

Cooperative base groups in Higher Education: the impact on Life Sciences students' self-directed learning readiness

A Lubbe
12080454

Dissertation submitted in fulfillment of the requirements for the degree *Magister Educationis* in Natural Sciences Education at the Potchefstroom Campus of the North-West University

Supervisor: Prof Elsa Mentz
Co-supervisor: Dr Neal Petersen

October 2015

DECLARATION

I declare that the dissertation hereby submitted by me for the degree Magister Educationis in Natural Sciences Education at the Potchefstroom Campus of the North-West University is my own independent work and has not previously been submitted by me at any other university or faculty.

DEDICATION

To all the important women in my life:

*My Mom , Anesta, I miss you! My Mother-in-law, Rina, I love you! Tannie Drienie,
I cherish you! Prof Elsa, I look up to you!*

*There are moments in
my life that I will
always remember not
because they were
important, but
because you were
there.*

ACKNOWLEDGEMENTS

I firstly wish to thank God. His unconditional love, mercy and favour enabled me to carry out this study.

I wish to express my heartfelt appreciation to the following individuals:

- Prof Elsa Mentz and Dr Neal Petersen for their wisdom, guidance and patience. Thank you for always believing in my abilities.
- Dr Suria Ellis for her expert advice during the quantitative phase of this investigation.
- Ms Jackie Viljoen for the language editing of this dissertation.
- Ms Roxanne Bailey for the technical editing of this dissertation.
- The participants of this investigation, without whom this study would have been impossible.
- My brother, Willem, for always motivating me and believing in me.
- My family and friends for their support.

Lastly I wish to thank my husband, Henning. His love and support was an anchor for my soul.

ABSTRACT

Although the need for and importance of self-directed learning are well documented, studies reporting on the influence of teaching–learning strategies, fostering self-directed learning skills, are limited.

The aim of this investigation was to determine and understand the impact of the implementation of cooperative base groups on the self-directed learning readiness of first-year Life Sciences students.

In order to achieve the research aim, a mixed method approach was followed. During the quantitative phase, the Self-Directed Learning Readiness Scale, a cooperative base group perception questionnaire, a checklist for social skills, and the academic achievement of first-year Life Sciences students at the Potchefstroom Campus of the North-West University were analysed.

In the qualitative phase of the investigation, semi-structured interviews were conducted with randomly selected first-year Life Sciences students of the experimental group. The questions in the interviews were aimed at determining the students' perception of cooperative base groups, how this perception contributed to their self-directed learning competencies, as well as the role that active involvement, the cooperative base group folder and personal support play in the development of self-directed learning competencies.

The results of the investigation contribute to the body of knowledge on cooperative learning as it provides insight into how students experience cooperative base groups. The implementation of cooperative base groups contributes to the development of the following characteristics and skills, which are vital for becoming self-directed in one's learning: viewing peers as resources; being able to give and receive help; developing good social skills; being motivated to learn; and taking initiative and responsibility for learning.

Key words: Self-directed learning, cooperative learning, cooperative base groups, first-year students, cooperative base group perception.

OPSOMMING

Die noodsaaklikheid en belangrikheid van selfgerigte leer is goed gedokumenteer. Daar is egter 'n beperkte aantal studies wat oor die invloed van onderrig-leerstrategieë wat selfgerigte leervaardighede beïnvloed, verslag doen.

Die doel van hierdie ondersoek was om die invloed van die implementering van koöperatiewe basisgroepe op die selfgerigte leergereedheid van eerstejaar-Lewenswetenskapestudente te bepaal en te begryp.

Ten einde hierdie doel te bereik, is 'n gemengde metodes-benadering gevolg. Gedurende die kwantitatiewe fase is die gereedheidskaal vir selfgerigte leer, 'n vraelys ten opsigte van die persepsies van koöperatiewe basisgroepe, 'n kontrolelyst vir sosiale vaardighede, asook die akademiese prestasie van eerstejaar-Lewenswetenskapestudente by die Potchefstroomkampus van die Noordwes-Universiteit geanaliseer.

Tydens die kwalitatiewe fase van die ondersoek is semigestruktureerde onderhoude met ewekansig geselekteerde eerstejaar-Lewenswetenskapestudente van die eksperimentele groep gevoer. Die onderhoudsvrae was daarop gemik om vas te stel wat die studente se persepsies van koöperatiewe basisgroepe was, hoe hierdie persepsies tot hulle selfgerigte leervaardighede bygedra het, asook die rol wat die aktiewe betrokkenheid, die koöperatiewe basisgroeplêer en persoonlike ondersteuning speel tydens die ontwikkeling van selfgerigte leervaardighede.

Die resultate van die ondersoek dra by tot die studieveld wat betref koöperatiewe leer, aangesien dit insig bied in hoe studente koöperatiewe basisgroepe ervaar. Die implementering van koöperatiewe basisgroepe dra by tot die ontwikkeling van die volgende eienskappe en vaardighede, wat noodsaaklik is om selfgerig in 'n mens se leer te word: om eweknieë as hulpbronne te sien; om in staat te wees om hulp te verleen en te ontvang; om goeie sosiale vaardighede te ontwikkel; om gemotiveerdheid te leer; om inisiatief en verantwoordelikheid vir eie leer te aanvaar.

Sleutelwoorde: Selfgerigte leer, koöperatiewe leer, koöperatiewe basisgroepe, eerstejaarstudente, persepsie van koöperatiewe basisgroep.

TABLE OF CONTENTS

DECLARATION	i
DEDICATION	ii
ACKNOWLEDGEMENTS	iii
ABSTRACT	iv
OPSOMMING	v
CONTENT	vii
LIST OF FIGURES	xi
LIST OF TABLES	xii
LIST OF ACRONYMS AND ABBREVIATIONS	xv
LIST OF APPENDICES	153

CONTENT

CHAPTER 1

INTRODUCTION AND PROBLEM STATEMENT	1
1.1. PROBLEM STATEMENT AND MOTIVATION	1
1.2. OVERVIEW OF RELEVANT LITERATURE.....	2
1.2.1. <i>Self-directed learning</i>	2
1.2.2. <i>Cooperative learning</i>	3
1.2.3. <i>Nature of Natural Sciences</i>	7
1.3. RESEARCH AIM.....	8
1.3.1. <i>Research question</i>	8
1.3.2. <i>Sub-questions</i>	8
1.4. RESEARCH DESIGN AND METHOD	9
1.4.1. <i>Research paradigm</i>	9
1.4.2. <i>Research design</i>	11
1.4.3. <i>Methods</i>	11
1.4.3.1. <i>Literature study</i>	12
1.4.3.2. <i>Quantitative method</i>	12
1.4.3.2.1. <i>Measuring instruments</i>	12
1.4.3.2.2. <i>Data collection</i>	13
1.4.3.2.3. <i>Data analysis</i>	13
1.4.3.3. <i>Qualitative method</i>	14
1.4.3.3.1. <i>Data collection technique</i>	14
1.4.3.3.2. <i>Data collection</i>	14
1.4.3.3.3. <i>Data analysis</i>	14
1.4.4. <i>Population and sample</i>	15
1.4.5. <i>Variables</i>	15
1.4.6. <i>Ethical aspects</i>	15
1.4.7. <i>Role of the researcher</i>	16
1.5. CHAPTER DIVISION.....	16
1.6. SUMMARY	17

CHAPTER 2

SELF-DIRECTED LEARNING AND COOPERATIVE LEARNING: A CONCEPTUAL AND THEORETICAL EXPOSÉ	18
2.1. INTRODUCTION	18
2.2. SELF-DIRECTED LEARNING.....	18
2.2.1. <i>Foundation and development</i>	18
2.2.2. <i>Conceptual clarification</i>	19
2.2.3. <i>The role of the facilitator within the self-directed learning environment</i>	21

2.2.4. <i>The role of the student: becoming a self-directed learner</i>	26
2.2.5. <i>Measuring levels of self-directed learning readiness</i>	29
2.3. COOPERATIVE LEARNING	31
2.3.1. <i>History and theoretical roots</i>	31
2.3.2. <i>Conceptual clarification</i>	33
2.3.2.1. <i>Heartbeat of cooperative learning</i>	34
2.3.2.1.1. <i>Positive interdependence</i>	34
2.3.2.1.2. <i>Individual accountability</i>	35
2.3.2.1.3. <i>Face-to-face promotive interaction</i>	36
2.3.2.1.4. <i>Interpersonal and small-group skills</i>	37
2.3.2.1.5. <i>Group processing</i>	38
2.3.2.2. <i>Formal cooperative learning</i>	39
2.3.2.3. <i>Informal cooperative learning</i>	41
2.3.2.4. <i>Cooperative base groups</i>	41
2.3.3. <i>Cooperative learning strategies</i>	42
2.3.4. <i>Benefits of cooperative learning</i>	44
2.3.5. <i>Challenges of cooperative learning</i>	46
2.4. SELF-DIRECTED LEARNING AND COOPERATIVE LEARNING: THE INFERENCE	47
2.5. SUMMARY	48
CHAPTER 3	
COOPERATIVE BASE GROUPS: ACADEMIC ACCOUNTABILITY AND PERSONAL SUPPORT	50
3.1. INTRODUCTION	50
3.2. CONCEPT CLARIFICATION	50
3.3. PURPOSE AND CHARACTERISTICS OF COOPERATIVE BASE GROUPS	55
3.4. IMPLEMENTATION OF COOPERATIVE BASE GROUPS	57
3.4.1. <i>The role of the facilitator</i>	57
3.4.1.1. <i>Planning</i>	57
3.4.1.2. <i>Introducing cooperative base groups to your audience</i>	61
3.4.1.3. <i>Observing and intervening</i>	62
3.4.1.4. <i>Assessment and evaluation</i>	63
3.4.2. <i>The responsibilities of the student</i>	64
3.5. SUMMARY	69
CHAPTER 4	
RESEARCH METHODOLOGY	70
4.1. INTRODUCTION	70
4.2. RESEARCH PARADIGM, DESIGN AND METHODOLOGY	71
4.3. STUDY POPULATION	75
4.4. RESEARCH METHOD: IMPLEMENTATION OF COOPERATIVE BASE GROUPS AS INTERVENTION .	75

4.4.1. Planning.....	75
4.4.2. Introducing cooperative base groups to the students	79
4.4.3. Observing and intervening	79
4.4.4. Assessment and evaluation	79
4.5. QUANTITATIVE RESEARCH	80
4.5.1. Quantitative research design.....	80
4.5.2. Participants.....	81
4.5.3. Data collection procedure and measuring instruments	82
4.5.3.1. Self-Directed Learning Readiness Scale	82
4.5.3.2. Cooperative base group perception questionnaire.....	83
4.5.3.3. Checklist for social skills.....	84
4.5.3.4. Academic achievement Point Score.....	85
4.5.4. Validity.....	85
4.5.5. Reliability	86
4.5.6. Quantitative data analysis	86
4.5.6.1. Statistical techniques and methods.....	87
4.6. QUALITATIVE RESEARCH.....	88
4.6.1. Qualitative research design.....	89
4.6.2. Participants.....	90
4.6.3. Data gathering procedure.....	90
4.6.4. Qualitative data analysis.....	90
4.7. ETHICAL ASPECTS	92
4.8. SUMMARY	93
CHAPTER 5	
RESULTS AND ANALYSIS.....	94
5.1. INTRODUCTION.....	94
5.2. IMPACT OF COOPERATIVE BASE GROUPS ON THE FIRST-YEAR LIFE SCIENCES STUDENTS’	
SELF-DIRECTED LEARNING READINESS.....	94
5.2.1. Self-Directed Learning Readiness Scale: pre-tests of control and experimental groups.....	95
5.2.2. Self-Directed Learning Readiness Scale: pre- and post-tests of control and experimental groups	96
5.2.3. Difference between Academic achievement Point Scores and pre-tests of the control and experimental groups per Self-Directed Learning Readiness Scale category	97
5.2.4. Difference between pre- and post-tests of the control group per Self-Directed Learning Readiness Scale category	98
5.2.5. Difference between pre- and post-tests of the experimental group per Self-Directed Learning Readiness Scale category	99
5.2.6. Difference between post-tests of the control and experimental groups per Self-Directed Learning Readiness Scale category	101
5.3. FIRST-YEAR LIFE SCIENCES STUDENTS’ PERCEPTION OF COOPERATIVE BASE GROUPS.....	102

5.3.1. Descriptive statistics	102
5.3.2. Factor analysis of the cooperative base group perception questionnaire	104
5.3.3. Correlations	107
5.3.4. Students' interview responses regarding their perception of cooperative base groups.....	109
5.4. EXTENT TO WHICH THE FIRST-YEAR LIFE SCIENCES STUDENTS' PERCEPTION OF COOPERATIVE BASE GROUPS CONTRIBUTED TO THEIR SELF-DIRECTED LEARNING COMPETENCIES.....	114
5.4.1. Checklist for social skills.....	114
5.4.2. Correlations between the checklist for social skills, the cooperative base group perception questionnaire factors and the Self-Directed Learning Readiness Scale post-test	115
5.4.3. Students' interview responses.....	116
5.5. CONTRIBUTION OF PERSONAL SUPPORT, STUDENTS' ACTIVE INVOLVEMENT AND THE COOPERATIVE BASE GROUP FOLDER TO FIRST-YEAR LIFE SCIENCES STUDENTS' SELF- DIRECTED LEARNING COMPETENCIES	119
5.6. HIGHLY NEGATIVE AND HIGHLY POSITIVE PERCEPTIONS: PROFILE OF STUDENTS	123
5.7. SUMMARY	125
CHAPTER 6	
FINDINGS, CONCLUSIONS AND RECOMMENDATIONS	127
6.1. INTRODUCTION	127
6.2. FINDINGS	127
6.2.1. Students' perception of cooperative base groups	127
6.2.2. Extent to which students' perception of cooperative base groups contributed to their self- directed learning competencies	130
6.2.3. Contribution of personal support within cooperative base groups to students' self-directed learning competencies	131
6.2.4. Contribution of active involvement to students' self-directed learning competencies.....	131
6.2.5. Contribution of the cooperative base group folder to students' self-directed learning competencies	132
6.2.6. Influence of the implementation of cooperative base groups on students' self-directed learning readiness.....	132
6.3. CONCLUSIONS ARISING FROM THIS INVESTIGATION	133
6.4. LIMITATIONS	136
6.5. RECOMMENDATIONS.....	137
6.6 FINAL REMARKS.....	139
REFERENCE LIST	140

LIST OF FIGURES

FIGURE 1.1 RESEARCH PARADIGM, DESIGN AND METHODOLOGY.....	10
FIGURE 2.1 THE 3-FACTOR SDL MODEL (OSWALD, 2003, P. 24).....	25
FIGURE 3.1 RESPONSIBILITIES OF COOPERATIVE BASE GROUP MEMBERS WITHIN THEIR GROUPS	65
FIGURE 4.1 RESEARCH PARADIGM, DESIGN AND METHODOLOGY.....	74
FIGURE 4.2 ILLUSTRATION OF HOW STUDENTS WERE ASSIGNED TO THEIR COOPERATIVE BASE GROUPS.....	76
FIGURE 4.3 AGENDA HANDED OUT DURING FIRST COOPERATIVE BASE GROUP MEETING	78
FIGURE 4.4 QUANTITATIVE RESEARCH DESIGN	81
FIGURE 4.5 QUALITATIVE RESEARCH DESIGN.....	89
FIGURE 5.1 SELF-DIRECTED LEARNING READINESS SCALE PRE-TEST AND POST- TEST MEAN VALUES PER SELF-DIRECTED LEARNING READINESS SCALE CATEGORY OF THE CONTROL GROUP	98
FIGURE 5.2 SELF-DIRECTED LEARNING READINESS SCALE PRE-TEST AND POST- TEST MEAN VALUES PER SELF-DIRECTED LEARNING READINESS SCALE CATEGORY OF THE EXPERIMENTAL GROUP	100
FIGURE 6.1 CONTRIBUTION OF THE RESULTS OF THE CURRENT INVESTIGATION ...	135

LIST OF TABLES

TABLE 1.1.	REPRESENTATION OF QUANTITATIVE DATA COLLECTION.....	13
TABLE 2.1	PROPERTIES OF SELF-DIRECTED LEARNING SHARED BY VARIOUS AUTHORS' DEFINITIONS	20
TABLE 2.2	THE STAGED SELF-DIRECTED LEARNING MODEL (GROW, 1991, P. 129) .	23
TABLE 2.3	INTERACTION PATTERNS UNDERPINNED BY SOCIAL INTERDEPENDENCE THEORY (JOHNSON & JOHNSON, 2013, PP. 89-90).....	33
TABLE 2.4	EXAMPLES OF INTERPERSONAL AND SMALL-GROUP SKILLS (GILLIES, 2007, P. 42).....	38
TABLE 2.5	DESCRIPTION AND BENEFITS OF A FEW COOPERATIVE LEARNING STRATEGIES (ABRAMI ET AL., 1995; DOYMUS, 2008; JOHNSON ET AL., 2008; KAGAN, 2001).....	42
TABLE 3.1	SUMMARY OF VARIOUS TYPES OF LONG-TERM STUDENT GROUPS	52
TABLE 3.2	WAYS OF ENSURING THE PRESENCE OF THE COOPERATIVE LEARNING ELEMENTS WITHIN COOPERATIVE BASE GROUPS	59
TABLE 3.3	ROLES AND RESPONSIBILITIES OF STUDENTS TO ENSURE CONTINUED EXISTENCE OF THE COOPERATIVE LEARNING ELEMENTS WITHIN THEIR COOPERATIVE BASE GROUPS	66
TABLE 4.1	STUDY POPULATION FOR CONTROL AND EXPERIMENTAL GROUPS	75
TABLE 4.2	METHODS BY WHICH THE RESEARCHER ENSURED THE PRESENCE OF THE COOPERATIVE LEARNING ELEMENTS.....	77
TABLE 4.3	NUMBER OF SELF-DIRECTED LEARNING READINESS SCALE QUESTIONNAIRES COMPLETED	83
TABLE 4.4	NUMBER OF COOPERATIVE BASE GROUP PERCEPTION QUESTIONNAIRES COMPLETED	84
TABLE 5.1	INDEPENDENT T-TEST: SELF-DIRECTED LEARNING READINESS SCALE PRE-TESTS OF CONTROL AND EXPERIMENTAL GROUPS	95
TABLE 5.2	INDEPENDENT T-TEST: ACADEMIC ACHIEVEMENT POINT SCORE OF THE CONTROL AND EXPERIMENTAL GROUPS.....	95
TABLE 5.3	DEPENDENT T-TEST: SELF-DIRECTED LEARNING READINESS SCALE PRE- AND POST-TESTS OF THE CONTROL AND EXPERIMENTAL GROUPS	96

TABLE 5.4	ANCOVA: POST-TEST OF THE CONTROL GROUP AND POST-TEST OF THE EXPERIMENTAL GROUP	96
TABLE 5.5	INDEPENDENT T-TEST: ACADEMIC ACHIEVEMENT POINT SCORE AND PRE-TESTS OF THE CONTROL AND EXPERIMENTAL GROUPS PER SELF-DIRECTED LEARNING READINESS SCALE CATEGORY	97
TABLE 5.6	DEPENDENT T-TEST: CONTROL GROUP PRE-TEST AND POST-TEST WITHIN THE SELF-DIRECTED LEARNING READINESS SCALE CATEGORIES	99
TABLE 5.7	DEPENDENT T-TEST: EXPERIMENTAL GROUP PRE-TEST AND POST-TEST WITHIN THE SELF-DIRECTED LEARNING READINESS SCALE CATEGORIES	101
TABLE 5.8	ANCOVA: POST-TESTS OF THE CONTROL AND EXPERIMENTAL GROUPS WITHIN THE SELF-DIRECTED LEARNING READINESS SCALE CATEGORIES	101
TABLE 5.9	FREQUENCY DISTRIBUTION OF STUDENT RESPONSES TO THE COOPERATIVE BASE GROUP PERCEPTION QUESTIONNAIRE	103
TABLE 5.10	KMO AND BARTLETT'S TEST FOR THE COOPERATIVE BASE GROUP PERCEPTION QUESTIONNAIRE	105
TABLE 5.11	TOTAL VARIANCE EXPLAINED BY FIVE FACTORS.....	105
TABLE 5.12	PATTERN MATRIX: FIRST-YEAR LIFE SCIENCES STUDENTS' RESPONSES..	106
TABLE 5.13	FACTOR CORRELATION MATRIX FOR IDENTIFIED FACTORS.....	108
TABLE 5.14	CRONBACH'S ALPHA COEFFICIENTS, MEANS AND STANDARD DEVIATION FOR IDENTIFIED FACTORS BASED ON FIRST-YEAR LIFE SCIENCES STUDENTS' RESPONSES TO THE COOPERATIVE BASE GROUP PERCEPTION QUESTIONNAIRE	109
TABLE 5.15	THEMES, CODES AND QUOTES ASSOCIATED WITH THE STUDENTS' PERCEPTION OF COOPERATIVE BASE GROUPS	110
TABLE 5.16	DESCRIPTIVE STATISTICS OF THE CHECKLIST FOR SOCIAL SKILLS AT WEEKS 3, 6 AND 11 RESPECTIVELY	114

