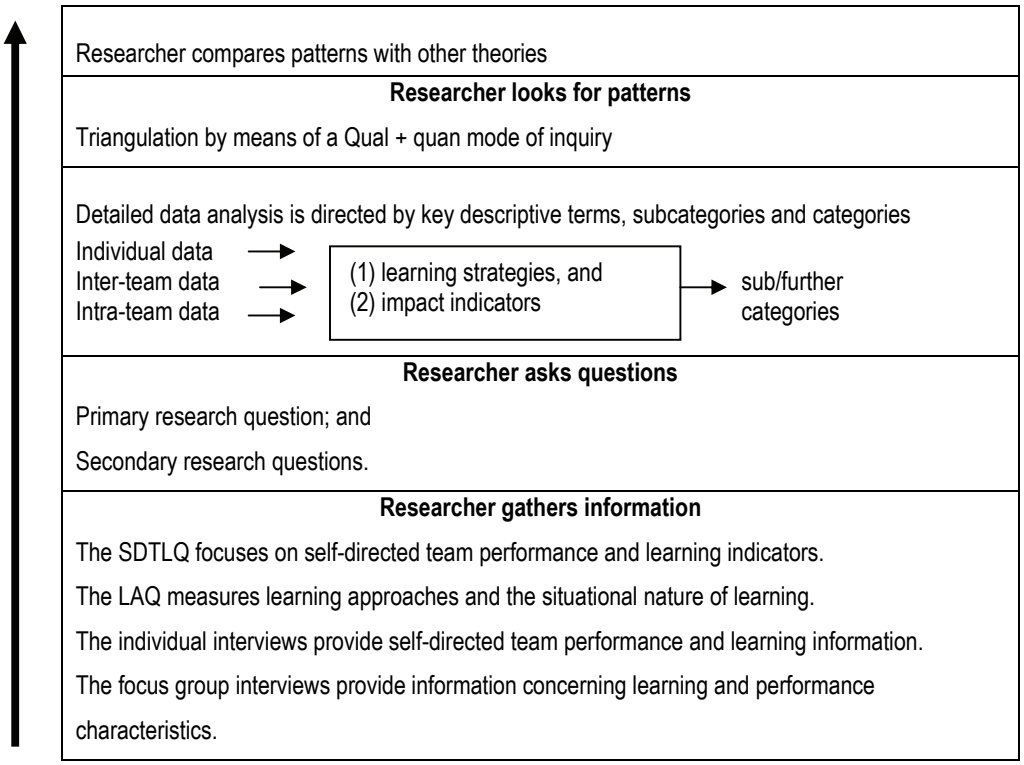
I agreed to provide the participants with an opportunity to learn from their participation, therefore the outcome of this study will be made available to participants and will be communicated by means of arranged internal organisational means.

9 Data analysis

Data analysis ←

Data analysis from a dominantly qualitative approach was viewed as an ongoing process that integrated all phases of qualitative and quantitative data. This qualitative data analysis observed a relatively systematic process that was guided by the primary and secondary research questions. This necessitated a continuous awareness and orientation by me to pay attention to evidence that illustrated the impact of self-directed team learning on the air traffic control work environment and the nature of such impact. I also considered my data analysis challenge to be guided by a search to identify individual and team self-directed learning initiatives and relationships, and then link self-directed team learning findings with air traffic control operational outcomes. Data were analysed from an integrative perspective (using information obtained to result into something new) as presented below in Figure 4.2 as a logic diagram; a basic visual representation of relationships among concepts (Cresswell, 1994: 96).

Figure 4.2 Overview of the analysis plan



Adapted from Creswell (1994: 96)

An intensive data analysis effort enabled me to trace present team performance – thus exploring team performance from an individual, collective and organisational perspective. This approach also allowed me to trace present team learning – thus presenting team learning from an individual, collective and organisational perspective. Finally, I was able to trace future team learning possibilities – proposed strategies from an individual, collective and organisational perspective.

I implemented an analytical approach suggested by Lederman (1990: 117-127) that consisted of data coding into prescribed categories. These categories coincided with the focus areas of the various data collection techniques listed above. The categories are summarised in Table 4.11.