TABLE 5.17 FACTOR CORRELATION MATRIX OF THE CHECKLIST FOR SOCIAL SKILLS, COOPERATIVE BASE GROUP PERCEPTION QUESTIONNAIRE FACTORS AND THE SELF-DIRECTED LEARNING READINESS SCALE POST-TEST	115
TABLE 5.18 THEMES, CODES AND QUOTES ASSOCIATED WITH THE STUDENTS' SELF- DIRECTED LEARNING COMPETENCIES	117
TABLE 5.19 CENTRAL THEMES IN CODING FOR THE INFLUENCE OF PERSONAL SUPPORT, ACTIVE INVOLVEMENT IN EVALUATING IDEAS, AND THE COOPERATIVE BASE GROUP FOLDER ON THE STUDENTS' SELF- DIRECTED LEARNING COMPETENCIES	120
TABLE 5.20 HIGHLY NEGATIVE AND HIGHLY POSITIVE PERCEPTIONS: PROFILE OF STUDENTS.....	124

LIST OF ACRONYMS AND ABBREVIATIONS

ANCOVA	Analysis of Covariance
APS	Academic achievement Point Score
Atlas.ti	Computers and qualitative data analysis software used during the current investigation
CBG	Cooperative base group
CBGs	Cooperative base groups
CBGP	Cooperative base group perception
CL	Cooperative learning
CSS	Checklist for social skills
CQDAS	Computers and Qualitative Data Analysis Software
GIG	Group – Individual – Group method of test writing
HE	Higher Education
KMO	Kaiser-Meyer-Olkin measure of sampling adequacy
LIFE 111	Life Sciences module in the first semester of the first year
LPA	Learning Preference Assessment
LS	Life Sciences
NWU	North-West University
OCLI	Oddi Continuing Learning Inventory
PRO-SDLS	Personal Responsibility Orientation to Self-Direction in Learning Scale
QUAN	Quantitative
QUAL	Qualitative
SDL	Self-directed learning
SDLI	Self-Directed Learning Instrument

SDLRS	Self-Directed Learning Readiness Scale
SSDL	Staged Self-Directed Learning model
STAD	Student team achievement division
t-Tests	Tests using the t-statistic that establishes whether two means collected from independent samples differ significantly
TGT	Team - games - tournaments
WhatsApp	Smartphone communication application
ZPD	Zone of Proximal Development

CHAPTER 1

INTRODUCTION AND PROBLEM STATEMENT

1.1. Problem statement and motivation

According to Coutinho and Neuman (2008, p. 4), "... the richest learning environment could be one that fosters support and encouragement and helps to build faith in abilities and skills" ..

The need for and importance of the development of skills and attitudes, enabling one to become a lifelong self-directed learner are well documented (Barry & Rees, 2006; Blumberg, 2005; Dynan, Cate, & Rhee, 2008; Francom, 2010; Kramarski & Michalsky, 2009; Murad, Coto-Yglesias, Varkey, Prokop, & Murad, 2010; O'Shea, 2003; Warburton & Volet, 2012). It is widely acknowledged in medical fields (Murad et al., 2010; O'Shea, 2003), engineering (Barry & Rees, 2006), business (Dynan et al., 2008) as well as veterinary science (Blumberg, 2005). The characteristics of a self-directed lifelong learner (Guglielmino, 1978; Guglielmino, 2008; Lord et al., 2010; Robertson, 2010), the facilitator's role in promoting self-directed learning (Knowles, 1975; Kramarski & Michalsky, 2009; Lord et al., 2010) as well as the role of the student in becoming self-directed in his or her learning (Knowles, 1975; Loyens, Magda, & Rikers, 2008) are some of the aspects of self-directed learning that have been well researched and documented. Although literature describing the need for self-directed learning is acknowledged (Francom, 2010; Guglielmino, 2008, 2013; Kramarski & Michalsky, 2009; Murad et al., 2010) fewer studies have been conducted on the successful implementation of teaching and learning strategies that develop the skills needed for someone to become a self-directed lifelong learner. While self-directed learning is present in every person to some degree, many individuals will need guidance and assistance in accepting responsibility and developing the skills needed to become a self-directed lifelong learner (Guglielmino, 1978).

According to Brinkworth, McCann, and Matthews (2009) as well as Krause and Coates (2008), the first year at university is universally considered an important period of transition for almost all students. Therefore it is considered a valuable time for promoting change in students' epistemological beliefs about knowledge and learning (Brownlee, Walker, & Lennox, 2009; Haigh & Kilmartin, 2009). Mayes (2009) noted that the challenge is preparing students, as close to the beginning of their studies as possible, with the skills, capacities and knowledge to be effective independent learners for the rest of their educational programmes; for their subsequent employability; professional development; and, for that matter, lifelong learning.

Because "all education springs from some image of the future" (Toffler, 1974, p. 3) and teachers' ability to cultivate self-directed learners is tied to their own self-regulation (Kramarski &

Michalsky, 2009), developing self-directed learning should first and foremost be promoted in undergraduate student teachers.

Kek and Huijser (2011) explored the combined relationships of student and facilitator factors on learning approaches and self-directed learning readiness at a Malaysian university. They found that students were highly self-directed in their learning when they perceived that they had peer support in their university community. Actively participating in questioning, explaining, justifying and evaluating their own and their peers' ideas, also contribute to students' self-directed learning (Kek & Huijser, 2011). De Corte (2003) argues that carefully designed learning environments, which foster students' engagement in active and constructive learning processes and which provide sociocultural support via interaction and collaboration not only promote better learning outcomes but also benefit future learning. Cooperative learning provides an environment through which peer support and collaboration in the classroom can take place.

Cooperative learning is defined as groups of individuals working together to achieve mutual learning goals or outcomes (Johnson & Johnson, 2009b). Cooperative base groups (CBGs) are one of the three types of cooperative learning identified by Johnson and Johnson (2009b), during which stable, long-term membership aims to provide academic and personal support within the group. Members hold each other accountable for learning, and positive attitudes toward the learning process are also established. There remains, however, scant evidence on the effects of implementing CBGs as well as their influence on self-directed learning (SDL).

Studies reporting fostering of skills and attitudes which are necessary for developing self-directed learning and embedded within first-year content are limited. The impetus for the present study, therefore, was to understand and evaluate the impact that the implementation of CBGs as a form of peer support, has on the self-directed learning readiness of first-year Life Sciences students. The researcher intended to explore the impact of CBGs on the self-directed learning readiness of first-year Life Sciences students.

1.2. Overview of relevant literature

The following section contains a brief overview of literature regarding self-directed learning, cooperative learning, as well as the nature of science.

1.2.1. Self-directed learning

Knowles' (1975) definition of self-directed learning provides not only a rich description of the process of self-directed learning, but also of the complexity thereof. According to Knowles (1975) and numerous other authors (Brockett & Hiemstra, 1991; Kasworm, 1983; Kramarski & Michalsky, 2009; Lord et al., 2010; Loyens et al., 2008; Lunyk-Child et al., 2001; Robertson,

2010), becoming self-directed in one's learning is a process during which individuals take initiative for formulating learning goals, take responsibility for the learning experience, use different learning strategies and evaluate learning outcomes. Knowles (1975) and Loyens et al. (2008) point out the importance of identifying learning needs and resources. The learner is therefore "fully in control of the decision-making process regarding the learner's own learning, and accepts full responsibility for it, but will probably seek expert help and advice" (Thornton, 2010, p. 159). The necessity of mastering a broad range of skills, attitudes and knowledge, and not only a single skill, contributes to the complexity of self-directed learning (Lord et al., 2010).

Patterson, Crooks and Lunny-Child (2002) identify "assessment of learning gaps, evaluation of self and others, reflection, information management, critical thinking, and critical appraisal" (p. 224) as the six major competencies of a self-directed learner, a view to which Du (2012) subscribes. Asking appropriate questions to guide their inquiry, interrogating the assumptions behind the ideas presented to them, identifying appropriate resources and tools and strategically modifying these tools to achieve their learning goals, are according to Warburton and Volet (2012) the key roles of individuals during the process of becoming self-directed learners.

Robertson (2010) suggests that, because self-directed learners take responsibility for managing their own learning, a range of cognitive and metacognitive skills are also required. In order for students to acquire these skills, educators and faculty members need to play a specific, if not crucial, role. Dynan et al. (2008) are of the opinion that the development of self-direction in learning is fundamentally up to educators and their encouragement. Faculty members need to be skilful in facilitating strategies that promote self-directed learning, and sensitive to attitudes and behaviours in self-directed learning settings (Lunny-Child et al., 2001). It is the duty of facilitators to provide direction, encouragement and support for students (Knowles, 1975; Lord et al., 2010; Lunny-Child et al., 2001).

Measuring the degree of attitudes, skills and personality characteristics that encompass an individual's current level of readiness to manage his or her own learning, is done with a tool such as the Self-Directed Learning Readiness Scale (SDLRS) (Deyo, Huynh, Rochester, Sturpe, & Kiser, 2011; Fisher, King, & Tague, 2001; Guglielmino, 1978) or the Self-Rating Scale of Self-Directed Learning (Williamson, 2007).

1.2.2. Cooperative learning

Cooperative learning is a pedagogical practice (Gillies & Boyle, 2010) during which individuals work together in small groups to accomplish mutual goals (Johnson & Johnson, 2009b; Johnson, Johnson, & Johnson Holubec, 2008), such as completing a task or understanding

material (Grissom, Beck, Simon, & Chizhik, 2013). The learning process of each individual within the group is maximised through cooperative learning (Johnson et al., 2008).

Positive interdependence, individual accountability, face-to-face promotive interaction, small-group skills and group processing are, according to Johnson and Johnson (2009b), the heartbeat of a successful cooperative learning environment. Positive interdependence is said to be the most vital element of cooperative learning (Johnson & Johnson, 2009a) and according to Grissom et al. (2013), tasks should be structured in such a manner as to include all group members. Johnson and Johnson (2009b) claim that “knowing that one’s performance affects the success of group mates seems to create responsibility forces that increase one’s efforts to achieve” (p. 367). Positive interdependence can be structured by establishing mutual goals, joint rewards, shared resources and assigned roles (Johnson et al., 2008). Assessing the performance of each group member’s contribution and giving feedback to the individual as well as the group, is known as individual accountability (Johnson & Johnson, 2009b; Johnson et al., 2008). The lack thereof, according to Johnson and Johnson (2009b), may lead to reduced feelings of personal responsibility and therefore individuals may lessen their contributions to a challenging task. Promotive interaction occurs when individuals discuss and teach what they know to fellow group members as they sit knee-to-knee, facing each other (Johnson & Johnson, 2009b; Johnson et al., 2008). In order for groups to function effectively, members need to possess certain social skills and know how to use these skills efficiently (Johnson et al., 2008). Social skills include effective communication, engaging in democratic decision-making and sharing resources fairly (Gillies, 2007). Group processing occurs when groups reflect on how they are managing their learning processes (Gillies, 2007; Johnson et al., 2008). Each member expresses respect for each other’s contributions, which has a tendency to increase self-esteem (Johnson & Johnson, 2009a).

Johnson et al. (2008) distinguish between three different types of cooperative learning, namely informal cooperative learning, formal cooperative learning and CBGs. Informal cooperative learning occurs when ad hoc groups meet for only a few minutes or a class period, and may be used at any time. The purpose of this type of cooperative group arrangement include that it:

focuses student attention on the material to be learned, sets a mood conducive to learning, helps cognitively organise in advance the material to be learned, ensures that students cognitively process the material being taught, provides closure to an instructional session, allows for identifying and correcting misconceptions, and personalises learning experiences (Johnson et al., 2008, p. 3:10).

Formal cooperative learning occurs when students work together for a whole class period or over several weeks (Johnson et al., 2008). This type of cooperative learning requires a number of pre-instructional decisions, for example:

- the group size and composition;
- the learning goals;
- the materials and method(s) required;
- strategies needed to ensure positive interdependence and individual accountability;
- ways in which intervention will take place to promote group skills; and
- methods of assessing learning (Johnson et al., 2008).

In contrast to informal and formal cooperative learning groups, the membership of CBGs is long-term and stable, lasting for a term or even a year. In the literature, this type of cooperative learning model is also referred to as:

- study teams (Davis, 1993; Toumasis, 2004);
- study groups (Dana & Yendol-Silva, 2003; Zevenbergen, 2004);
- out-of-class study groups (Rybczynski & Schussler, 2011);
- team-based learning (Parmelee, Michaelsen, Cook, & Hudes, 2012); and
- out-of-class academic collaboration (Jacobs, 2013) amongst others.

These types of meetings occur on a regular basis outside the classroom. Providing academic and/or personal support, encouragement as well as assistance to group members (Johnson et al., 2008) and improving students' academic performance (Moust, Robertsen, Savelberg, & De Rijik, 2005) are some of the primary responsibilities of these types of cooperative learning groups. The main difference between CBGs and other types of long-term student groups is the presence or absence of the five basic elements of cooperative learning and personal support. Chapter three contains a detailed discussion of similarities and differences between these various types of long-term student groups. Johnson and Johnson (2009a) noted that CBGs tend to improve attendance, personalise the work and learning experience, and improve quality and quantity of learning. Each CBG has a folder, which consists of standard forms students use during each meeting. The purpose of the folder is to manage attendance, assignments and feedback of each group member. To further personalise the folder and help build the group's identity, Johnson et al. (2008) suggest that the groups include a motto or symbol in the folders. "Individuals are empowered, are given hope and purpose, and experience meaning when they contribute to the well-being of others within a cooperative effort" (Johnson et al., 2008, p. 4:16).

According to Gillies (2007) as well as Johnson et al. (2008), cooperative groups function best when the groups are heterogeneous, consisting of individuals with a “variety of backgrounds” (Grissom et al., 2013, p. 283), “especially in terms of achievement, motivation and task orientation” (Johnson et al., 2008, p. 4:2). Gillies (2007) claims that students “learn more in mixed-ability groups of high-, medium-, and low-ability students” (p. 152), and that students with wide-ranging needs benefit from working in mixed-ability groups. Furthermore, Gillies and Boyle (2010) state that working cooperatively enables students to learn to listen to what others have to say, give and receive help, share ideas, clarify concerns and construct new understandings.

Various strategies can be implemented during cooperative lessons, for example:

- turn to your neighbour summaries;
- reading comprehension triads;
- jigsaw procedure;
- drill-review pairs;
- read-and-explain pairs;
- cooperative note-taking pairs (Johnson et al., 2008);
- circle the sage;
- pass-n-praise;
- team pair solo;
- think pair share (Kagan, 2001); and
- cooperative graffiti (Abrami, Chambers, Poulsen, D'Apollonia, & Howden, 1995).

Strategies applicable to this investigation will be discussed in Chapter 2 (see Table 2.5). Sharan (2010) points out that this “rich variety of methods” (p. 303) may in fact lead to confusion, and therefore the gap between the promise of cooperative learning and the implementation thereof still exists.

It is important to realise that not all group efforts can be seen as being cooperative, if the five basic elements are not present, group work may lead to frustration and disappointment (Sharan, 2010). According to Gillies and Boyle (2011), many educators are still reluctant to implement cooperative learning, despite the well-documented benefits, but once cooperative learning is implemented by prepared facilitators to informed students, it is highly successful (Johnson & Johnson, 2009b; Lou et al., 1996; Schul, 2011). Sharan (2010) suggests that the chosen cooperative learning method must be coordinated with the group work skills, the self-directed readiness of students, as well as the facilitators’ readiness to offer as much or as little structure as required. If successfully implemented, cooperative learning is beneficial to both students and

facilitators (Gillies & Boyle, 2011; Johnson & Johnson, 2009b; Johnson et al., 2008; Lou et al., 1996; Shimazoe & Aldrich, 2010). Shimazoe and Aldrich (2010) identify the following claimed benefits of cooperative learning to students: “[it] promotes deep learning, helps earn higher grades, teaches social skills and civic values, teaches higher order skills, promotes personal growth and develops positive attitudes toward autonomous learning” (p. 53). More time given to reflect on how well the students are learning and decreasing the grading load, are benefits of cooperative learning to facilitators (Shimazoe & Aldrich, 2010).

1.2.3. Nature of Natural Sciences

Ledoux (2002) defines Natural Science as a discipline that deals with natural events using scientific methods, while Vhurumuku (2010) states, “our understanding of the nature of science is defined by the ideas and assumptions we hold concerning scientific knowledge and the science process, it is not dependent on our knowledge of specific scientific laws, etc., or our ability to use science process skills” (p. 27). Natural Sciences comprise three dimensions, namely:

- the substantive structure (body of knowledge or content);
- the syntactical structure (describes the way in which the body of knowledge is acquired);
- and the “way of thinking that will lead to a better understanding of nature” (Van Aswegen, Fraser, Nortje, Slabbert, & Kaske, 1993, p. 2).

Bybee (2002) points out that science is more than a corpus of knowledge, and Sokolinski (2010) states that investigations play a crucial role in science education.

Physical Sciences, Earth Sciences and Biological Sciences (known as Life Sciences) have been defined as the different disciplines in Natural Sciences (Van Aswegen et al., 1993). Van Aswegen et al. (1993) describe the nature of Life Sciences as a body of objective knowledge, acquired through reliable processes and subject to constant change because of a continuous search for meaning.

In 1964, Schwab identified Life Sciences (LS) as an “investigative” discipline (p. 3). LS is therefore a subject in which investigation, exploration and discovery play an essential role. Cooperation amongst peers as well as the processes that occur during scientific investigations enhances the learning of science (Bybee, Carlson-Powell, & Trowbridge, 2008). Mastering the skills of the syntactical structure and using them to discover the substantive structure, will make the learners “effective, independent, autonomous, lifelong learners” (Van Aswegen et al., 1993, p. 36).

Because learning is a hands-on (Bybee et al., 2008), minds-on (Lunetta, Hofstein, & Clough, 2007), social activity (Vygotsky, 1978), as well as being structured and progressive (Bransford, Brown, & Cocking, 2000), literature suggests that the learning of Life Sciences occurs best through active learning exercises (Haak, HilleRisLambers, Pitre, & Freeman, 2011; Mestre & Cocking, 2002). According to Mecer, Dawes, Wegerif, and Sams (2004), students who are taught to talk and reason with each other as they partake in LS investigations or activities, demonstrate significantly better knowledge and understanding of scientific concepts and relevant parts of the science curriculum, compared to students who do not talk and reason. Such investigations and activities occur during cooperative group work, as cooperative group work can be useful in scaffolding the development of reasoning and scientific understanding (Mecer et al., 2004).

1.3. Research aim

The present study aimed to investigate the impact of the implementation of CBGs on the self-directed learning readiness of first-year Life Sciences students.

To be able to achieve the above-mentioned aim, the study focused on the following questions:

1.3.1. Research question

What is the impact of the implementation of CBGs on first-year Life Sciences students' self-directed learning readiness?

In order to answer the research question, I attempted to answer the following sub-questions:

1.3.2. Sub-questions

- How does the personal support within the CBGs contribute to first-year Life Sciences students' self-directed learning competencies?
- How does the active involvement of the first-year Life Sciences students' in evaluation of their own and their peers' ideas within CBGs contribute to their self-directed learning competencies?
- How does the CBG folder contribute to the first-year Life Sciences students' self-directed learning competencies?
- What is the first-year Life Sciences students' perception of CBGs?
- To what extent does the first-year Life Sciences students' perception of CBGs contribute to their self-directed learning competencies?
- To what extent does the implementation of CBGs have an impact on the first-year Life Sciences students' self-directed learning readiness?

1.4. Research design and method

The following diagram (Figure 1.1) illustrates the paradigm, research design and method that was followed during this investigation, and which are discussed subsequently.

1.4.1. Research paradigm

According to Creswell and Plano Clark (2007), a person's worldview or paradigm influences how research is conducted. The main worldviews that are associated with quantitative and qualitative research designs are respectively positivism/post-positivism and constructivism/interpretivism (Creswell, 2003; Feilzer, 2009). Pragmatism, which offers an alternative worldview to those of positivism/post-positivism and constructivism/interpretivism, places emphasis on the problem to be researched as well as the consequences of the research (Creswell & Plano Clark, 2007; Feilzer, 2009). Pragmatism permits the researcher to be free of practical restrictions imposed by the "forced choice dichotomy between postpositivism and constructivism" (Feilzer, 2009, p. 8) and "researchers do not have to be prisoner of a particular research method" (Robson, 1993, p. 291). The worldview most frequently associated with mixed methods research, according to Teddlie and Tashakkori (2009), is pragmatism which is problem-centred, concerned with applications and solutions to problems, uses all approaches to understand research problems (Creswell & Plano Clark, 2007) and "endorses a strong and practical empiricism as the path to determine what works" (Johnson & Onwuegbuzie, 2004, p. 18).

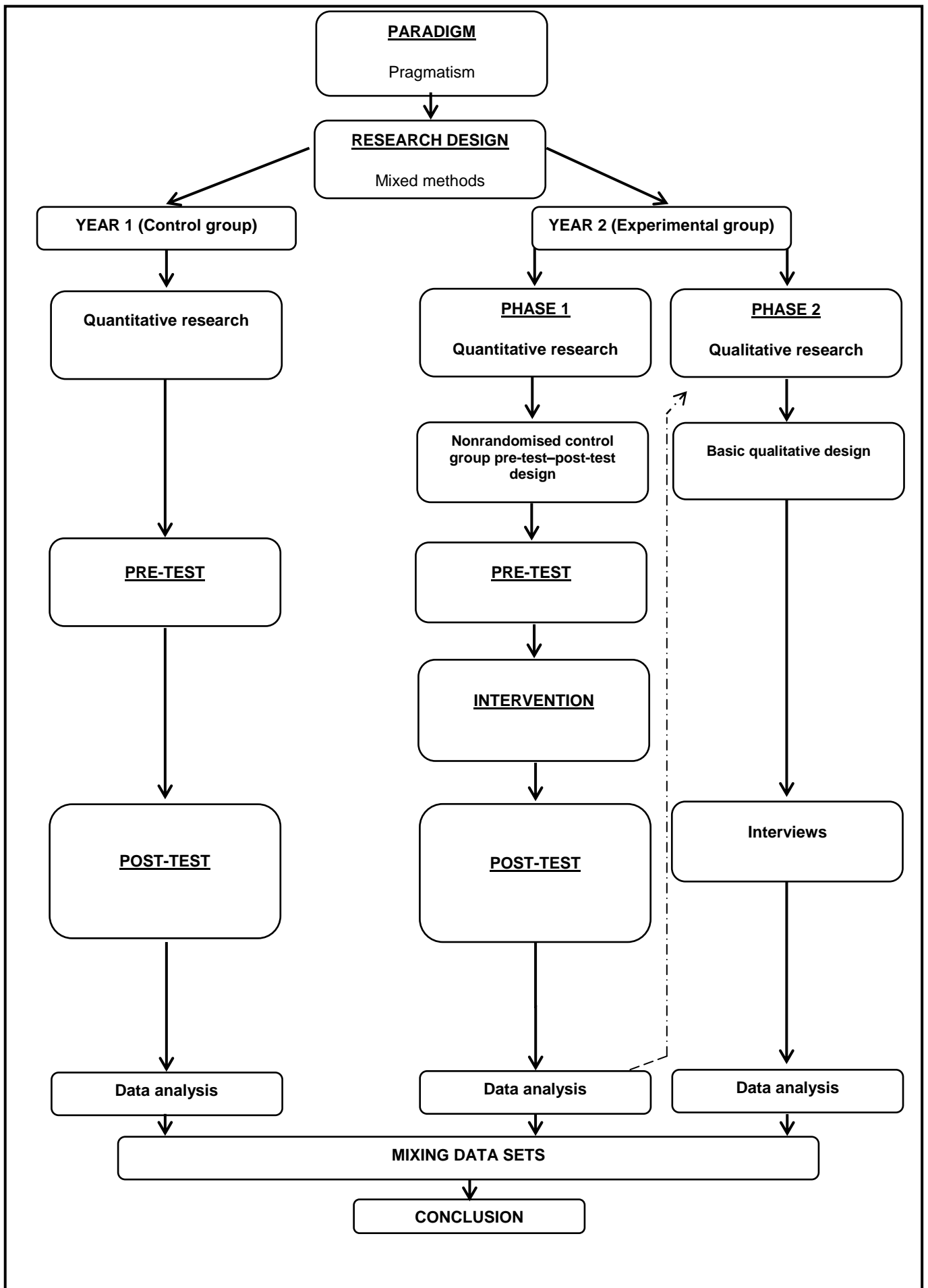


Figure 1.1 Research paradigm, design and methodology

1.4.2. Research design

According to Johnson and Onwuegbuzie (2004), a mixed methods research approach is followed when both quantitative and qualitative data sets are viewed as important and useful (see also Creswell & Plano Clark, 2007). This non-purist position offers the researcher the best chance to answer intricate research questions (Johnson & Onwuegbuzie, 2004). Creswell and Plano Clark (2007) point out that mixed methods research “provides a more complete picture by noting trends and generalizations as well as in-depth knowledge of participants’ perspectives” (p. 33). The mixed methods sequential approach was followed during the present study, as one set of data that was collected and analysed prior to the second set (Guest, 2012). The purpose of this type of integration is to enhance the results of the quantitative data with the aid of qualitative data (Guest, 2012). In this case, the emphasis was on the quantitative data, collected and analysed first, followed by the qualitative data. This type of sequential design is known as the explanatory design (see 4.2), as the purpose of the mixing of data is to enhance or explain quantitative findings further. The follow-up explanations model (see 4.2) is used when the researcher identifies specific quantitative findings that need supplementary explanation. The strength of this two-phase structure lies in its straightforwardness, as only one type of data is collected at a time, while in-depth qualitative studies are used to explain quantitative results. According to Creswell and Plano Clark (2007), adequate time for implementation of both phases (quantitative and qualitative) may present a challenge for researchers following this type of mixed method design. The fact that the researcher cannot specify how participants for the second (qualitative) phase will be selected, as the initial findings must first be obtained, may also pose a challenge for researchers (Creswell & Plano Clark, 2007).

In the present study, the quantitative research followed a nonrandomized control group pre-test–post-test design and the qualitative research, a basic qualitative design. According to Dimitrov and Rumrill Jr (2003), in the nonrandomised control group pre-test-post-test design, the experimental and control groups are selected without random assignment. Both the experimental and control groups take a pre- and post-test, but only the experimental group receives the intervention.

1.4.3. Methods

The following sections contain a brief overview of how the literature study was conducted, as well as how the quantitative and qualitative data were collected and analysed.

1.4.3.1. Literature study

The following key words were used for the detection of relevant literature, through online databases: cooperative learning (*koöperatiewe leer*), CBGs, self-directed learning (*selfgerigte leer*), self-directed learning readiness scale, lifelong learning (*lewenslange leer*), team work, group work, study teams, study groups, team-based learning, cohort groups, out-of-class groups, small-group learning, nature of science, Life Sciences, and teaching science. The databases used included the following: Google Scholar, ERIC, EBSCOhost, Science Direct and Nexus.

1.4.3.2. Quantitative method

The Self-Directed Learning Readiness Scale (SDLRS), cooperative base group perception (CBGP) questionnaire, and a checklist for social skills (CSS) are the measuring instruments discussed in the following section.

1.4.3.2.1. Measuring instruments

Quantitative data collection took place using the 58-item Self-Directed Learning Readiness Scale, consisting of a five-point Likert-type scale (Guglielmino, 1978), to measure students' level of self-directedness. This five-point Likert-type scale ranges from 1 ('Almost never true of me; I hardly ever feel this way') to 5 ('Almost always true of me; there are very few times when I don't feel this way'). The SDLRS is the most widely used instrument in the world and has been translated into 22 languages, including Afrikaans (Guglielmino & Associates, 2012; Merriam, Caffarella, & Baumgartner, 2007). The content validity of the self-directed readiness scale was determined using a Delphi survey (Guglielmino, 1978). Guglielmino (1978), amongst others, reported an internal reliability coefficient of 0.72 to 0.96, and has scored test-retest reliability of 0.82 and 0.79 (Delahaye & Smith, 1995; Long & Agyekum, 1984; McCune & Guglielmino, 1991).

A second questionnaire, measuring students' perception of CBGs (CBGP) was developed and administered to the students at the end of year 2. The nature and number of questions in the CBGP questionnaire were determined in accordance with relevant literature.

The checklist for social skills (CSS) is another questionnaire which was developed for the purpose of this investigation. The CSS listed the behaviours and actions associated with much-needed social skills, making sure that specific social skills were not left out or forgotten. The CSS formed part of the CBG intervention and was one of the documents included within the CBG folder.

1.4.3.2.2. Data collection

Table 1.1 aims to illustrate the quantitative data collection process. The SDLRS was administered at the beginning and end of the LS module in both years 1 and 2 of this investigation. In year 2, at the end of the LS module, the CBGP questionnaire was administered to students. The CBG folders contained a checklist for social skills (CSS), which students completed on three respective occasions during year 2 of this investigation. The Academic achievement Point Score (APS) is a variable based on students' marks obtained during their final school year, and is used by South African universities for admission purposes. During the present investigation, the APS of the first-year students was used as a benchmark for ability and to ensure that the data was comparable.

Table 1.1. Representation of quantitative data collection

Year 1	Year 2
Without CBGs	With CBGs
Quantitative data collection methods	Quantitative data collection methods
SDLRS pre-test SDLRS post-test APS	SDLRS pre-test SDLRS post-test CBGP questionnaire CSS APS

1.4.3.2.3. Data analysis

The total score of the SDLRS is a measure of the current level of self-directed learning, and it is converted to the following bands: 'below average', 'average', and 'above average'. If the score ranges from 58 to 201, the readiness for self-directed learning is said to be 'below average', 202 to 226 indicates an 'average' level of readiness towards self-directed learning, whereas a score ranging from 227 to 290 indicates an 'above average' level of self-directed readiness (Guglielmino, 1978). The total score for the first-year Life Sciences students was calculated after each administration of the SDLRS. The scores of the students' self-directed readiness was analysed with the aid of Statistical Consultation Services at the North-West University (Potchefstroom campus). Correlations between the SDLRS post-test scores, the CSS and CBGP questionnaire factors were calculated to determine whether there is a relationship between ability and self-directed learning readiness. Inferential statistics were performed to partial out the effect of possible differences in the respective SDLRS pre-test scores. The SDLRS post-tests of years 1 and 2 were compared by making use of Analysis of Covariance

(ANCOVA), controlling for possible differences in APS. Dependent t-tests were used to analyse and compare the SDLRS pre- and post-tests of both years (control and experimental groups), while independent t-tests were used to analyse and compare the pre-tests of years 1 and 2. Pre- and post-tests of both years were compared within the three categories of the SDLRS ('below average', 'average' and 'above average'). Effect sizes were calculated to determine whether differences were important in practice. The CBGP questionnaire, comprising a 4-point Likert-type scale, was analysed by making use of descriptive statistics in order to determine possible correlations with the SDLRS post-test scores. Correlations between the CSS, CBGP questionnaire factors, as well as SDLRS post-test were determined.

1.4.3.3. Qualitative method

The manner in which the qualitative data was collected and analysed is discussed in following sections (1.4.3.3.1-1.4.3.3.3).

1.4.3.3.1. Data collection technique

Open-ended semi-structured interviews were conducted to collect qualitative data from seven randomly selected students (Appendix C). Participation of the first-year Life Sciences students was voluntary. The questions that were asked during the interviews were compiled after the quantitative data analysis and based on relevant literature.

1.4.3.3.2. Data collection

According to DeMarrais (2004), an interview is a "process in which a researcher and participant engage in a conversation focused on questions related to a research study" (p. 55). The face-to-face interviews took place at the end of the LS module of year 2 of this investigation. Randomly chosen students took part voluntarily. The interviews were conducted by the researcher in a comfortable environment, and data collected was treated confidentially at all times. The identities of the students involved were only known to the researcher.

1.4.3.3.3. Data analysis

The transcribed data was coded using Atlas.ti. Codes were grouped into themes and themes were grouped into families according to the set research sub-questions. Peer review strategies (Creswell & Plano Clark, 2007) were employed to validate the data. The following steps (Cresswell, 2003) were followed in the qualitative data analysis:

- organising and preparing the data for analysis through transcribing the interviews;
- coding the data through labelling formed categories;
- developing themes by combining similar codes together;

- connecting and interrelating themes; and
- formulating a qualitative narrative.

Findings were validated by using an external audit, as suggested by Merriam (2009). A researcher outside the investigation, was asked to assess the process (Creswell, 2003; Merriam, 2009).

1.4.4. Population and sample

This investigation involved the first-year Life Sciences module at a university in South Africa. First-year LS students took part in this investigation. Analysis of the quantitative data as well as recommendations from literature determined the open-ended questions posed to randomly selected students during the semi-structured interviews. The sample size, ten percent of population size, for the interviews was determined upon finalising the quantitative data analysis, as the final population size and quantitative results influenced the number of students taking part in the second (qualitative) phase of the investigation.

1.4.5. Variables

An independent variable, according to Creswell (2003), is a variable that causes or influences an outcome. The independent variables in this investigation were the intervention (CBGs) and APS of the first-year students. Dependent variables are dependent on the independent variables, and are the “results of the influence of the independent variables” (Creswell, 2003, p. 94). The self-directed learning readiness of the first-year students was the dependent variable in this investigation.

1.4.6. Ethical aspects

This investigation fitted into an existing self-directed learning project, and the ethical aspects of this study were covered by the permission given by the ethical committee of the North West University. No student was at a disadvantage for not participating, as the intervention formed part of the researcher’s teaching strategy and therefore all students were exposed to CBGs. Informed consent forms were signed before completing the CBGP questionnaire, as well as taking part in the interviews. All data was treated confidentially, and will be stored in a safe place for the period required by the North-West University’s ethical committee. The researcher as well as the personnel of Statistical Consultation Services was the only individuals who had access to the data collected during this investigation. Ethical issues regarding the study are discussed in detail in Chapter 4 (§4.7).

1.4.7. Role of the researcher

The researcher assumed a participatory role in both phases of this investigation on account of the following:

- The researcher is also the lecturer of the Life Sciences module at the tertiary institution where the investigation took place.
- The researcher conducted the SDLRS and CBGP questionnaire with the participants during the quantitative phase of the investigation.
- The researcher conducted the interviews with the randomly selected participants during the qualitative phase of the investigation.

This participatory role may have led to the researcher developing cordial and supportive relationships with some participants, which may have created a potential for bias. Extensive verification procedures were used to establish the accuracy of the findings. Furthermore, the researcher's academic supervisors carefully audited all research procedures and data analysis done during this investigation.

1.5. Chapter division

Chapter 1: Introduction

Provides a preview of the investigation

Chapter 2: Self-directed learning (SDL) and cooperative learning (CL): a conceptual and theoretical exposé

Provides a conceptual and theoretical framework of SDL and CL

Chapter 3: Cooperative base groups (CBGs): academic accountability and personal support

Provides a conceptual and theoretical framework of CBGs

Chapter 4: Research methodology

Describes the research design and method followed

Chapter 5: Results and analysis

Presents the quantitative and qualitative results

Chapter 6: Findings, conclusions and recommendations

Gives a detailed summary of all results analysed, as well as recommendations for further investigation

1.6. Summary

The aim of this chapter was to explain the need for investigating the effect of cooperative base groups on first-year Life Sciences students' self-directed learning readiness. A brief literature review of self-directed learning, cooperative learning, as well as the nature of science, was given. The sub-questions, needed to answer the research question, were identified and stated. This chapter contains a brief discussion of the selected paradigm, the research design, as well as the methods followed. The chapter concludes with the chapter division for this study.

CHAPTER 2

SELF-DIRECTED LEARNING AND COOPERATIVE LEARNING: A CONCEPTUAL AND THEORETICAL EXPOSÉ

2.1. Introduction

In this chapter, literature on self-directed learning (SDL) as well as cooperative learning (CL) will be examined, in order to lay out the foundation and development of SDL, as well as the historical roots of CL. Conceptual clarification for both SDL and CL, the role that the facilitator and the student play in the process of becoming self-directed in learning, as well as measuring the levels of self-directed readiness will be discussed. This chapter also includes the five basic elements of CL, various CL strategies, and a discussion on the documented benefits and challenges of CL. This chapter concludes with relating SDL and CL, as well as the gap in the body of research and implications for teaching and learning.

2.2. Self-directed learning

In the following sections of this chapter, the foundation, development and conceptual clarification of SDL (see 2.2.1 and 2.2.2), the important roles of facilitators (see 2.2.3) and students (see 2.2.4), as well as measuring the levels of self-directed readiness (see 2.2.5) will be discussed.

2.2.1. Foundation and development

According to Guglielmino and Long (2011), being self-directed in learning is “our most basic, natural response to newness, problems, or challenges in our environment” (p. 2). Guglielmino and Long (2011) also argue that the complexity and increasing pace at which our world is changing affect our everyday lives, and requires lifelong SDL. Nepal and Stewart (2010) point out that in the ever-changing knowledge economy, where the only constant is change, SDL skills are of critical importance. Encouraging a lifelong learning perspective implies that educational institutions need to prepare learners to engage in SDL processes. Bullock (2013) claims that schools, as well as education programmes which prepare teachers to work in schools, are obligated to prepare and equip individuals for a changing world.

According to Hiemstra (2003), there are four influential people worth mentioning when discussing SDL. The first influential person is Cyril Houle, who deserves much recognition for influencing the explosion of research, thought and literature in SDL (Hiemstra, 2003). In Houle’s book, *The inquiring mind* (1961), he describes the results of a study he conducted with

22 adult learners. After interviewing these learners, he classified them into three categories based on their reasons for participation in continued learning. The adult learners were categorised as being goal-oriented, activity-oriented or learning-oriented. The latter group's adults are described as individuals who are motivated by a desire to know (Houle, 1961). Tough and Knowles, the next two influential, were both students of and influenced by Houle. Tough's research project in Toronto, led to his 1971 book, *The adult's learning projects*, as well as the discovery that most learners have a preference to plan and direct their own learning (Hiemstra, 2003). Knowles' 1975 book *Self-directed learning*, is a guide for teaching and learning, aimed directly at the SDL concept (Hiemstra, 2003), and was greatly influenced by Tough's 1971 publication (Brockett & Donaghy, 2005). With the following statement, Knowles acknowledged that SDL is not a linear process, but is influenced by external environmental and internal learner factors:

If self-directed learners recognise that there are occasions on which they will need to be taught, they will enter into those taught-learning situations in a searching, probing frame of mind and will exploit them as resources for learning without losing their self-directedness (Knowles, 1975, p. 21).

According to Hiemstra (2003), the last individual worth mentioning, is Huey Long. Long began the annual international symposium on SDL and is possibly the person most responsible for the continuous growth in knowledge, research, and scholarship relating to SDL.