Table 4.11 Data analysis categories

Individual interviews	Focus groups
• Impact/influence of teamwork on workplace performance outcomes. • Impact/influence of teamwork on the individual's performance. • Impact/influence of learning from experience on teamwork.	• Reflecting on team characteristics (team performance and learning environment) • Individual and collective learning strategies reported. • Reflecting on team learning opportunities reported.
SDTLQ	**LAQ**
• Self-directed Team Performance responses. • Self-directed Team Learning responses.	• Learning approaches in terms of learning content (LAQc) responses. • Learning approaches in terms of social orientation (LAQs) responses.

Compiled by the researcher

This form of data analysis allows for patterning of responses (Cohen, Manion & Morrison, 2000: 82) and relationships between categories of data (Cohen, Manion & Morrison, 2000: 342). Data analysis took place upon completion of data collection. Qualitative data analysis followed an inductive reasoning mode and quantitative data analysis followed a supporting deductive reasoning mode. An abstract descriptive synthesis of the data emerged as a result of the inductive analysis approach utilised. A technique of comparing and contrasting, as suggested by McMillan & Schumacher (2001: 464) was used to identify

segments that emanated from individual interviews and focus group interview data. These segments were presented as key descriptive terms, subcategories and categories that addressed:

- team performance;
- team learning; and
- continued learning.

I realised that objectivity can never really be captured. However, I decided to add to the richness of understanding by making use of triangulation. The use of triangulation reflects an attempt to facilitate an in-depth understanding of the phenomena in question. Triangulation is thus not a tool or strategy for validation, but an alternative to validation (Flick, 1998: 230). The success of this data analysis depended on the thoroughness of this triangulation process.

This data analysis strategy is aligned to Marshall and Rossman's approach (1989: 112-120) and allows for the following stages (Vaughn, Schumm & Sinagub, 1996: 105-113; Marshall & Rossman, 1989: 112-120 and de Vos, 1998: 342-343):

- Organising data. An initial framework for participant responses assisted to identify trends and patterns that appear and reappear. This initial framework consisted of a breakdown of the primary and secondary research questions.

- Generating key descriptive terms, subcategories and categories. In the framework, I made provision for the linking of units of information presented by individuals and teams. This approach allowed me to identify descriptions, characteristics and comparisons as inferred by data collected. Provision was thus made for accumulated data to be analysed from:

    - both an overall sample perspective (considering data from all respondents) as well as a team perspective;
    - an intra-team perspective; and
    - an inter-team perspective.

- Evaluating and categorising data for informational adequacy, credibility, and usefulness. Units of information were directed into identifiable categories. During this stage statistical supportive information was used in order to provide further meaning to the various categories.

- Looking for, and recording, plausible explanations and interpretations. Triangulation was used to facilitate this entire stage. This decision is motivated below.

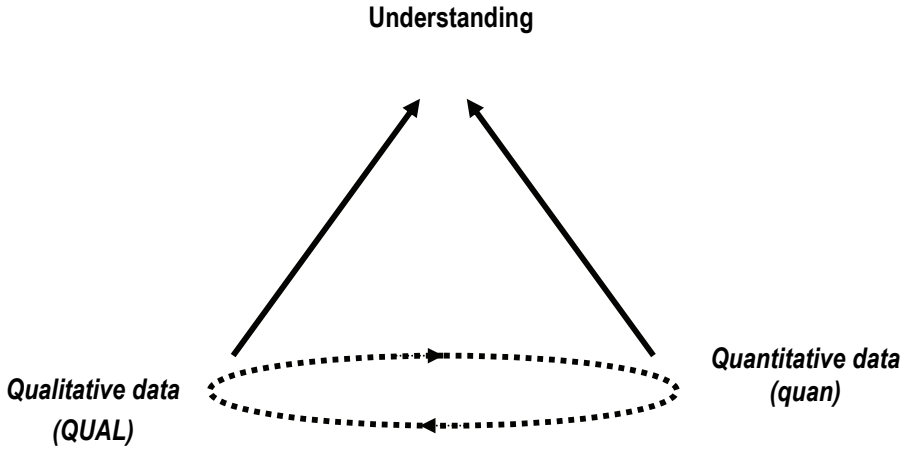
    - Maxwell (1996: 95) states that many of the conclusions of qualitative studies have an implicit quantitative component. Lather (1986: 270) follows on this line of thought when she states that the researcher must consciously utilise designs that allow counterpatterns as well as convergence if data is to be credible.