2.2.2. Conceptual clarification

The complexity of SDL is evident in the densely packed definitions of various authors (Brockett & Hiemstra, 1991; Brookfield, 2009; Ellinger, 2004; Gibbons, 2002; Kasworm, 1983; Knowles, 1975; Savin-Baden & Major, 2004). According to Davis, Bailey, Nypaver, Rees, and Brockett (2010), SDL is an approach to knowledge relying on an individual being able to and responsible for directing his or her own learning. Knowles' 1975 definition of SDL is one of the most cited definitions in SDL literature:

A process in which individuals take the initiative, with or without the help of others, to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes (p. 18).

Even though definitions of SDL are divergent, the following table (Table 2.1) aims to identify shared properties that several authors advocate SDL to encompass. Properties shared are indicated within each of the definitions with a distinct colour.

Table 2.1 Properties of self-directed learning shared by various authors' definitions

Author	Definition of SDL	Shared properties
(Knowles, 1975, p. 18)	A process in which individuals take the initiative, with or without the help of others , to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies , and evaluate learning outcomes .	Is a process Learners take initiative Learners formulate learning goals/ outcomes
(Kasworm, 1983, p. 1)	Set of generic, finite behaviors; as a belief system reflecting and evolving from a process of self-initiated learning activity ; or as an ideal state of the mature self-actualized learner.	Learners take responsibility
(Brockett & Hiemstra, 1991, p. 24)	Self-direction in learning refers to both the external characteristics of an instructional process and the internal characteristics of the learner , where the individual assumes primary responsibility for a learning experience .	Learners select learning strategies Learners evaluate learning experiences and outcomes/goals
(Gibbons, 2002, p. 24)	Self-directed learning is any increase in knowledge, skill, accomplishment, or personal development that an individual selects and brings about by his or her own efforts using any method in any circumstances at any time .	Learners do not work in isolation
(Brookfield, 2009, p. 2615)	Self-directed learning is learning in which the conceptualization, design, conduct and evaluation of a learning project are directed by the learner . This does not mean that self-directed learning is highly individualised learning always conducted in isolation. Learners can work in self-directed ways while engaged in group-learning settings ; provided that this is a choice they have made believing it to be conducive to their learning efforts .	
(Nepal & Stewart, 2010, p. 497)	SDL is a continuous engagement in acquiring, applying and creating knowledge and skills in the context of an individual learner's unique problems .	

As is evident from Table 2.1, SDL is first and foremost viewed as a continuous process. During this process, an individual takes initiative and responsibility for the learning activity as well as for formulating his or her own learning goals. Taking initiative and responsibility implies, amongst others, that an individual is creative, inventive and accountable. According to Brockett and Hiemstra (1991), taking primary responsibility for learning can also be described as accepting ownership of the learning experience, which in turn means that there is a degree of freedom in selecting the factors associated with the learning experience. Thornton (2010) emphasises that students who realise their own limitations and choose to seek guidance are “nonetheless being self-directed; this decision-making process should be acknowledged” (p. 159). A self-directed individual also implements appropriate learning strategies and evaluates his or her learning practices (Brockett & Hiemstra, 1991; Brookfield, 2009; Gibbons, 2002; Kasworm, 1983; Knowles, 1975). During the process of becoming more self-directed in one’s learning, the help and support of other individuals plays a noteworthy role (Brookfield, 2009; Knowles, 1975).

A simple, yet appropriate, analogy of taking a trip can be used to explain that SDL entails the individual deciding not just where to take a trip, but how he or she will go (both the means of transportation as well as route), when such person will leave, how he or she will get there and how long he or she will be staying.

2.2.3. The role of the facilitator within the self-directed learning environment

Knowles (1975) claims that acting as a facilitator instead of the source of content knowledge, should be the key role of an educator. Gillies (2007) concurs with Knowles (1975) by stating, “teachers will no longer dispense knowledge and information but will facilitate students’ learning by monitoring their progress, encouraging their efforts, challenging their understandings, and scaffolding their learning” (p. 199). Although the terms **teacher**, **lecturer**, **educator**, **instructor** and **facilitator** are all used in literature describing SDL role players (Dyran et al., 2008; Kramarski & Michalsky, 2009; Lord et al., 2010; Thornton, 2010), the researcher will make use of the term **facilitator**. With the use of this term, the researcher wishes to emphasise the fact that the construction of knowledge in an active learning environment should be facilitated.

Because facilitators’ instructional decisions as well as their interactions with students influence the effective promotion of SDL development (Lord et al., 2010), the role that facilitators play can be described as vital (Thornton, 2010). Although a persistent myth about SDL is that it inevitably involves the facilitator becoming more and more redundant (Thornton, 2010), Lord et al. (2010) point out that facilitators can assist in the development of skills, needed to be successful self-directed learners, through giving support and guidance. Thornton (2010) claims that any facilitator, looking to encourage effective SDL, should bear in mind that, together with

practical or methodological concerns, cognitive or psychological preparation is also of utmost importance.

According to Oswald (2003), an important first step in fostering self-directedness is preparing students for SDL. This not only introduces students to the general rigours of directing their own learning, but also familiarises students with the facilitator's expectations (Oswald, 2003).

Climate setting, diagnosing learning needs, and designing the learning plan are, according to Knowles (1975), the three main aspects involved in the process of facilitating SDL. Promoting a sincere and caring atmosphere, creating a sense of mutual respect, encouraging dialogue, and encouraging an atmosphere of mutual trust are the elements needed for setting the climate. Diagnosing learning needs, as well as designing learning plans, involves facilitator–student collaboration (Knowles, 1975). In order for students to be successful in planning, implementing, monitoring and evaluating their own learning, they need assistance from the facilitators (Thornton, 2010).

Being skilful in facilitating pedagogies that engage students in self-direction is, according to Lord et al. (2010) another important role a facilitator plays in effectively promoting SDL. The authors further suggest that the facilitator should be sensitive to student attitudes and behaviours in SDL settings. Facilitators should be aware of the roles that classroom environments can play in aiding SDL development (Lord et al., 2010). According to Robertson (2010), facilitators guiding students in directing their own learning, should be approachable and capable of setting up a positive affective learning environment in which students feel supported.

Most people seem to think that there is one way to teach well. What is 'good teaching' for one student in one stage of development may not be 'good teaching' for another student or even for the same student at a different stage of development. Good teaching does two things: It matches the student's stage of self-direction, and it empowers the student to progress toward greater self-direction (Grow, 1991, p. 140).

Borich (2000) identifies the following as the sequence of activities required by facilitators to promote SDL:

- providing information about when and how to use learning strategies;
- illustrating how these strategies are to be used in the context of real problems;
- providing students with the opportunity to restructure content in terms of their own ways of thinking and prior understandings; and
- gradually shifting the responsibility of learning to students through activities that engage them in increasingly more complex patterns of thought.

According to Borich (2000), reducing the amount of explaining, explicitness of cues, and prompting will occur as students gradually accept the shift in responsibility.

SDL models that focus on what can be done by facilitators in formal classroom settings to foster SDL were labelled by Merriam and Caffarella (1991) as 'instructional models'. According to Merriam (2001) the best known of these models is Grow's (1991) Staged Self-Directed Learning (SSDL) model (see Table 2.2).

Table 2.2 The Staged Self-Directed Learning model (Grow, 1991, p. 129)

Stage	Student	Teacher	Examples
Stage 1	Dependent	Authority Coach	Coaching with immediate feedback. Drill. Informational lecture. Overcoming deficiencies and resistance.
Stage 2	Interested	Motivator Guide	Inspiring lecture plus guided discussion. Goal-setting and learning strategies.
Stage 3	Involved	Facilitator	Discussion facilitated by teacher who participates as equal. Seminar. Group projects.
Stage 4	Self-directed	Consultant Delegator	Internship, dissertation, individual work or self-directed study-group.

According to Grow (1991, p. 129), the purpose of the model "is to match the learner's stage of self-direction and prepare the learner to advance to higher stages". According to the SSDL model, learners find themselves in one of the four possible stages, and consequently, the teaching style and the facilitator's role must be stage-appropriate. Mismatch can occur between teaching styles and learning stages, which may cause various problems (Grow, 1991). According to Grow (1991), students can find themselves on a continuum of SDL, with a highly dependent student in Stage 1 at the one end of this continuum, and a self-directed learner in Stage 4 at the other end. The role of the facilitator consequently also changes along this continuum from a coach in Stage 1 to that of a consultant in Stage 4 (Grow, 1991).

Students finding themselves in Stage 1 (S1) are highly dependent on an authority figure. Grow (1991) therefore states that the facilitator's role is that of a coach and an expert; providing distinct objectives, discipline and direction. An S1 facilitator makes use of rigorous assignments

with fixed deadlines, as well as immediate, frequent, task-oriented feedback (Grow, 1991). Focus is placed on the module, not the students, and therefore communication is one way only. It should be mentioned, however, that all students may, irrespective of the stage, become temporarily dependent when facing new topics, and students can be dependent in one, many or all modules (Grow, 1991).

According to Grow (1991), a Stage 2 (S2) student is interested and responds to the enthusiasm and motivational techniques of the facilitator. These S2 facilitators, according to Grow (1991) “begin training students in such basic skills as goal setting” and motivate the students to achieve high standards (p. 132). The S2 facilitator makes use of two-way communication, and the enthusiasm of the facilitator carries students until they become self-motivated. The facilitator has failed if students remain dependent upon facilitators’ motivation to learn (Grow, 1991).

The role of a coach or motivator is replaced in Stage 3 (S3) by that of a facilitator (Grow, 1991). Students in S3 of Grow’s (1991) SSDL model, want to be involved with both the facilitators and other learners, they also want to be appreciated for who they are and what they are able to do. Grow (1991) states that the students are empowered in S3, while the focus is on facilitation and communication. Students share in the decision-making process, and are also provided with written criteria, learning contracts and evaluation checklists to help them monitor their own learning progress (Grow, 1991).

Grow (1991) is of the opinion that students in Stage 4 (S4) are self-directed and set their own goals and standards, with or without the help of experts, institutions and other resources to pursue these goals. According to Grow (1991), an S4 student will construct knowledge effectively regardless of the type of facilitator. Facilitating S4 students happens through delegation and the facilitator’s role is not to teach subject matter, but to cultivate the students’ ability to construct knowledge. Grow (1991) mentions that both two-way communication and external reinforcement are gradually reduced, and students are weaned from “being taught” (p. 135).

After studying the SDL models of Tough (1976), Knowles (1975), Garrison (1997), Brockett and Hiemstra (1991) and Long (1989), Oswald (2003) identified the following nine components concerning SDL: opportunity, support, collaboration, motivation, contextual control, cognitive control, skill with content, skill with SDL, and also willingness to direct one’s own learning. Believing that all of these components need to be considered when facilitating SDL, Oswald (2003) synthesised the 3-Factor SDL Model consisting of three major groups, each of which is made up of three components of SDL. The major groups are:

- learning situation;
- learners' attributes; and
- components of learning.

According to Oswald (2003), this 3-Factor SDL Model (see Figure 2.1) indicates the relationship between the major groups and the components of SDL that each comprises of.

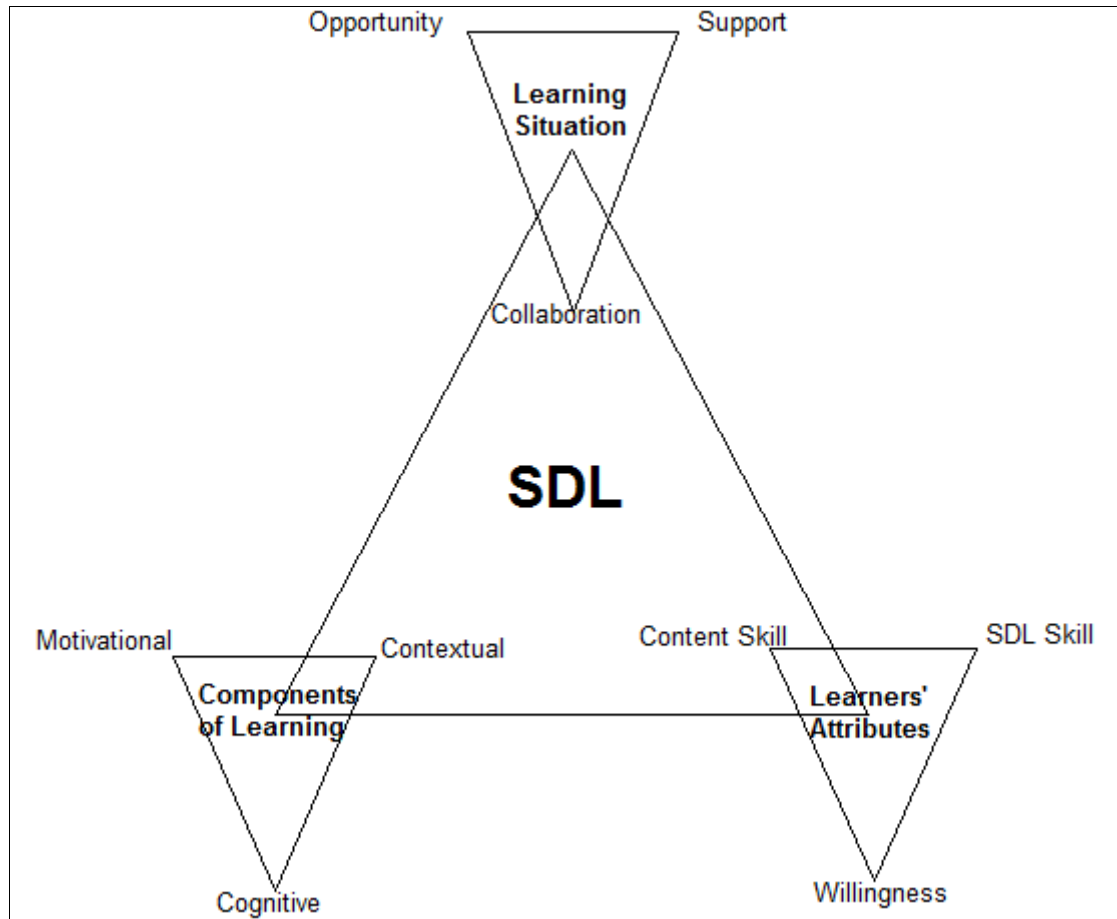


Figure 2.1 The 3-Factor SDL Model (Oswald, 2003, p. 24)

According to Oswald (2003), SDL occurs when the learning situation contains opportunity, support and collaboration. **Opportunity** refers to the extent to which the facilitator is committed to fostering SDL within the learning situation, whilst **support** refers to the expertise, guidance and materials provided to learning situations (Oswald, 2003). “Although learners take responsibility for directing their own learning, it is necessary for instructors to provide resources and scaffolding to support learners’ endeavours with new or unfamiliar knowledge and skills” (Oswald, 2003, p. 25). Because successful self-directed learners often make use of the help of peers and peer-support groups, **collaboration** is believed to be a crucial aspect of SDL.

The other two major groups, learners' attributes and components of learning, both indicate the role that the student plays in SDL, and will therefore be discussed in the next section (see 2.2.4). It is important to realise that the process of successfully directing one's own learning can only take place with all the components in association with each other (Oswald, 2003).

In his article "Teach me how to learn: principles for fostering students' self-directed learning skills", Francom (2010) reveals the following four major guidelines for fostering SDL in a formal educational environment:

- matching the level of SDL required in learning activities to student readiness;
- progressing from the facilitator to the student's direction of learning over time;
- supporting the acquisition of subject matter knowledge and SDL skills together; and
- having students practice SDL in the context of learning tasks.

These principles focus on what facilitators can do to give students opportunities to practice SDL skills within formal educational environments, and should guide facilitators in designing teaching and learning activities (Francom, 2010).

Besides providing support and guidance to learners, selecting appropriate pedagogies, and matching teaching style with the SSDL stages, Kramarski and Michalsky (2009) claim that the ability of facilitators to promote self-directed learners is tied to their own self-regulation.

2.2.4. The role of the student: becoming a self-directed learner

Because this study falls within the context of higher education (HE) in South Africa, the researcher will make use of the term **student** instead of **learner**. Merriam-Webster's Online Dictionary defines a **student** as an individual who studies something and attends an educational facility, while a **learner** is someone who acquires knowledge, skills or a behavioural tendency (Merriam & Webster, 2014). Because a **learner** is someone who takes part in learning which, according to the Merriam-Webster Online Dictionary, is the process of gaining knowledge or skills by means of studying, instruction or experience (Merriam & Webster, 2014), the researcher wants to emphasise that a student should become a SDL learner.

According to Knowles (1975), the following competencies are required by a self-directed learner, namely the ability to:

- relate collaboratively to peers;
- see peers as resources for diagnosing needs and planning learning;
- give help and receive help from peers;
- diagnose own learning needs realistically, with help from facilitators and peers;

- translate learning needs into learning objectives;
- relate to educators as facilitators, and to take initiative in making use of their resources;
- identify human and material resources;
- select effective strategies for making use of learning resources; and
- collect and validate evidence of the achievement of various kinds of learning objectives.

After conducting a Delphi study, Guglielmino (1978) identified the following as predominant characteristics of a highly self-directed learner:

- taking initiative in the learning process;
- independence and persistence in learning;
- accepting responsibility for one's own learning;
- self-discipline;
- curiosity;
- taking joy in learning;
- a tendency to be goal-oriented; as well as
- a tendency to view problems as challenges.

Warburton and Volet (2012) further noted the following as key roles of a self-directed learner:

- asking appropriate questions in order to guide enquiry;
- interrogating the assumptions behind the ideas presented to them;
- identifying appropriate resources and tools; and
- using or modifying selected resources and tools to achieve learning goals.

Robertson (2010) is of the opinion that taking responsibility for one's own learning requires that a broad range of cognitive and metacognitive skills be learned. According to Garrison (1991), a self-directed learner not only takes responsibility for the construction of meaning, but also includes the participation of others in confirming worthwhile knowledge. Lord et al. (2010) further suggest that a self-directed learner is not only curious and motivated, but also reflective, analytical, persistent, flexible and independent.

Dynan et al. (2008) explain that SDL skills are the basis of lifelong learning, and suggest that these skills should be focused on as soon as possible in a college curriculum. The authors identified the following abilities as essential skills needed to engage in SDL:

- applying the basic concepts to real-world problems or situations;
- recognising and explaining major underlying assumptions;
- building simple models based on principles; and
- comparing and contrasting the costs and benefits of simple models, and explaining why one is better than the other (Dynam et al., 2008).

As previously described (see 2.2.3), Oswald (2003) formulated the 3-Factor SDL Model, which consists of three major groups. Two of these major groups, learners' attributes and components of learning, describe the role(s) that students play in the process of becoming self-directed in their own learning. Content skill, SDL skill and willingness to direct one's own learning are the components comprising the second major group, learners' attributes. Prior understanding of basic concepts within the content domain, as well as mastering of basic skills within a certain area will have an influence on the amount of time and effort invested by learners towards promoting their own SDL skills (Oswald, 2003). Motivational, contextual and cognitive factors are the components of learning that students must take responsibility for (Oswald, 2003). Motivational factors include self-efficacy and volition, whilst contextual factors refer to those components of learning over which the students have control, for example resources, peers and other external influences. According to Oswald (2003), the cognitive factors include critical self-reflection on the individual's own learning process, as well as the knowledge and skill the students are trying to master.

Grow (1991) notes, "students do not naturally arrive at high school, college, or adult education programs at once dependent upon teachers and resentful of being taught" (p. 142). They become that way rather, as a result of years of dependency training (Grow, 1991). Because learning does not take place in isolation but in association with others (Knowles, 1975), learning can be placed on a continuum, ranging from educator-oriented to self-directed (Loyens et al., 2008). When shifting from one end of the continuum to the other, the amount of control over learning, evaluation of learning needs, content selection, as well as the selection and implementation of learning strategies, changes (Fisher et al., 2001). Grow (1991) is of the opinion that it is appropriate to vary the teaching and learning methods in order to maximise the learning potential in any given situation (Grow, 1991). This statement seems to contradict Grow's intentions with the SSDL model. As previously mentioned, Grow (1991) suggests that learners find themselves in one of the four proposed stages of SDL. According to Grow's (1991) explanation of these stages, it is evident that learners need to progress from being highly dependent to being self-directed in their learning. According to Brockett and Hiemstra (1991), taking personal responsibility for one's thoughts and actions, and the consequences thereof, is important. The authors point out that each individual assumes some degree of personal responsibility, and that it is not an either/or characteristic. The role of facilitators is therefore to

help learners become increasingly able to assume personal responsibility for their own learning (Brockett & Hiemstra, 1991).

2.2.5. Measuring levels of self-directed learning readiness

Quantifying and measuring self-direction in learning, which began shortly after Knowles (1975) had proposed the linear model of the process of SDL (Stockdale, 2003), implies an internal state of psychological readiness to undertake self-direction in learning (Merriam et al., 2007).

After studying various types of resources, Cheng, Kuo, Lin, and Lee-Hsieh (2010) identified five existing SDL instruments that directly measure SDL, namely:

- Guglielmino's (1978) SDL readiness scale (SDLRS);
- Deng's (1995) Chinese version of Guglielmino's SDLRS;
- Ho's (1998) SDL ability scale;
- Fisher et al.'s (2001) SDL readiness scale; and
- Williamson's (2007) self-rating scale of SDL.

According to Cheng et al. (2010), the latter two instruments have been extensively tested among nursing students, while Ho's (1998) instrument is only available in Chinese, and Deng's (1995) instrument is adapted from Guglielmino's (1978) SDLRS. Cheng et al. (2010) developed the 20-item Self-Directed Learning Instrument (SDLI). This is a valid and reliable instrument for specifically identifying nursing students' SDL abilities across different programmes and grades (Cheng et al., 2010).

Two other measuring instruments not mentioned by Cheng et al. (2010), are Oddi's (1986) Oddi Continuing Learning Inventory (OCLI) and Stockdale's (2003) Personal Responsibility Orientation to Self-Direction in Learning Scale (PRO-SDLS). The OCLI was developed after an extensive list of personality characteristics, believed to be associated with self-directed continuing learners, was compiled from literature reviews (Harvey, Rothman, & Frecker, 2006). The list of personality characteristics was categorised into three overlapping domains: proactive versus reactive learning drive, cognitive openness versus defensiveness, and commitment to learning versus apathy or aversion to learning. The final OCLI instrument consists of 24-items, includes various items from each of the three domains, and aims to measure personal SDL characteristics (Harvey et al., 2006). The 25-item PRO-SDLS was developed by Stockdale (2003) in an attempt to assess teaching-learning and learner characteristics (Stockdale & Brockett, 2011) among college students (Brockett & Hiemstra, 1991). The OCLI together with the SDLRS are according to Merriam et al. (2007), the two instruments that have been widely used to assess aspects of self-directedness as a personality trait.

The purpose of Guglielmino's (1978) original study was not only to obtain consensus on the essential personality characteristics of highly self-directed learners, but also to develop an instrument for assessing an individual's readiness for SDL. After three rounds of the Delphi survey, 56 characteristics of a self-directed learner were identified, of which 33 were deemed essential (Guglielmino, 1978). These 33 essential characteristics were used to develop a 41-item survey. Upon further revision of the SDLRS, nine of the original items were removed and replaced with 26 new items, resulting in the currently used 58-item SDLRS (Guglielmino, 1978). The 58-item, five-point Likert-type scale measures the attitudes, values and abilities of learners in terms of their readiness to participate in SDL at the time of their response (Guglielmino & Guglielmino, 1991). According to Merriam et al. (2007), the Delphi survey with a panel of 14 acknowledged SDL experts, including Allen Tough, Cyril Houle and Malcolm Knowles, resulted in the development of the SDLRS as well as the "most commonly used operational definition of the self-directed learner" (Merriam et al., 2007, p. 121).

Because the SDLRS has been translated into more than 20 languages, it is no surprise that it is the most widely used instrument for measuring self-directedness in learning (Merriam et al., 2007). After reading each of the 58 items in the SDLRS, individuals indicate the degree to which they feel the statements are true for them by using the responses of the five-point Likert-type scale. The readiness of individuals is assessed as a total score, which is then converted into the following three bands: above average, average, and below average (Guglielmino, 1978).

Although an individual's SDLRS score is a measure of his or her current level of SDL readiness, it is important to remember that an individual's score can be changed through appropriate educational interventions (Guglielmino, 1978). According to Guglielmino and Klatt (1994), individuals with high SDLRS scores prefer to plan and implement their own learning after determining their learning needs. This, however, does not imply that such individuals will never choose structured learning situations; instead, they may well choose traditional courses or workshops as part of their learning plan. Individuals with average SDLRS scores are, according to Guglielmino and Klatt (1994), more likely to be successful in more independent situations even though they may not be comfortable with taking charge of the entire process of identifying learning needs, planning and implementing their own learning. Below average scorers mainly prefer to function in a structured learning environment with lectures and traditional classroom settings (Guglielmino & Klatt, 1994). Results of a study by Dynan et al. (2008) corresponded with those obtained by Guglielmino and Klatt (1994). High scorers, individuals in the above-average and high bands, improve their SDL readiness in unstructured environments, while low scorers, individuals in the average, below-average and low bands, improve in structured environments (Dynan et al., 2008).

Content validity of the SDLRS was established by Guglielmino's (1978) Delphi technique that, as previously mentioned, involved a panel of 14 experts in a three-round survey. A vast majority of research supports the reliability and validity of the instrument (Chuprina & Durr, 2006; Delahaye & Smith, 1995; Long & Agyekum, 1984; McCune & Guglielmino, 1991; Muller, 2007; Oliveira & Simões, 2006; Zsiga, 2007), yet it received some criticism regarding methodological and validity issues (Brockett, 1985; Field, 1989; Stockdale, 2003). Guglielmino's SDLRS remains the most often used quantitative measure of SDL (Merriam et al., 2007) despite the fact that it has not been revised since 1978 (Stockdale, 2003), administrative costs are high (Fisher et al., 2001) and various other measuring instruments exist.

In 2000, Delahaye and Choy (2000) conducted a comprehensive review and concluded, "there has been extensive support for the SDLRS in the literature as an accurate and useful instrument for measuring readiness for self-directed learning' (p. 2).

2.3. Cooperative learning

The history and theoretical roots of CL (see 2.3.1), the clarification of important and relevant concepts (see 2.3.2), cooperative learning strategies (see 2.3.3), the benefits of CL (see 2.3.4), as well as challenges that the implementation of CL holds (see 2.3.5) are discussed in the next section of this chapter.

2.3.1. History and theoretical roots

Although research on CL began in 1897 (Wong & Wong, 2001), groups have existed for as long as there have been humans (Johnson et al., 2008). Johnson et al. (2008) are of the opinion that a rich and long history of CL, exists. In their book *Cooperation in the classroom* (2008), a detailed overview and timeline of the history of CL is given (p. A:2–A:12). According to this timeline, it was argued from as early as the first century that learners could benefit from teaching one another. Colonel Francis Parker's instructional methods of structuring cooperation in classrooms, dominated American education through the turn of the 19th century, and during the mid-1960s Johnson, Johnson and Holubec began to train teachers how to implement CL successfully. From the 1970s, various individuals built on the work of CL advocates and developed numerous CL strategies (Johnson et al., 2008), which will be discussed in 2.3.3.

Johnson et al. (2008) state that research on CL has been guided by three theoretical perspectives: social interdependence, cognitive developmental and behavioural learning, while Dat-Tran (2013) proposes that social interdependence, cognitive perspective, social learning theory and constructivism all provide rational and empirical support for the supremacy and success of CL.

Piaget (1974) and Vygotsky (1978) contributed to the development of the cognitive developmental theory, which focuses on what happens within a single person (Johnson et al., 2008). According to Vygotsky (1978), cooperative activities promote the development of individuals as same-aged individuals work in one another's zone of proximal development (ZPD). The ZPD is defined by Vygotsky as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Piaget (1974) supports the cognitive developmental theory and emphasises the participation of learners in the learning and thinking process by constructing and reconstructing knowledge for themselves (Dat-Tran, 2013).

The behavioural learning theory assumes that cooperative efforts are powered by extrinsic motivation to achieve group rewards (Johnson et al., 2008), while the social learning theory "bridges behavioural and cognitive learning theories by taking into account how imitable behaviours are affected by cognitive constructs, such as attention, retention, production and motivation" (Dat-Tran, 2013, p. 108).

Constructivist proponents believe "learners are in control of constructing their own meaning in an active way" (Almala, 2005, p. 10), and therefore a significant contribution was made by the constructive learning theory to learner-centred learning approaches (Dat-Tran, 2013). Through observation, reflection, experimentation, discovery and particularly social interaction, learners actively gain knowledge (Brooks & Brooks, 1999). In constructivist learning environments, students are empowered to apply knowledge in many different settings, whilst making it as real-life as possible (Almala, 2005). Constructivist learning is contrasted with traditional learning in the following ways (Marlow & Page, 2005, p. 7):

- "constructivist learning is constructing knowledge, not receiving knowledge";
- "constructivist learning is understanding and applying, not retention";
- "constructivist learning is thinking and analysing, not accumulating and memorizing";
- and
- "constructivist learning is dynamic, not passive".

According to Johnson et al. (2008), social interdependence theory not only gives a clear definition of cooperative, competitive and individualistic efforts, but also specifies the circumstances under which cooperation is most effective, the outcomes most effected by cooperation, and the modus operandi facilitators should follow in implementing CL (Deutsch, 1962; Johnson, 1970; Johnson & Johnson, 2005). It is further believed that the absence of social interdependence detaches an individual from others (Dat-Tran, 2013). According to Johnson et al. (2008), the way in which social interdependence within a group is structured

influences the way in which individuals react, which also influences the outcomes. Johnson et al. (2008) claim social interdependence theory to be the most influential theoretical perspective concerning CL and is most clearly related to practice.

Table 2.3 below illustrates the interaction patterns influenced by the social interdependence theory.

Table 2.3 Interaction patterns underpinned by social interdependence theory (Johnson & Johnson, 2013, pp. 89-90)

Type of interdependence ...	Occurs when ...	Resulting in ...	This leads to ...
<i>Positive</i> interdependence	situations are structured <i>cooperatively</i>	<i>promotive</i> interaction	<ul style="list-style-type: none"> • increased efforts to achieve • positive interpersonal relationships • psychological health
<i>Negative</i> interdependence	situations are structured <i>competitively</i>	<i>oppositional</i> interaction	<ul style="list-style-type: none"> • decreased efforts to achieve • negative interpersonal relationships
<i>No</i> interdependence	situations are structured <i>individualistically</i>	<i>no</i> interaction	<ul style="list-style-type: none"> • psychological maladjustment

Competitive learning situations are characterised by negative goal interdependence where one individual strives to achieve higher than other individuals, and this “involves obstructing of each other’s attempts to achieve” (Johnson & Johnson, 2013, p. 449). Students in individualistic learning situations are independent of one another and their success depends solely on their own performance. CL situations are characterised by positive goal interdependence and individual accountability. Positive interdependence has several effects on individuals’ motivation and efficiency.

2.3.2. Conceptual clarification

When a small group of students work together to accomplish a mutual goal (Killen, 2007), students will learn more than they would have had they worked alone (Johnson & Johnson, 2009a). “When efforts are structured cooperatively, there is considerable evidence that students will learn more, use higher level reasoning strategies more frequently, build more complete and complex conceptual structures, and retain information learned more accurately” (Johnson & Johnson, 2008b, p. 35). According to Gillies (2007), simply “placing students in

groups and expecting them to work together will not necessarily promote cooperative learning” (p. 29). CL is, in its broadest sense, defined as group work that occurs when students work cooperatively in small groups to accomplish mutual goals (Gillies, 2007; Johnson et al., 2008). Working in small groups with a fixed composition on learning tasks that are structured, is another definition of this instructional technique (Cooper, Prescott, Cook, Smith, & Mueck, 1990). Johnson et al. (2008) point out that a cooperative group has a sense of individual accountability, which means that all students need to know the material in order for the whole group to be successful.

Three types of CL groups exist, namely formal CL, informal CL, and CBGs (Johnson et al., 2008) and these will be discussed in detail in subsections 2.3.2.2 to 2.3.2.4.

2.3.2.1. Heartbeat of cooperative learning

Nelson (2010) identifies the following four components, which are crucial to CL approaches:

extensive structuring of the learning tasks; strongly interactive student-student execution of the tasks; immediate debriefing or other assessments to provide the teacher and students with prompt feedback about the success of the intended learning; and, importantly, instructional modifications by the teacher that take account of this feedback (p. 121).

According to Millis (2010), experts distinguish between CL and other small-group learning situations based on the presence of certain key components. Positive interdependence, individual accountability and group processing are three givens in literature on CL (Johnson & Johnson, 2013; Millis, 2010). Furthermore, Johnson and Johnson (2013) are of the opinion that CL will only be more productive than competitive and individualistic efforts when promotive face-to-face interaction and small-group skills are also present. The following basic components of CL will subsequently be discussed: positive interdependence, individual accountability, promotive face-to-face interaction, interpersonal small-group skills, as well as group processing.

2.3.2.1.1. Positive interdependence

According to Hornby (2010), positive interdependence is crucial in CL activities, and Grissom et al. (2013) suggest that CL tasks should be structured in such a way as to include all members of a group. According to Millis (2010), students are given a “vested reason to work together on a task”, which is challenging and encourages cooperation between students (p. 5). Once positive interdependence exists among group members, each member will understand that his or her contribution is crucial for his or her own success and that of the group (Gillies, 2007; Johnson & Johnson, 2013). It also establishes that each group member’s efforts are required and

indispensable for the success of the group, and each member has a unique contribution to make to the joint effort because of his or her resources, roles and task responsibilities (Johnson & Johnson, 2013). Group members therefore realise that they must complete their assigned work in order for the group to attain its goal (Gillies, 2007). Besides uniting diverse students with a common goal, clearly perceived positive interdependence ensures that there are no 'free-riders' (Millis, 2010).

Positive interdependence can, according to Johnson and Johnson (2013), be structured within a group, in a number of ways:

- Positive goal interdependence: the group is united around a shared goal, and realises that they can only achieve their learning goals if all members in the group attain theirs.
- Positive reward interdependence: this may be used to supplement goal interdependence, by giving the same reward(s) to each group member when the group achieves its shared goals. The quality of cooperation within the group is enhanced through regular celebrations of group efforts and success.
- Positive resource interdependence: because each group member has only a portion of the resources necessary to complete a task, the members' resources have to be combined in order for the group to achieve its goals. Resources that have to be shared can also be limited by giving only one copy to each group.
- Positive role interdependence: interconnected roles, which specify the responsibilities that the group needs in order to complete the task, are assigned to each group member. Such specific roles may include readers, recorders, checkers of understanding, encouragers of participation, and elaborators of knowledge. Johnson and Johnson (2013) claim that such roles are crucial for high-quality learning.
- Positive identity interdependence: established through a group name or motto.
- Positive outside threat interdependence: this type of interdependence exists when groups are placed in competition with one another.
- Positive fantasy interdependence: when a certain task is given that requires group members to imagine that they are in a hypothetical scenario, this type of interdependence exists.

2.3.2.1.2. Individual accountability

According to Johnson and Johnson (2013), the purpose of CL groups is to make each member a stronger individual in his or her own right, and group members should be able to complete

similar tasks individually after participating in a cooperative lesson. In order for this to take place, facilitators need to:

- assess each group member's contribution;
- provide feedback to both the group and the individual group members;
- help groups evade redundant efforts by group members; and
- ensure that every group member is responsible for the final result.

Johnson and Johnson (2013) suggest that individual accountability can be structured in the following ways:

- ensuring that groups are small because the smaller the group, the lesser the chance for social loafing;
- giving individual tests to students;
- randomly selecting students to answer questions or to present their work in front of the group or entire class;
- observing and recording the regularity with which each member contributes to the group;
- assigning a student in each group the role of checker; and
- having students do simultaneous explaining by explaining what they have learned to someone else.

Millis (2010) is of the opinion that individual accountability is the most "abused" component of other small-group learning situations (p. 5). Each group member's contribution towards an assignment or a task is taken into account when assigning a group grade and, according to Millis (2010), this prevents "social loafing" (p. 5).

2.3.2.1.3. Face-to-face promotive interaction

Johnson et al. (2008) state that promotive interaction takes place when individuals encourage and facilitate each other's efforts to reach the shared group's goal by:

- giving and receiving both task-related and personal help and assistance;
- exchanging information and other resources;
- giving and receiving feedback on task performance and teamwork behaviours;
- promoting intellectual controversy through challenging each other's reasoning;
- encouraging group members' efforts to achieve, which in turn also increases one's own commitment to do so;
- influencing each other's reasoning and behaviour alike;

- promoting the interpersonal and small-group skills needed for effective teamwork; and
- processing the effectiveness of the group and how it can be improved continuously.

Groups should be structured in such a way that members sit knee to knee in order to establish and ensure promotive interaction (Johnson et al., 2008).

2.3.2.1.4. Interpersonal and small-group skills

It is important to realise that we are not born intuitively knowing how to interact well with others (Johnson & Johnson, 1994). “If children are not taught how to interact appropriately with each other, they are more likely to encounter conflict and difficulties with cooperating as they work in small groups” (Gillies, 2007, p. 41). Johnson and Johnson (2013) state that placing socially unskilled individuals in a group and instructing them to work cooperatively will not be successful. According to Gillies (2007), the following skills can facilitate students’ interactions:

- **Interpersonal skills:** actively listening to one another, expressing ideas freely, accepting personal responsibility for one’s behaviour, and providing helpful criticism.
- **Small-group skills:** taking turns, sharing tasks, trying to understand the other individual’s perspective, and clarifying differences.

Table 2.4 outlines specific examples of the interpersonal and small-group skills as well as how these can be taught (Gillies, 2007, p. 42).

Table 2.4 Examples of interpersonal and small-group skills (Gillies, 2007, p. 44)

Skill	What does it look like?	What does it sound like?
Listening	Eye contact	Yes; I see; Ah! Mm (verbal encouragement)
Stating ideas clearly	Scan group, face group	I think ...; My thoughts are ...
Accepting responsibility	Scan group, face group	I-statements
Giving constructive criticism	Eye contact	I liked that idea, but have you thought that you could do it this way too?
Taking turns	Eye contact, face group	I've had my go ...; It's your turn to have a go.
Sharing tasks	Pass the materials, allocate jobs	Have we all got something?
Understanding others	Appropriate facial gestures	Do you mean ...? Are you saying ...?
Clarifying differences	Eye contact, face group	I'm not sure I understand ...?

Because these interpersonal and small-group skills are required for high-quality cooperation, it should be taught explicitly (Johnson & Johnson, 1994). Getting to know and trust each other, communicating effectively, accepting and supporting each other, and constructively resolving conflicts are actions proposed by Johnson et al. (2008) to be undertaken in order for students to cooperate to achieve their shared goals. Interpersonal and small-group skills not only promote higher achievement, but also contributes to building more positive relationships among group members (Johnson & Johnson, 2013).

2.3.2.1.5. Group processing

The effectiveness of a group is greatly influenced by whether or not the group reflects on how they are managing the processes of learning as well as how well they are functioning as a whole (Gillies, 2007; Johnson & Johnson, 1994). Millis (2010) states that group processing is important for both facilitators and students in order to ensure that the group functions more productively. Facilitators and students need to pay careful attention to the functioning of the group in order to actively take part in making the group more fruitful (Millis, 2010). "It involves students asking such metacognitive questions as: How are we doing? Is there anything else that we should be doing? What could we do differently?" (Gillies, 2007, p. 5). This type of

processing should be learnt by students in order for them to reflect on the roles of the group members as well as to validate each member's contribution (Gillies, 2007). According to Johnson et al. (2008), two types of group processing exists:

- **Small-group processing:** at the end of each class session, time needs to be allocated in order for each cooperative group to process and reflect on how effectively the group members worked together. Describing which member actions were helpful or not in completing the group's tasks, will enable the group to make the necessary decisions about which behaviours need to change. Such processing will ...
 - enable the groups to focus on maintaining healthy work relationships among the members;
 - facilitate the learning of vital cooperative skills;
 - ensure that group members receive immediate feedback on their contribution;
 - ensure that metacognitive and cognitive level thinking take place; and
 - ensure positive behaviours of all group members. It should be emphasised that, in order for small-group processing to be successful, sufficient time must be allocated during class sessions.
 - emphasise positive feedback, maintain student involvement in processing, prompt students that cooperative skills should be used while they process, and communicate the purpose of processing.
- **Whole class processing:** a formal observation sheet may be used to gather specific data on each of the cooperative groups while the facilitator systematically moves from one group to the next. A whole class processing session can then be conducted at the end of the class session. The results of the facilitator's observation sheet are shared with the whole class.