    - Triangulation is critical in establishing data trustworthiness (Lather, 1986: 270 and McMillan & Schumacher, 1989: 418). Validity and reliability are enhanced by including triangulation in qualitative research (Maxwell, 1996: 94). Triangulation reduces the risk of chance associations and systematic biases.

Triangulation thus relied on information collected from a diverse range of individuals, teams and settings, using a variety of methods (Maxwell, 1996: 93) as illustrated above. Independent measures of the same phenomena should agree (Swanson & Holton, 1997: 105). This implies that data collected relating to, for example learning preferences, by means of a one-to-one interview and the LAQ should result in statistical similarities. A deeper qualitative analysis (unbound by predefined variables) was introduced in order to gain deeper understanding in cases of differences.

Triangulation as a technique was used to determine whether multiple sources of data agreed and to obtain better, cross-checked insights (Burgess, 1985: 306). This proposed data analysis strategy explained above facilitated such an approach, the reason being that various data types were linked and tested to determine areas of congruence and incongruence. Triangulation furthermore allowed me to test and support claims that are inherently quantitative by qualitative means. Figure 4.3 and 4.4 captures the essence of triangulation as utilised in this study.

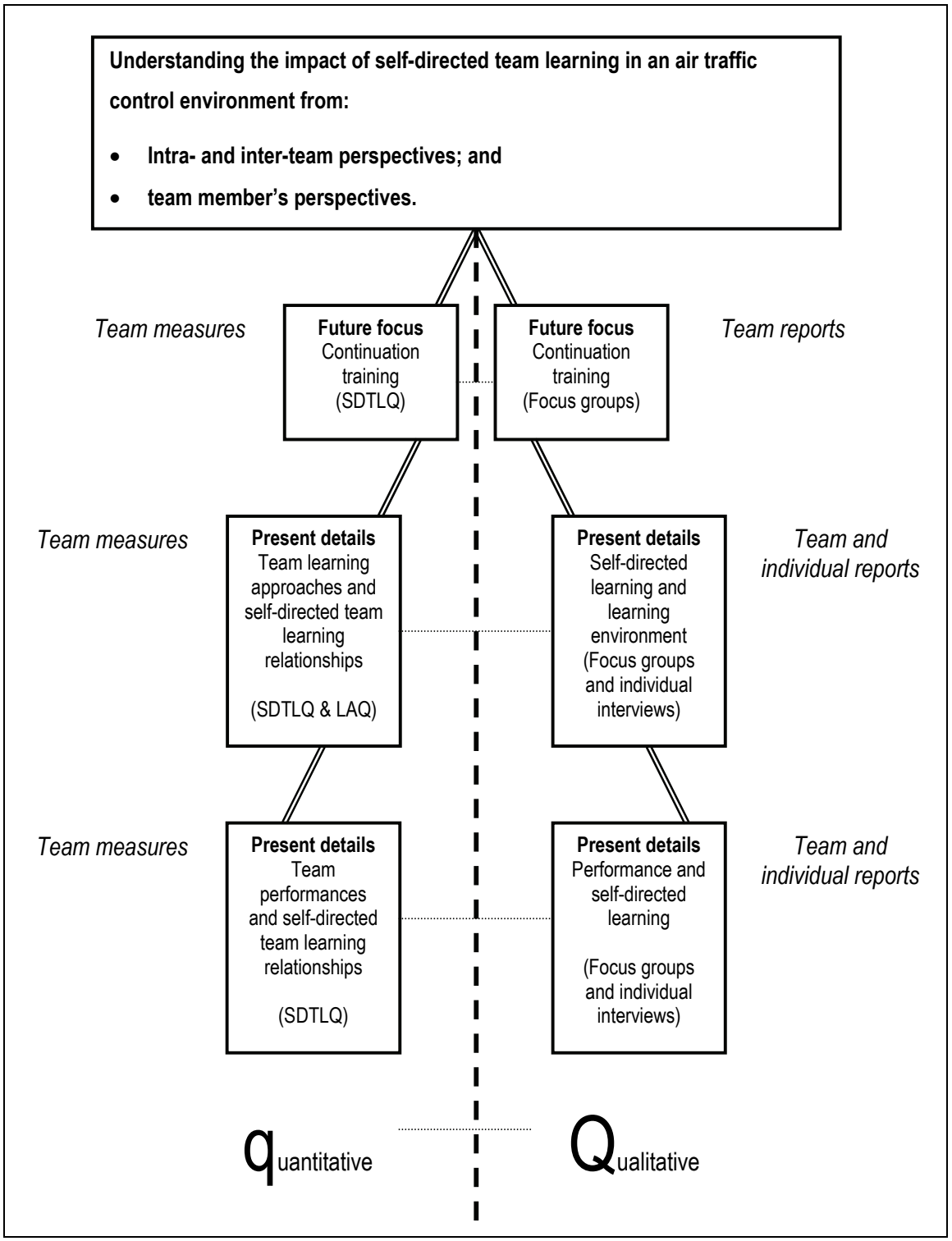
Figure 4.3 Triangulation



Compiled by the researcher

In an attempt to understand and appreciate possible individual and team learning, team performance and continued learning similarities and/or differences, an addition to this triangulation technique was incorporated. This extension favoured a crystallisation technique that supported the process of inductive data analysis by means of intensive reflective dialogues (McMillan and Schumacher, 2001: 463). This orientation guided a multifaceted segmentation, categorisation and pattern-seeking (McMillan and Schumacher, 2001: 463) data analysis approach that, in turn relied on individual, intra- and inter-team perspectives. Figure 4.4 illustrates this approach.

Figure 4.4 Data triangulation and crystallisation



Compiled by the researcher

10 Data validation

Data validation	Validity
	Reliability
	Trustworthiness

Compiled by the researcher

10.1 Validity

Actions supporting validity of the **quantitative research design element** of this study are presented below. Paragraph 7.4 acknowledges the factor and construct validity of the LAQ. I therefore did not embark on further validity procedures with regard to the LAQ.