The following sections (2.3.2.2 – 2.3.2.4) contain a discussion of the three different types of CL.

2.3.2.2. Formal cooperative learning

The purpose of formal CL is to ensure that students are actively involved and invested in the intellectual work of organising material, explaining it, summarising it, and integrating it into existing conceptual structures (Johnson et al., 2008). This type of cooperative grouping can last from one class period to several weeks. According to Johnson et al. (2008), the following steps should be taken by a facilitator when conducting a formal cooperative lesson: making pre-instructional decisions, explaining the task and cooperative structure, monitoring and intervening, and assessing, evaluating and processing.

- Making pre-instructional decisions

In order to plan a lesson, the first important step is to know what the lesson aims to accomplish, and consequently to formulate academic and social skills objectives.

Deciding on the group size and assigning students to the various groups are the next important step. For Lou et al. (1996) as well as for Gillies (2007), the optimal group size is three to four members per group. When the group is small, each group member's individual contribution is more visible (Gillies, 2007). Gillies (2007) suggest that the group size depends on the time available, the students' experience with group work, the students' ages, and resources available. Johnson and Johnson (2013) emphasise that the performance of a small group depends on how it is structured. Seong and Hong (2013) note that individuals tend to arrange "themselves and others by categorizing them into distinct social groups on the basis of their identifiable characteristics" in order to reduce the risk of uncertainty. Johnson et al. (2008) are of the opinion that randomly assigning students to groups is the most effective and easiest way to ensure a group's heterogeneity.

Deciding which roles to assign to each member of a group is another action needed for maximising student learning (Johnson et al., 2008). Problems such as one or more members making no contribution towards the task or assignment can be reduced by assigning appropriate roles. Assigning appropriate roles also creates interdependence among group members (Johnson et al., 2008).

Arranging the room in order for all group members to sit face-to-face or knee-to-knee, but still being able to see the facilitator, is another pre-instructional decision for which the facilitator is responsible. Planning and arranging of materials in order to structure and ensure positive interdependence are, according to Johnson et al. (2008), the last of the pre-instructional decisions that the facilitator must make.

- Explaining the task and cooperative structure

During each lesson, the academic task must be explained to the students, the criteria for success must be specified, positive interdependence and individual accountability must be structured, expected behaviours must be explained, and intergroup cooperation must be emphasised.

- Monitoring and intervening

This is done during the lesson by observing students' behaviour, arranging face-to-face promotive interaction, and intervening when necessary to improve task work and teamwork.

- Assessing, evaluating and processing

During this step, the educator provides closure to the lesson, assesses and evaluates both the quantity and quality of achievement, structures group processing, and helps students formulate an improvement plan. Johnson et al. (2008) identify the following as parts of processing:

- feedback entails that every individual in every group as well as the whole class gives and receives descriptive feedback on the success of the task and teamwork;
- students must analyse and reflect on the feedback that they receive;
- the educator must help each student and all groups to set goals for improving their work quality; and
- the group's success and members' hard work should be celebrated.

2.3.2.3. Informal cooperative learning

Sometimes it is necessary for educators to give a short lecture, show a video clip, give a demonstration or have a guest speaker in class. Informal CL can be implemented in order to ensure that the students are cognitively active. These temporary, ad hoc groups can last anything from a few minutes to a whole period. Purposes of informal CL groups are:

- focusing students' attention on the material to be learned;
- setting a mood that encourages learning;
- helping to organise material to be learned cognitively;
- ensuring that students process the material that is being taught cognitively;
- providing closure to an instructional session;
- identifying and correcting misconceptions or gaps in comprehension; and
- personalising the learning experience (Johnson et al., 2008).

2.3.2.4. Cooperative base groups

CBGs (CBGs) are long-term learning groups with a heterogeneous composition. Providing each other with personal and academic support, holding each other accountable for striving to

learn, and ensuring that all members make good academic progress are some of the responsibilities of CBGs (Johnson et al., 2008). Chapter 3 comprises a detailed discussion on this type of CL group, as well as the importance thereof with regard to this study.

2.3.3. Cooperative learning strategies

Cooperative learning strategies (Johnson et al., 2008), also referred to as CL tasks (Gagne & Parks, 2013), CL structures (Kagan, 2001) or CL methods (Kyndt et al., 2013; Slavin, 1983) are class activities that can be used in CL lessons.

Although numerous cooperative learning strategies exist, the researcher will focus primarily on four cooperative learning strategies, explained in Table 2.5 and based on various authors (Abrami et al., 1995; Doymus, 2008; Johnson et al., 2008; Kagan, 2001). Other strategies that can be used in CL lessons, include student team achievement division (STAD), team-games-tournaments (TGT), the round robin technique, the think-pair-share strategy, and numbered heads together (Doymus, 2008; Gagne & Parks, 2013; Johnson & Johnson, 2005; Kagan, 2001; Slavin, 1983).

Table 2.5 Description and benefits of a few cooperative learning strategies (Abrami et al., 1995; Doymus, 2008; Johnson et al., 2008; Kagan, 2001)


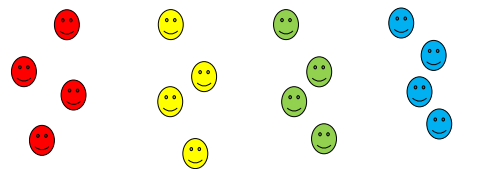

Strategy	Brief description	Benefits for Life Sciences
<p>Jigsaw (Doymus, 2008; Johnson et al., 2008)</p>	<p>Each group member studies a different topic in expert groups and then returns to his or her home group to teach other member.</p> <p>1.Home groups:</p>  <p>2.Expert groups:</p>  <p>3.Home groups:</p> 	<p>Effective alternative to lecturing and individual reading.</p> <p>Positive interdependence is promoted as each member is responsible for a specific section of a topic, and all members need to teach their sections in order for the group to master the topic.</p>

Table 2.5 Description and benefits of a few cooperative learning strategies (Abrami et al., 1995; Doymus, 2008; Johnson et al., 2008; Kagan, 2001) (continued)

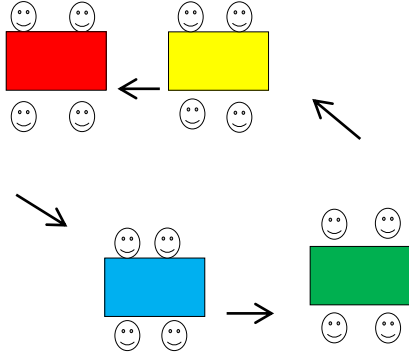


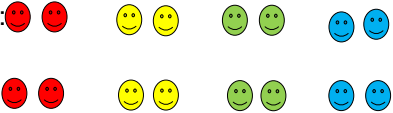
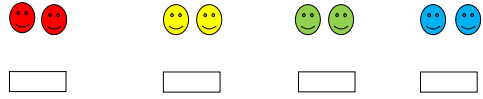
Strategy	Brief description	Benefits for Life Sciences
<p>Cooperative graffiti (Abrami et al., 1995)</p>	<p>Each group is assigned a specific topic. Group members simultaneously write on a single large sheet of paper, as many ideas on a given topic as possible. After a certain amount of time, the groups rotate their papers. Each group then checks the topic and adds on the graffiti.</p> 	<p>Group members get the opportunity to brainstorm aspects of a topic simultaneously.</p> <p>Effective teambuilding activity.</p> <p>Effective eliciting of prior knowledge.</p>
<p>GIG (Johnson et al., 2008)</p>	<p>Procedure for giving a test during which students prepare for the test in a group, take the test individually, and retake the test as a group.</p> <p>Group: </p> <p>Individual: </p> <p>Group: </p>	<p>Optimises each group member's preparation for the test.</p> <p>Makes each group member accountable to his or her peers.</p> <p>Effective assessment of each group member's knowledge.</p> <p>Provides immediate clarification and remediation.</p>

Table 2.5 Description and benefits of a few cooperative learning strategies (Abrami et al., 1995; Doymus, 2008; Johnson et al., 2008; Kagan, 2001) (continued)

Strategy	Brief description	Benefits for Life Sciences
Note-taking pairs (Johnson et al., 2008; Kagan, 2001)	Students are assigned to pairs and instructed to take notes during a lecture/presentation. Every couple of minutes, the lesson is stopped and students are instructed to compare their notes in their assigned pairs. The focus is on increasing the quality and quantity of their notes. 	Teaches students to take better notes and how to review notes more effectively.

According to Kagan (2001), cooperative learning strategies not only increase engagement, but also help students practice skills and build classroom community.

2.3.4. Benefits of cooperative learning

“Cooperative experiences are not a luxury. They are absolutely necessary for healthy development” (Johnson et al., 2008, p. A:20).

According to Tsay and Brady (2010), a few decades of empirical research have recognised the effectiveness and benefits of CL in Higher Education.

Johnson et al. (2008) summarise the outcomes of cooperative efforts under the following three broad categories: effort to achieve, positive interpersonal relationships, and psychological health.

- Effort to achieve

CL not only leads to the achievement of better grades (Johnson et al., 2008; Shimazoe & Aldrich, 2010; Tsay & Brady, 2010) and greater retention (Johnson et al., 2008), but also to the greater use of higher-order thinking and critical thinking skills (Johnson et al., 2008; Millis, 2010; Shimazoe & Aldrich, 2010). After studying students utilising the jigsaw cooperative learning strategy, Lunberg (2003) found that students in cooperative groups, who learned from each other and taught one another, had better academic achievement. Johnson et al. (2008) further states that

CL promotes students' meta-cognitive skills. Greater intrinsic motivation leads to the willingness to take on difficult tasks, and also to persist despite facing possible difficulties (Johnson et al., 2008). This, in turn, results in high expectations for success, a high commitment to achieve, as well as continuing curiosity and interest in learning (Johnson et al., 2008; Shimazoe & Aldrich, 2010). Greater group interaction, which leads to creative thinking and the generation of new ideas and solutions is, according to Johnson et al. (2008), an important outcome of cooperative efforts. A study done by Cavanagh (2011) showed that CL not only improved students' understanding of the content, but also improved their interest during class sessions. The active participation of students lead to students having positive attitudes (Johnson et al., 2008) as well as being more motivated and prepared for class sessions (Cavanagh, 2011). Snowman and Biehler (2003) are of the opinion that inter-ethnic friendships and the enhancement of language acquisition, among linguistically diverse students, are promoted through CL. Greater transfer of learning from one situation to another takes place through cooperative efforts, therefore "what individuals learn in a group today, they are able to do alone tomorrow" (Johnson et al., 2008, p. A:16).

- Positive interpersonal relationships

CL promotes positive relationships among group members which, in turn, results in lower absenteeism and fewer members dropping out of groups (Johnson et al., 2008). Johnson and Johnson (2008a) suggest that minimising the use of competitive and individualistic learning and maximising the use of CL groups, are the best practices for promoting positive relationships among students. The possibility of bullying occurring will be reduced when students are working cooperatively together (Johnson & Johnson, 2008a). Committing to each other's learning and success, liking each other, as well as giving and receiving social support are some of the outflows resulting from positive peer relationships. Social support, personal as well as academic, "tends to promote achievement and productivity, physical health, psychological health, and successful coping with stress and adversity" (Johnson et al., 2008, p. A:19). According to Schul (2011), cooperative efforts result in students respecting each other's opinion, therefore students learn to negotiate peacefully. Gillies (2007) states that students not only listen to what others have to say during CL situations, but also learn to share their own ideas and perspectives. Giving and receiving help, seeking ways of resolving difficulties, and actively working to construct new understanding are also benefits mentioned by Gillies (2007). Patrick, Bangel, Jeon, and Townsend (2005) are of the

opinion that all levels of students can benefit from CL activities if a higher level of thinking is required. Higher-level thinking in which group members need to discuss and brainstorm their ideas with one another, will result in greater interaction (Patrick et al., 2005).

- Psychological health

According to Johnson et al. (2008), the psychological health of students includes the following indices: self-esteem, self-efficacy, personal control and confidence in one's competencies. Psychological health refers to the ability that a student not only has to develop and maintain interdependent relationships, but also to modify these relationships appropriately in order to achieve goals. Johnson et al. (2008) indicate that cooperative efforts result in greater psychological health. In order for students to manage social interdependence, they not only need to recognise the presence or absence of interdependence, but also to identify whether such interdependence is positive or negative. Thereafter, students need to be motivated accordingly in order to "act in ways that are consistent with normative expectations for appropriate behaviour within the situation" (Johnson et al., 2008, p. A:19).

It is important to realise that the above-mentioned outcomes, as summarised by Johnson et al. (2008), have an influence on each other. Students will work harder to achieve mutual goals if friendships are caring and committed. Furthermore, the psychologically healthier students are, the better they will work together to achieve mutual goals, and the more caring and committed the relationships tend to be (Johnson et al., 2008).

Besides the well-documented benefits of CL for students, facilitators seem to benefit from cooperative efforts as well. According to Shimazoe and Aldrich (2010), CL not only gives facilitators more time to reflect on how well students are learning, but also reduces the grading load. Millis (2010) is of the opinion that CL helps facilitators to foster learning as well as positive outcomes, such as respect for others and increased self-esteem. Large, diverse classes can be transformed into communities of supportive teams by making use of CL (Millis, 2010).

2.3.5. Challenges of cooperative learning

Despite the well-documented benefits of CL, Gillies and Boyle (2011) state that many educators are still reluctant to implement CL and to switch roles from that of an educator to that of a facilitator. Sharan (2010) is of the opinion that misconceptions about CL as well as the careful planning, monitoring and evaluation required for successful implementation, may well make incorporating CL into practice more complicated than anticipated. Together with the challenges CL poses to the facilitator's control of the learning process, the personal commitment facilitators

have to make to sustain their efforts, contributes towards the reluctance towards implementation of CL. In order for the widely attributed benefits of CL to be realised, Gillies and Boyle (2011) state that group activities need to be well planned, students need to be prepared for working in groups, and the facilitator's expectations for the activities have to be stated explicitly.

Because the essence of CL is the grouping of students into small groups, Gillies (2007) states that the grouping of diverse students may pose a problem. "Lower achievement, close minded rejection of new information, divisiveness, scapegoating, bullying, stereotyping, prejudice, and racism" are some of the negative outcomes of diversity among students (Gillies, 2007, p. 2). Placing students in groups that are not truly cooperative, inadequate monitoring, groups that are too large, as well as the overuse of CL are, according to Johnson and Johnson (2013), negative results from the incorrect implementation of CL.

Even though groups outperform individuals, especially when multiple skills, judgments and experiences are required (Johnson et al., 2008), many educators are still hesitant to implement CL (Gillies & Boyle, 2011). It is known that perceptions of unfairness may occur if the lowest performing members of a group receive the same grade as the highest achieving members (Baker & Campbell, 2005), therefore some students prefer working alone. Although this may lead to frustration within the group, these challenges are not impossible to overcome (Baker & Campbell, 2005) and if positive interdependence and individual accountability are correctly implemented, this should not be a problem. The influence that educators, acting as facilitators, have over many of the variables that affect the successfulness of CL is of great value.

2.4. Self-directed learning and cooperative learning: the inference

Guglielmino (1978) describes a highly self-directed learner as:

one who exhibits initiative, independence, and persistence in learning; one who accepts responsibility for his or her own learning and views problems as challenges, not obstacles; one who is capable of self-discipline and has a high degree of curiosity; one who has a strong desire to learn or change and is self-confident; one who is able to use basic study skills, organize his or her own time, set an appropriate pace for learning, and develop a plan for completing work; one who enjoys learning and has a tendency to be goal-oriented (p.73).

From this description and others previously discussed (see 2.2.4), it is clear that the following attributes form part of the profile and repertoire of a self-directed learner:

- takes initiative;
- may or may not utilise the help of others;

- diagnoses own learning needs;
- formulates own learning goals;
- identifies and selects own resources;
- chooses appropriate learning strategy;
- evaluates learning outcomes;
- takes responsibility for own learning;
- asks appropriate questions in order to guide own learning effectively; and
- possesses interpersonal skills.

Which role does the use of CL then play in the development of a self-directed learner? CL, taking place within a cooperative environment, occurs when students work together in small groups in order to maximise all group members' learning experience (Johnson & Johnson, 2013). As previously discussed (see 2.3.4), making use of CL groups, will result in students having:

- high academic achievement;
- improved interpersonal and social skills;
- increased critical thinking;
- higher-level thinking and reasoning;
- increased intrinsic motivation;
- continuing curiosity;
- the ability to give and receive help;
- positive attitudes towards learning; as well as
- the ability to reflect on learning.

Johnson and Johnson (2008b) claim that, if students are facilitated to find their own answers and discover solutions to problems, in-depth comprehension and understanding, as well as long-term retention of knowledge will be improved. This, together with the development of higher-level thinking skills, intrinsic motivation, interpersonal skills, as well as critical thinking skills, fits the profile of a self-directed learner (Barry & Rees, 2006; Guglielmino, 1978; Warburton & Volet, 2012; Williamson, 2007).

2.5. Summary

The aim of this chapter was to discuss the relevant self-directed learning and cooperative learning literature. The groundwork of self-directed learning and cooperative learning was explained, and important concepts clarified. The role that both the facilitator and student plays in self-directed learning, as well as instruments used for measuring self-directed learning

readiness, were discussed. This chapter also contains a discussion of the three types of cooperative learning, the five basic elements of cooperative learning, as well as some cooperative learning strategies. Benefits and challenges of cooperative learning were also outlined. This chapter concludes with linking self-directed learning and cooperative learning.

CHAPTER 3

COOPERATIVE BASE GROUPS: ACADEMIC ACCOUNTABILITY AND PERSONAL SUPPORT

3.1. Introduction

As previously discussed in Chapter 2, cooperative base groups (CBGs) is one of the three types of cooperative learning groups, and this chapter reports on a literature review of CBGs. In order to set the backdrop needed for answering the first five research sub-questions (Chapter 1), attention will be given to the different types of long-term groups, as described under diverse headings in CL and group work literature. The characteristics of CBGs and their purpose is discussed. A detailed discussion will be given regarding the respective roles and responsibilities of facilitators and students when implementing CBGs.

3.2. Concept clarification

Whilst Johnson et al. (2008) make use of the term **cooperative base groups** (CBGs) to describe groups of students working together for long periods of time, the terms **study teams** (Davis, 1993), **study groups** (Zevenbergen, 2004), **out-of-class study groups** (Rybczynski & Schussler, 2011), and **out-of-class academic collaboration** (Jacobs, 2013) are used in literature to describe related student groupings. **Team-based learning** (Parmelee et al., 2012) is another type of student group with long-term membership, which involves pre-class preparation and in-class discussions of permanent groups of five to seven students (Parmelee et al., 2012). According to Michaelsen and Sweet (2011), the following four elements are at the core of team-based learning: strategically formed, long-term groups; four-step readiness assurance process; application activities; and formative and summative feedback through peer evaluation. A clarifying lecture is given after the fourth step in the readiness assurance process to address aspects that students do not yet understand. When using Petty's (2006) definition of team-based learning, Michaelsen and Sweet (2011) highlight the fact that team-based learning can be classified as a type of CL.

Table 3.1 presents a summary of study groups, out-of-class study groups, study teams, out-of-class academic collaboration, team-based learning, as well as CBGs, and will be discussed subsequently.