The SDTLQ was presented to four senior South African Air Force Officers on 22 July 2005 in order to assist with a pilot validity phase. These four officers were selected on account of their:

- experience as air traffic controllers;
- knowledge of human resource development practices; and
- awareness of the aim and objectives of this research project.

Feedback was received on 01 August 2005 via email. The reported process followed by the four officers was divided into two phases: an individual critical review of the SDTLQ followed by a group critical feedback session. The feedback provided and associated corrective actions are presented in Table 4.12.

Table 4.12 Feedback received from the South African Air Force and corrective actions

Feedback received from the South African Air Force	Corrective actions
Reference to the rank of "First Lieutenant" should read "Second Lieutenant".	Question 3 was changed accordingly.
The term "Air Traffic Control Assistant" should be changed to read "Command and Control Assistant".	Question 6 was changed accordingly.
Post levels depicted in question 6 may differ from military ranks in question 3.	No corrective action was required.

The term "traffic sequencing" used in question 11 should be rephrased to read "traffic sequencing abilities of the controllers".	Question 11 was changed accordingly.
Question 12 leading sentence used the word "directed". However, it was proposed to replace the word with "directed/facilitated/guided" in order to ensure clarity.	Question 12 was changed accordingly.
Question 16 refers to decision-making in terms of training objectives. Respondents may simply select the "Yes" or "No" as a result of perceived corporate directives. More response options may need to be considered.	This comment was noted and a four-scale response option was included (similar to the scale used throughout the questionnaire with similar question types).
Question 21 refers to the use of learning contracts. Learning contracts are generally not considered to be a training option that is widely used in the South African Air Force.	This comment was noted and feedback from respondents in this regard will be of interest. Analyses will be performed in accordance with this forewarning.
Outlay of this questionnaire is considered to be user-friendly.	Outlay remained unchanged.
Contents of the questions correspond to expectations. This is described as a result of existing understanding and/or awareness of the aim and objectives of this research project.	Contents remained unchanged.