Small groups of students, with long-term and stable membership, meeting regularly to provide each other with academic support, are the characteristics that the above-mentioned

student groupings all have in common (Davis, 1993; Jacobs, 2013; Johnson & Johnson, 2013; Parmelee et al., 2012; Rybczynski & Schussler, 2011; Zevenbergen, 2004). All of these groups meet on a regular basis in order to discuss and study course material for tasks, tests and exams. Although literature is not specific about the optimal amount of time to be spent in these groups, Shaw (2011) suggests that a period shorter than six weeks will minimise group bonding and learning. Various authors state that groups can stay together for at least a semester or a year, or for as long as the duration of a module/course (Johnson et al., 2008; Parmelee et al., 2012). Spending many hours working together, depending on each other and supporting one another will, according to Johnson et al. (2008), develop long-term, committed and caring relationships. Lipson Lawrence (2002) states that the establishment of a community, which in turn aids the development of strong bonds amongst students, is developed when students work together for a lengthy period of time.

Table 3.1 Summary of various types of long-term student groups

Characteristics	Team-based learning	Study teams	Study groups	Out-of-class study groups	Out-of-class academic collaboration	Cooperative base groups
Membership	Long-term, stable membership					
Group size	Small groups					
Structure	Formal		Informal		Formal	
Group formation	Strategically formed by facilitator	Randomly selected or self-formed	Self-formed		Selected by facilitator or self-formed	Randomly selected

Table 3.1 Summary of various types of long-term student groups (continued)

Characteristics	Team-based learning	Study teams	Study groups	Out-of-class study groups	Out-of-class academic collaboration	Cooperative base groups
Meetings	In class and outside of class	Outside of class				In class or outside of class
Support provided	Academic support					Academic and personal support
Cooperative learning elements	<ul style="list-style-type: none"> • Positive interdependence • Individual accountability • Small-group skills 	No elements specified		<ul style="list-style-type: none"> • Small-group skills • Group processing 	<ul style="list-style-type: none"> • Positive interdependence • Individual accountability • Small-group skills • Face-to-face promotive interaction • Group processing 	

Because students in study groups or out-of-class study groups usually do not get any information on how to function effectively, and because they are not directed by the facilitator, these two groups have an informal structure. Team-based learning, study teams, out-of-class academic collaboration and CBGs are known to have a formal structure because of the facilitator's role in forming and directing these groups. It should be made clear, however, that out-of-class academic collaboration can either be formally or informally structured, depending on whether the groups are institutionally, facilitator-, or student-initiated (Jacobs, 2013). Certain academic tasks may also be utilised by the facilitator in order to ensure that these groups are functioning optimally (Davis, 1993; Johnson & Johnson, 2013). Long-term student groups with an informal structure are self-formed without the aid of a facilitator (Rybczynski & Schussler, 2011; Zevenbergen, 2004).

In the case of formally structured long-term student groups, students can either be randomly selected by the facilitator or the groups may be self-formed (Davis, 1993; Jacobs, 2013; Johnson & Johnson, 2013). Davis (1993) is of the opinion that students should be randomly selected by the facilitator when classes are big, and in smaller classes, students should be able to select the groups themselves, whilst Parmelee et al. (2012) feel strongly about not letting students self-select their groups. In order to ensure the heterogeneity of the group, Johnson and Johnson (2013) suggest random selection of students by the facilitator. In the case of team-based learning, it is recommended that facilitators ensure that each group is as diverse as possible and that the assignment process is a transparent process (Parmelee et al., 2012). Jacobs (2013) states that facilitators should have input into the formation of heterogeneous groups, either by dividing the students into groups or by explaining to them the reasons for heterogeneous grouping and allowing them to form their own groups. Although literature on all of the discussed long-term student groups states that these groups provides their members with academic support, a CBG is the only grouping that also provides personal support to its members (Johnson & Johnson, 2013). Because students also meet outside of class, one cannot help but wonder whether there is not a degree of personal support involved within team-based learning groups, study groups, out-of-class study groups, study teams and out-of-class academic collaboration.

As previously discussed (see 2.3.2.1), positive interdependence, individual accountability, small-group skills, face-to-face promotive interaction, and group processing are the heartbeat of CL. Because of the informal structure of both study groups and out-of-class study groups, none of the CL elements are specified in these two types of long-term student groups. Because of their formal nature, team-based learning, study teams and out-of-class academic collaboration, therefore, contain some of the CL elements, whilst CBGs contain all of the elements. Because team-based learning involves individual tests of pre-class preparation, followed by team tests

and peer evaluation, the following three CL elements are present: positive interdependence, individual accountability and social skills (Parmelee et al., 2012). According to Davis (1993), small-group skills, positive interdependence and individual accountability are the CL elements present within study teams. Being able to listen with understanding, helping each other in mastering the course material, giving and receiving constructive criticism, and managing differences are small-group skills that study teams need in order to function successfully (Davis, 1993). When group tasks require interdependence, students will perceive that each member has a responsibility towards the other members, and that the members are dependent on each other (Davis, 1993). Parmelee et al. (2012) further state that the better the group members work together, the better the individual and group scores will be. To ensure positive interdependence, Davis (1993) suggests that the tasks given to a study team group should be structured in such a way that all group members make an equal contribution and that the division of labour is fair. In the case of out-of-class academic collaboration, the presence of small-group skills, face-to-face promotive interaction, and group processing depends on whether the group is initiated by the facilitator or self-formed by the students (Jacobs, 2013). According to Jacobs (2013), students can learn how to work together in either a special course or as part of a fixed course in order to promote the development of small-group skills. Face-to-face promotive interaction among students can be ensured by providing facilities that are exclusively set aside for out-of-class academic collaboration, and where such facilities are fitted out with hook-up points for a variety of electronic devices. Jacobs (2013) argues that group processing not only indicates to the students that the facilitator values out-of-class academic collaboration, but also enables students to improve their own out-of-class academic collaboration experiences. Highlighting the positive contributions of each group member and developing skills necessary for constructive feedback, are according to Parmelee et al. (2012), an important aspect of team-based learning. CBGs are the only type of long-term student group that does not contain only some of the CL elements, but all of them (Johnson et al., 2008).

Because CBGs provide both academic and personal support, and have all five essential elements embedded, the focus of the current investigation was on CBGs and the implementation thereof. In the following section (see 3.3), a closer look is taken of the purpose and characteristics of CBGs. As efforts to locate empirical studies done on the implementation of CBGs produced scant literature, subsequent sections rests heavily on the work of David W. and Roger T. Johnson.

3.3. Purpose and characteristics of cooperative base groups

As previously mentioned (see 3.2), the main purpose of CBGs is not only to provide academic support, encouragement and assistance to members for the completion of given tasks; to hold

the members of the group accountable for the goals set by the group; and to ensure that all the group's members are developing academically (Johnson et al., 2008), but also to provide personal support to each member of the group as well (Johnson & Johnson, 2013).

Both academic and personal support, provided by the members of a CBG, stem from the close relationships between CBG members (Johnson et al., 2008). According to Johnson et al. (2008), academic and personal support are collectively known as social support, and refer to the emotional concern, instrumental, informational and appraisal aid available to individuals. The presence of social support will lead to increased achievement and productivity, as well as persistence in tasks that are perceived as challenging (Johnson et al., 2008). The greater the social support within CBGs, the less the members will perceive situations as being stressful and according to Johnson et al. (2008), individuals involved in caring and close relationships live longer and get sick less often resulting in better physical and psychological health. Bertucci, Conte, Johnson, and Johnson (2010) point out, however, that social support within a CBG does not develop without time and effort. Specific actions taken by the members of a CBG in order to provide academic and personal support to its members will be discussed in a subsequent section on the responsibilities of the student (see 3.4.2). The absence of relationships within a CBG will lead to a lack of social support, and "without a sense of belonging, acceptance, and caring resulting from cooperative efforts of others, students can remain isolated and vulnerable" (Johnson et al., 2008, p. 4:11). According to Johnson et al. (2008), a CBG is an important tool for encouraging academic values, as well as for the development of caring and dedicated relationships.

CBGs are divided into two types, depending on the duration of the group, namely school CBGs and class CBGs (Johnson et al., 2008). Individuals in school CBGs stay together for at least a semester or a year, but preferably even longer. These groups meet once or twice a week in order to:

- re-establish personal contact;
- check to see that no one is experiencing unnecessary stress;
- check to see if members are keeping up with their work;
- review the work that has been done; and
- provide positive feedback to each other.

Class CBGs stay together for the duration of a module or course, and meet either at the beginning or end of each class, or at the beginning of the first session of a week and at the end of the last session of that week (Johnson & Johnson, 2013; Johnson et al., 2008). The members of class CBGs are expected to exchange contact details and class schedules, in case they would want to meet outside of class (Johnson et al., 2008).

Although CBGs occurring within a tertiary institution are referred to in the literature as 'school base groups', the base groups implemented within this study were for the duration of a Life Sciences module at a tertiary institution. For the purpose of this study, therefore, the **term cooperative base group** (CBG) referred to the long-term grouping of tertiary students, providing academic and personal support to its members for the duration of a module.

3.4. Implementation of cooperative base groups

The facilitator's planning and pre-instructional decisions determine the success of CBGs (Johnson & Johnson, 2013). Not only will these procedures be discussed in detail within the subsequent sections, but the responsibilities of the students within CBGs will also be addressed

3.4.1. The role of the facilitator

Facilitators need to carry out specific tasks and take up certain responsibilities in order to set the stage for implementation of CBGs (Crowe & Hill, 2006; Felder & Brent, 2007; Johnson & Johnson, 2009b; Sharan, 2014). Making pre-instructional decisions, explaining the task and cooperative structure, monitoring and intervening, and assessment, evaluation and processing, are the responsibilities of a facilitator within a general CL environment (as discussed in 2.3.2.2). Roles of the facilitator, outlined by Johnson et al. (2008) specifically for the implementation of CBGs, are:

- forming groups;
- scheduling time for meetings;
- creating specific documentation;
- ensuring the presence of the CL fundamentals; and
- orchestrating group processing.

The abovementioned aspects forms part of the planning of the facilitator, and will be discussed in the following sections.

3.4.1.1. Planning

The facilitator needs to decide on the number of students allocated to a CBG. Various authors suggest that groups should consist of a maximum of four, as small groups will make it more difficult for students to hide and not to participate (Davis, 1993; Gillies, 2007; Johnson & Johnson, 2013; Shaw, 2011). Small groups will ensure greater interaction among members, leading to greater group cohesion and an increase in personal support provided. Active and equal participation is certain in small groups (Davis, 1993; Felder & Brent, 2007; Johnson &

Johnson, 2013), and, according to Davis (1993), the skilfulness of the group members should also be taken into account when deciding on the group size, as less skilled members necessitate smaller groups.

Once the size of the CBGs has been decided, the composition of the groups and the procedure of assigning students to their groups must be planned. According to Johnson and Johnson (2013), CBGs should be maximised in terms of academic skills, race, personality, social skills and gender. In addition, Baer (2003) states that heterogeneous groups promote intergroup relations. Heterogeneity not only establishes bonds between students from a variety of backgrounds, but also aids the development of small-group skills and attitudes, and gives the students access to a variety of perspectives (Jacobs, 2013). Being exposed to diverse problem-solving approaches, generating greater cognitive disequilibrium, increased quality of reasoning, as well as increased accuracy of long-term retention are added advantages of heterogeneous CBGs (Johnson & Johnson, 2013). In order to ensure heterogeneity within the CBG, Johnson and Johnson (2013) advocate that students should be randomly assigned to groups. Oakley, Felder, Brent, and Elhadj (2004) indicate how the use of a 'getting-to-know-you' form aids the formation of heterogeneous groups, as the form requires not only biographic information but also academic and personal aspects. Although literature states that students should be assigned to groups instead of being given the opportunity to decide on their membership (Baer, 2003; Baker & Campbell, 2005), Jacobs (2013) suggests that facilitators could, alternatively, explain the benefits of heterogeneous groups to students and then allow them to establish their own groups.

Because CBGs should meet regularly, either at the beginning or at the end of each class or session, or at the beginning or end of each week, the facilitator needs to set sufficient time aside for these meetings. According to Johnson et al. (2008), this will ensure that the caring and committed relationships created, provide the social support necessary for improved attendance and increased academic achievement. Standard documentation that students will use during each meeting, includes the following: self-disclosure, administrative, academic, and closing tasks (see 4.4.1). All of these tasks, as well as the sequence in which it should to be dealt with within the CBGs, are specified on an agenda (Johnson et al., 2008). Agendas are prepared by the facilitator and handed out to each CBG at the beginning of the meeting to ensure that the groups know what is expected of them.

Because the five CL elements are the heartbeat of CL, ensuring that these elements are present is an important aspect that needs the facilitator's attention when planning to introduce CBGs. Table 3.2 depicts a summary of possible ways in which to ensure the presence of

positive interdependence, individual accountability, face-to-face promotive interaction, small-group skills, and group processing.

Table 3.2 Ways of ensuring the presence of the cooperative learning elements within cooperative base groups

Cooperative learning element	Ensuring its presence within CBGs
Positive interdependence	Assigning roles (Felder & Brent, 2007; Johnson et al., 2008) Team-building activities (Crowe & Hill, 2006) Limited resources per group (Johnson et al., 2008) CBG folder (Johnson et al., 2008) Group contracts (Crowe & Hill, 2006; Johnson et al., 2008)
Individual accountability	Assigning roles (Crowe & Hill, 2006; Johnson & Johnson, 2013; Johnson et al., 2008) CBG folder (Johnson et al., 2008) Group contracts (Crowe & Hill, 2006; Johnson et al., 2008) Individual tests and quizzes (Shadle, 2010)
Face-to-face promotive interaction	Small groups (Felder & Brent, 2007; Johnson & Johnson, 2013) Permanent meeting place (Johnson & Johnson, 2013)
Small-group skills	Value of small-group skills (Sharan, 2014) Conflict management tools (Felder & Brent, 2007)
Group processing	Time for and method of reflection (Johnson et al., 2008; Sharan, 2014)

The facilitator can ensure that positive interdependence among members is being strengthened by assigning roles to each group member (Felder & Brent, 2007; Johnson et al., 2008). These roles vary and may include a reader, runner, observer, encourager of participation, a checker of understanding, and a coordinator (Felder & Brent, 2007; Johnson et al., 2008). Because each group member will make a unique contribution to the group through his or her specific role, positive interdependence will be promoted and social loafing will be eliminated. According to Johnson et al. (2008), the structuring of positive goal interdependence will ensure that group

members recognise that they cannot succeed unless all the other group members succeed as well, therefore strengthening positive interdependence among members of CBGs. Team-building activities are, according to Crowe and Hill (2006), a strategy used by facilitators to build team spirit, implying that group identity is established and positive interdependence reinforced. By limiting the resources made available for each CBG, facilitators will ensure that group members share the resources. In doing so, group members will have different expertise leading to positive interdependence amongst group members (Johnson et al., 2008). Johnson et al. (2008) suggest that each CBG create its own base group folder, which will not only offer direct communication between students and the facilitator, but will also enable the group to manage their documentation. Instructing members to create a group name or motto will aid the structuring of individual accountability, as it helps build group identity. Crowe and Hill (2006) state that requiring written contracts will ensure that members know who will be responsible for which tasks in order for deadlines to be reached. This will therefore promote positive interdependence through members holding each other accountable.

Assigning roles to group members, requiring file folders and written contracts can also be utilised by facilitators to ensure the presence of individual accountability (Crowe & Hill, 2006; Johnson & Johnson, 2013; Johnson et al., 2008). The forming of a small CBG, makes each member more accountable for his or her actions and responsibilities because students' visibility is increased (Johnson et al., 2008). Tests and quizzes can be used to keep students within the CBGs individually accountable for their own work (Shadle, 2010).

Promotive face-to-face interaction is established through keeping the size of the CBGs small, and providing a permanent place for the CBGs to meet (Johnson & Johnson, 2013).

While ensuring that small-group skills are present within the CBGs, the facilitator should help students realise the value of the skills, and encourage the use thereof. According to Johnson et al. (2008), small-group skills can be divided into the following categories: skills that aid the formation of groups, the functioning of groups, the formulation of knowledge, as well as thinking and reasoning. Gillies (2014) lists behaviours included in the small-group skills that are necessary for successful group work. These behaviours include:

- the ability of group members to listen actively to each other during discussions;
- being able to consider other group members' ideas and perspectives;
- the ability to provide constructive criticism to the ideas of fellow group members;
- being able to share resources; and
- the ability to take turns.

Johnson et al. (2008) suggest a checklist for social skills that needs to be prepared by the facilitator and given to the CBGs periodically. According to Felder and Brent (2007), providing tools that will enable group members to manage conflicts within a CBG, will help students develop small-group skills.

Facilitators should structure group processing by allocating sufficient time for group members to reflect on their experiences in working together, as well as providing techniques for students to use while discussing their group's effectiveness (Crowe & Hill, 2006; Johnson et al., 2008; Sharan, 2014). According to Sharan (2014), group processing involves looking back on how group members worked together, as well as looking ahead in order to "plan and set goals for the best ways they can continue working together" (p. 806).

3.4.1.2. Introducing cooperative base groups to your audience

Once all the planning is done, the facilitator needs to introduce CBG to the students. Although literature on CBGs does not explicitly mention or discuss the manner in which CBGs should be introduced to the students, Johnson and Johnson (2013) discuss how the task and cooperative structure should be explained to students in cooperative settings. Aspects of such settings that are applicable to CBGs will be highlighted.

Oakley et al. (2004) explain that the first day of class is used for announcing and explaining group work and the necessity thereof as students do not know instinctively how to work in groups. Explaining what the academic task is, what needs to be done in order to complete the task, and how to do it are identified by Johnson and Johnson (2013) as aspects that the facilitator needs to pay attention to when implementing CL. Upon discussing the steps to be followed when making use of team-based learning, Parmelee et al. (2012) state that students are oriented by means of a summary about team-based learning. This brief summary is given to the students to read out of class and is part of their preparation for an orientation session. Just as students might not know how to work well in groups (Nuhfer, 2010), they may also not know how to complete the self-disclosure, administrative, academic, and closing tasks crucial to CBGs.

Nuhfer (2010) emphasises the fact that facilitators need a good plan for the first day of class, as the students' expectations for the whole period of working together will be determined by the tenor that is set initially. Explaining good group dynamics is, according to Crowe and Hill (2006), an important role of the facilitator. From the beginning, groups need to know what happens during each of the group performance phases. Crowe and Hill (2006) identify the four phases as forming, norming, storming and performing. Facilitators need to explain to the members that they are going to get to know each other during the forming phase by sharing

personal information and writing a contract. According to Stetson (2003), the facilitator can reduce the anxiousness and uncertainty of the students by explaining the purpose of the CBG and by modelling the expected behaviours. When the group members strive to meet each other's expectations, the norming phase is taking place. During the norming phase, trust is also built through meeting the set expectations of the group and its members. If facilitators model active listening skills, foster an atmosphere of trust, and provide team-centred learning, the development of the norming phase is encouraged (Stetson, 2003). If one or more of the group's members do not live up to their contracts by not meeting a deadline or by submitting work of a low standard, the group will enter the storming phase. Conflict among group members can, according to Stetson (2003), be reduced by listening to all the members' viewpoints and through acknowledging that the conflict faced is an opportunity for the CBGs to improve. The facilitator needs to explain to the group that this phase is normal, and as soon as the group works past its conflicts, members enter the performing phase. During the performing phase, group members overcome their adversities, leading to strong group performance (Crowe & Hill, 2006). According to Stetson (2003), good communication skills, commitment to the CBG, and high group morale are a few behaviours that can be expected by the CBGs in the performing phase. Providing students with a couple of precautionary notes on group functioning and possible problems within the group provides, according to Oakley et al. (2004), guidance to students. To aid the continuous success of the CBGs, Stetson (2003) recommends that facilitators provide feedback on group functioning and focus on task accomplishments and interpersonal support.