Compiled by the researcher

Validity of individual interviews and focus group interviews was dealt with by complying with McMillan and Schumacher's (2001: 408) proposed strategies to enhance design validity. I used this framework (Table 4.13) to provide a description of my actions in response to each strategy.

Table 4.13 Enhancing design validity

Strategy	Description of my action
Prolonged and persistent field work	Data collection took place during four phases, whilst data analysis and triangulation ensured a match between findings and participant reality.
Mixed-method strategies	This study allowed for triangulation with respect to data collection and analysis.

Participant language; verbatim accounts	Interviews were recorded and transcribed in a verbatim manner. One language (English) was used.
Low-inference descriptors	Detailed description of explanations and situations were recorded and transcribed.
Multiple researchers	My testing for understanding of data collected and reviewed was facilitated by my supervisor.
Mechanically recorded data	Use was made of voice tape recording.
Participant researcher	My recorded perceptions and assumptions (noted during interviews) were tested during the data analysis phase to ensure understanding and intended meaning.
Member checking	I checked formally with participants for accuracy of data collected and transcribed.
Participant review	
Negative cases or discrepant data	I actively searched for, and recorded, analysed, and reported negative cases or discrepant data that were an exception to patterns or that modified patterns found in data.

Adapted from McMillan & Schumacher (2001: 408)

10.2 Reliability

Actions supporting reliability of the **quantitative research design element** of this study are presented below. Paragraph 7.4 acknowledges the reliability of the LAQ. I therefore did not embark on further reliability procedures with regard to the LAQ.

Reliability of the SDTLQ was assured by the following measures.

- Response items of the SDTLQ were aligned to the outcome of the literature review of this study.
- All respondents received similar pre-briefings.
- The purpose of the SDTLQ and any misunderstandings were dealt with in a face-to-face manner by me thus ensuring comprehension.
- The same questionnaire was administered to all respondents.
- All respondents were literate and representative of the population.

- The SDTLQ was completed in an anonymous manner thus encouraging honesty.
- No time limitations were placed on completion of the SDTLQ.

10.3 Trustworthiness

Actions supporting trustworthiness of the **qualitative research design element** of this study are presented in Table 4.14.

Table 4.14 Ensuring trustworthiness

Strategies	My actions
Credibility	Used more than one source of data. Used more than one data collection method. Used a member-checking technique.
Applicability	Collected data from air traffic control teams and team members. Interpreted data in accordance with research questions and derived criteria. Used a member-checking technique.
Consistency	Used a structured interview approach, with the same format, sequence and questions for each respondent (this approach is presented in Appendices B and C). Presented detailed descriptions of participants, sample drawn, data collection methods, and data analysis strategies. Ensured detailed descriptions/transcripts of information collected.
Neutrality	Ensured non-involvement by the researcher in workplace activities. Recorded phenomena as faithfully as possible, while also raising additional questions, checked out hunches, and moved deeper into analysis of the phenomena. Encouraged respondents to present examples in order to demonstrate their unique way of viewing the world. Did not exert power-based influences during interviews.

Adapted from Krefting (1991: 215)

11 Conclusion

This research design demonstrates the feasibility of an integrated phenomenological qualitative and descriptive quantitative mode of inquiry (illustrated by the typology quan + QUAL). This mode of inquiry supported the employment of mixed-method data collection techniques to uncover the complex, multivariate nature of human performance and learning.

Cohen, Manion, & Morrison (2000: 75) refer to the research design and methodology phase as a process of *operationalisation*. This *operationalisation* (Cohen, Manion, & Morrison, 2000: 75) phase as presented in this chapter allowed me to translate broad research intentions, philosophies, academic and workplace inspired debates, and research methodologies into a streamlined concrete whole. This "choreographed" (Flick: 1998: 230) research design allowed me to engage in a rigorous and complex investigation of the social setting under study.

In Chapter 5 the data analysis and presentation of results as applicable to this study are presented.