3.4.1.3. Observing and intervening

Observing students' behaviour and interactions, providing task assistance, and intervening to facilitate the learning of small-group skills, are identified by Johnson and Johnson (2013) as specific roles for which the facilitator is responsible when implementing CL. Although these roles are not specifically allocated to facilitators implementing CBGs, as previously discussed (see 3.3 & 3.4.1.1), it is known that students within CBGs interact with each other in order to complete certain set tasks and develop social skills (Johnson et al., 2008). Therefore it is crucial that the facilitator observe the interactions as well as the use of small-group skills among members of the CBGs in order to intervene if and when needed (Johnson & Johnson, 2013). The term **monitor** is defined by Johnson and Johnson (2013) as continuously checking, therefore it is suggested that the facilitator observe during every lesson (Johnson et al., 2008). Johnson et al. (2008) state that the observations made by the facilitator determine whether or not any formal intervention will take place. The following are a number of guidelines for facilitators who consider intervening for the improvement of small-group skills:

- decide whether it is best to stop the group for immediate intervention, or to wait until group processing;
- decide whether the problem is group-specific or generic to all groups, as this will determine single group or whole class intervention;
- show the group members or whole class the data collected through the observation, and have students identify the problem and where possible, three possible solutions;
- have the group members decide which solution they are going to implement first; and
- have students go back to their work (Johnson et al., 2008).

Because group members' small-group skills need to improve continuously, facilitators have to engineer processes through which students can assess their effectiveness as a CBG creatively, and plan on how to improve it (Johnson et al., 2008).

3.4.1.4. Assessment and evaluation

According to Johnson et al. (2008), the first step facilitators take when structuring group processing is ensuring that each group member receives positive feedback on the quality of his or her small-group skills. The facilitator can allocate sixty seconds to each CBG member, during which he or she has to identify three things that the other group members did to help the members learn or function effectively as a CBG. A positive feedback form on which each member comments on how well each of the other members used the small-group skills can be provided to each CBG. Each member completes the following statements:

- "I appreciate it when you ..."
- "I admire you for ..."
- "I enjoy it when you ..."
- "You really helped the group when you ..." (Johnson et al., 2008, p. 9:6).

Sharan (2014) suggests that a reflective discussion takes place through questions that the facilitator asks the group members. Questions may include the following:

- "What did the group do well today?"
- "What did you find difficult?"
- "How can you improve how you get along?" (Sharan, 2014, p. 806).

Parmelee et al. (2012) advocate that peer evaluation consists of both a qualitative and quantitative component, enabling students to evaluate each group member's contribution while

practicing giving constructive feedback. It should be stated that group processing is equally important to the facilitator, as it enables the facilitator to direct his or her practice (Sharan, 2014) and/or influences his or her decision to intervene (Johnson et al., 2008).

3.4.2. The responsibilities of the student

Because CBGs provide academic and personal support to its members (Johnson et al., 2008), and because of the documentation necessary for ensuring the presence of both academic and personal support (as discussed in 3.4.1), it is not surprising that the student too has a vital role to play within his or her CBG.

Although literature fails to describe the specific roles that students need to play within their CBGs, Johnson et al. (2008) highlight the following as the primary responsibilities of CBG members:

- providing each other with support and encouragement necessary for completing tasks;
- holding each other accountable for taking part in the learning process; and
- making sure that all members are succeeding academically.

This is done by dealing with academic support tasks, personal support or self-disclosure tasks, routine or administrative tasks, as well as assessment and evaluation of closing tasks (Johnson et al., 2008).

When using academic support tasks, the group members should take responsibility for each other's academic progress by making sure that all members of the CBGs are achieving. This can be done by encouraging each other to complete assignments, checking to see if there are members requiring assistance in completing an assignment or project, preparing together for upcoming assessments, as well as discussing assignments and missed or misunderstood information (Johnson et al., 2008). Personal or self-disclosure tasks aid the formation of interpersonal relationships that are needed for personal support. Sharing something personal with the rest of the CBG, listening sympathetically to the problems of group members, and helping each other to solve non-academic difficulties (such as personal problems) are some of the responsibilities that students have within their CBGs for providing personal support (Johnson et al., 2008). Routine or administrative tasks provide structure to the group, and each member has a responsibility to complete specific documentation as stipulated by the agenda. Filling in the attendance register and the mark sheet should be done by the members of each CBG (Johnson et al., 2008). With the assessment and evaluation of closing tasks, each group member takes up the responsibility to provide feedback on how well the group is functioning

and the possible reasons for the group's performance (Johnson et al., 2008), thus honest and constructive feedback is crucial (Parmelee et al., 2012).

Figure 3.1 aims to illustrate the comparison of CBGs with an umbrella, shielding its members against academic and non-academic difficulty, therefore providing academic and personal support (Johnson et al., 2008).

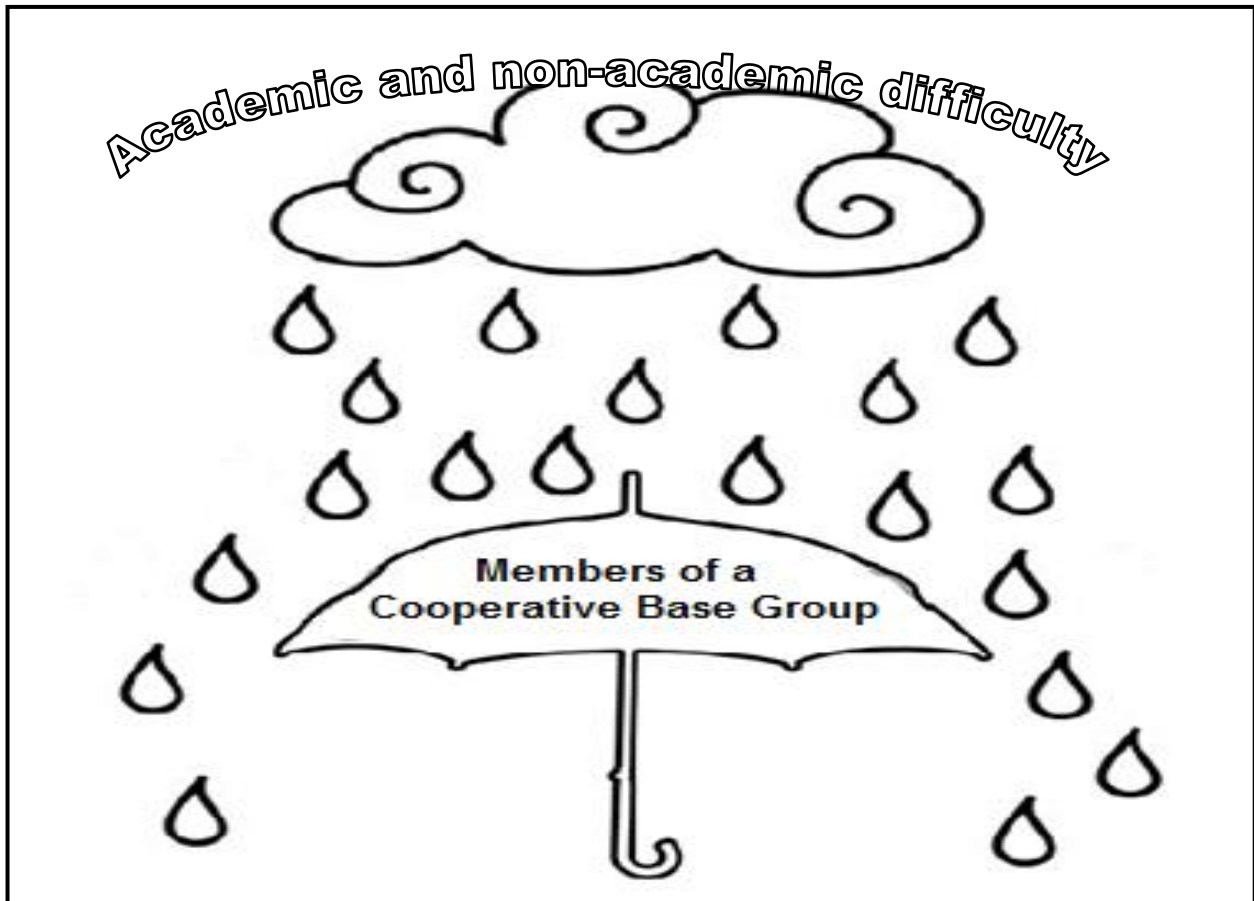


Figure 3.1 Responsibilities of cooperative base group members within their groups

Just as an unopened umbrella will be of no use on a rainy day, it is merely not enough for students to attend CBG meetings without participating actively. As previously indicated (see 3.4.1.1), Johnson et al. (2008) are of the opinion that committed and caring relationships will develop among group members through regularly scheduled meetings. This implies that students have a responsibility to attend these meetings. Because standard documentation (see 3.4.1.1) needs to be dealt with during each CBG meeting, it is equally important for students to participate actively within their CBGs. Through active participation when completing the various tasks planned and set by the facilitator, students will be able to support the CBGs by assisting each other with academic and non-academic difficulties.

The five basic CL elements within the CBGs act as the waterproof material that will protect the students. If students do not take up their responsibility towards the group members, the CBGs

will not be able to shelter its members against academic and personal difficulties. Table 3.3 contains a summary of roles and responsibilities of students in order to ensure the continued existence of positive interdependence, individual accountability, face-to-face promotive interaction, small-group skills, and group processing.

Table 3.3 Roles and responsibilities of students to ensure continued existence of the cooperative learning elements within their cooperative base groups

Cooperative learning elements	Ensuring its continued existence within CBGs
Positive interdependence	<p>Taking up assigned roles (Felder & Brent, 2007; Johnson et al., 2008)</p> <p>Actively participating in team-building activities (Crowe & Hill, 2006)</p> <p>Sharing resources (Johnson et al., 2008)</p> <p>Participating in compiling file folder (Cottell, 2010; Johnson et al., 2008)</p> <p>Participating in selecting group name/motto (Johnson et al., 2008; Robinson & Cooper, 2010)</p> <p>Participating in setting of group contracts (Johnson & Johnson, 2013)</p> <p>Clarifying miscommunication (Johnson & Johnson, 2013)</p> <p>Participating in effective decision-making (Johnson & Johnson, 2013)</p>

Table 3.3 Roles and responsibilities of students to ensure continued existence of the cooperative learning elements within their cooperative base groups (continued)

Cooperative learning elements	Ensuring its continued existence within CBGs
Individual accountability	<p>Taking up assigned roles (Felder & Brent, 2007; Johnson et al., 2008)</p> <p>Assisting in compiling file folder (Hilton, Kopera-Frye, & Millis, 2007)</p> <p>Participating in setting of group contracts (Johnson & Johnson, 2013)</p> <p>Individual tests and quizzes (Panitz, 2010; Shadle, 2010)</p> <p>Taking up responsibility for own learning (Shadle, 2010) and group members' learning (Cohen, 2010)</p>
Face-to-face promotive interaction	<p>Organising seating arrangements for optimal interaction (Johnson & Johnson, 2013; Lipson Lawrence, 2002)</p> <p>Avoiding competing with group members (Johnson & Johnson, 2013)</p> <p>Avoiding one-way communication (Johnson & Johnson, 2013)</p>
Small-group skills	<p>Observing social skills amongst group members (Johnson & Johnson, 2013; Shadle, 2010)</p> <p>Practicing social skills (Shadle, 2010)</p> <p>Assessing how well the skills are being implemented (Cohen, 2010)</p> <p>Encouraging each other to use social skills (Johnson & Johnson, 2013)</p> <p>Congratulating each other when skills are observed (Johnson & Johnson, 2013)</p> <p>Helping others to learn the social skills (Johnson & Johnson, 2013)</p>
Group processing	<p>Actively taking part in group processing (Nelson, 2010)</p> <p>Giving positive feedback to group members (Jaques & Salmon, 2007)</p> <p>Continually taking part in assessing the effectiveness of the group (Johnson & Johnson, 2013)</p>

Assigned roles, as previously discussed (see 3.4.1.1), ensure that students within CBGs are dependent on each other, as well as individually accountable for their own, as well as each other's learning. This implies that when group members take these roles seriously, and understand their importance and function, positive interdependence and individual accountability will be reinforced within the CBGs. Literature describes a variety of roles that can

be assigned to students (Felder & Brent, 2007; Johnson et al., 2008), and the responsibility of each can be depicted as follows:

- reader – is responsible for reading aloud to the group;
- runner – is responsible for collecting the group’s file folders from the facilitator at the beginning of each base group meeting;
- observer – uses an observation sheet to record specified actions;
- encourager of participation – is responsible for inviting quiet or reluctant group members to partake in the group’s activities;
- checker of understanding – checks that all group members understand what is expected of them; and
- coordinator – is responsible for reminding fellow group members of when and where meetings take place, and keeping each member on task during meetings.

Because team-building activities (Crowe & Hill, 2006) and creating a group name/motto for the file folders (Johnson et al., 2008) build team spirit and team identity, it is understandable that these actions necessitate the participation of all the group’s members. Robinson and Cooper (2010) specify the use of file folders in order to increase team building among students. Through sharing the available or necessary resources with fellow group members, students ensure that positive interdependence exists within their CBG (Johnson & Johnson, 2013). Through this type of positive interdependence, known as positive goal interdependence, students will work together to achieve the group’s goals. Partaking in setting up a plan for how each group member will apply his or her resources in order to achieve the group’s goals, is another responsibility of each CBG member, and this ensures that members are positively interdependent and individually accountable (Johnson & Johnson, 2013). Because communication is one of the most important aspects for managing good relations among diverse peers (Johnson & Johnson, 2013), clarifying miscommunications will create unity amongst group members. Participating in group decision-making will increase the group members’ commitment to the group (Johnson & Johnson, 2013). How group members seat themselves influences the interaction amongst group members (Johnson & Johnson, 2013); therefore, frequent eye contact and two-way communication increase cooperation. Lipson Lawrence (2002) suggests, “free-flowing dialogue” is promoted when students are sitting in a circle (p. 84). Observing how fellow group members are using small-group skills, will enable the students to know when to use these skills, as well as how to assist others in order to improve the group’s overall functioning (Johnson & Johnson, 2013; Shadle, 2010). Taking part in group processing in order to improve the effectiveness of the CBG, as well as being able to give positive feedback to fellow group members, is vital to the success of a CBG (Nelson, 2010).

According to Johnson and Johnson (2013), positive and constructive feedback will result in group members feeling empowered, and “the resulting reactions and feedback provide a rich source for understanding oneself and reframing one’s experiences” (p. 515). Jaques and Salmon (2007) are of the opinion that it is equally important being able to receive feedback, and suggest various guidelines for receiving feedback, including listening to the person giving feedback, accepting the feedback as genuine and helpful, giving the feedback serious consideration, and thanking the giver for his or her concern and help.

Positive relationships among group members, as a result of team spirit and team identity, will lead to group cohesion. Johnson and Johnson (2013) define group cohesion as “the mutual attraction among members of a group and the resulting desire to remain in the group” (p. 79). Therefore the active participation of group members will result in an increase in feelings of personal responsibility toward fellow group members, increased willingness to listen to and be influenced by fellow group members, and increased commitment to each other’s success within the CBG (Johnson & Johnson, 2013).

3.5. Summary

Chapter 3 aimed to point out the importance of CBGs in providing both academic and personal support to their members. From a review of the literature, it became evident that several different terms are used to describe long-term student groups. After comparing the different terms, it was clear that CBGs are the only type of long-term student group that provides both academic and personal support. CBGs are also the only type of long-term student group that have all five of the CL elements (positive interdependence, individual accountability, face-to-face promotive interaction, small-group skills and group processing) present. The implementation of CBGs and the success thereof are not only the responsibility of the facilitator, but of the students as well. The facilitator needs to carry out specific planning tasks before introducing CBGs to his or her audience. Following that, observing the functioning of the CBGs, intervening when necessary, as well as structuring group processing in order to evaluate the functioning of the groups, are tasks for which facilitators are continually responsible. CBGs are compared to an umbrella, providing support against academic and non-academic rainstorms, and it is crucial that all CBG members realise their importance within the group.

CHAPTER 4

RESEARCH METHODOLOGY

4.1. Introduction

Chapters 2 and 3 aimed to set the backdrop needed for attempting to achieve the research aim of this investigation. Self-directed learning (SDL), SDL readiness, instruments utilised to determine SDL readiness, cooperative learning, as well as cooperative base groups (CBGs) were the concepts dealt with and discussed within these chapters.

The aim of this research was to investigate the impact of the implementation of CBGs on the SDL competencies of first-year Life Sciences students. In order to achieve this aim, the researcher identified the following sub-aims:

- to investigate the contribution of personal support within the CBGs towards the first-year Life Sciences students' SDL competencies;
- to investigate the contribution of active involvement in evaluation of own and peers' ideas within CBGs towards the first-year Life Sciences students' SDL competencies;
- to investigate the contribution of the CBG folder towards the first-year Life Sciences students' SDL competencies;
- to establish the first-year Life Sciences students' perception of CBGs;
- to investigate the contribution of the first-year Life Sciences students' perception of CBGs towards their SDL competencies; and
- to determine whether the implementation of CBGs significantly influenced the first-year Life Sciences students' SDL readiness.

Chapter 4 deals with the empirical research process of this investigation, and is based on the theoretical frameworks set in both Chapters 2 and 3. The following sections contain a detailed discussion of the research paradigm, design and methodology followed during this investigation. The study population will be described, as well as the quantitative and qualitative procedures that were followed during this investigation.

4.2. Research paradigm, design and methodology

The research paradigm, design and the methodology for this investigation are illustrated in Figure 4.1 and will be discussed in the sections that follow.

According to Mertens (2003), a paradigm can be defined as a “worldview, complete with the assumptions that are associated with that view” (p. 139). A more recent definition, given by Morgan (2007), defines paradigms as “systems of beliefs and practices that influence how researchers select both the questions they study and the methods that they use to study them” (p. 49). It is no secret that a researcher’s paradigm influences how his or her research is conducted (Creswell & Plano Clark, 2007).

Quantitative research is associated with positivism and post-positivism paradigms (Teddlie & Tashakkori, 2009). A positivist approach to research adopts the scientific method, meticulously testing hypotheses and collecting data by means of quantitative measurements (Teddlie & Tashakkori, 2009). Post-positivists acknowledge the researcher’s value system as well as the important role the system plays in not only how research is conducted, but also how data is constructed (Teddlie & Tashakkori, 2009).

Qualitative research is associated with constructivism and variants (Creswell & Plano Clark, 2007; Teddlie & Tashakkori, 2009). Constructivists believe that the meaning of the phenomena being investigated is constructed individually and collectively by the researchers (Teddlie & Tashakkori, 2009).

Pragmatism is described as a deconstructive paradigm that advocates the integration of quantitative and qualitative methods in order to solve practical problems in the real world (Creswell & Plano Clark, 2007; Feilzer, 2009; Teddlie & Tashakkori, 2009) and “offers an epistemological justification and logic for mixing approaches and methods” (Onwuegbuzie, Johnson, & Collins, 2009, p. 128).

Rejecting the ‘either-or’ choices between constructivism/interpretivism and positivism/post-positivism, and searching for practical answers to intriguing questions, are the major characteristics of pragmatism (Feilzer, 2009; Teddlie & Tashakkori, 2009, p. 86). In contrast to positivists/post-positivists and constructivists/interpretivists, pragmatists have confidence in using both quantitative and qualitative methods to address their research questions (Teddlie & Tashakkori, 2009). Furthermore, pragmatists recognise their freedom to choose both inductive and deductive reasoning to answer their research questions (Teddlie & Tashakkori, 2009).

According to Teddlie and Tashakkori (2009), pragmatism is the paradigm most frequently associated with mixed methods research, and places emphasis on both the problem under investigation and the consequences of the research (Creswell & Plano Clark, 2007; Feilzer, 2009).

Because the research question was of primary concern for the researcher, she believed that both quantitative and qualitative methods were needed to best address the complex research questions. Therefore a pragmatic stance (see 1.4.1) was taken throughout this investigation.

According to Teddlie and Tashakkori (2009), mixed methods research is an alternative non-purist (Johnson & Onwuegbuzie, 2004) method in the quantitative and qualitative traditions. Johnson and Onwuegbuzie (2004) advocate the use of a mixed methods approach when both quantitative and qualitative data sets are viewed as important for the purpose of answering complex research questions (Ivankova, Creswell, & Stick, 2006). Johnson and Onwuegbuzie (2004) identify the following as the strong points of mixed methods research:

- narrative data can be used in order to add meaning to numerical data;
- stronger evidence for a conclusion can be provided by means of convergence and justification of findings;
- additional insight and understanding can be added that might be overlooked when making use of only quantitative or only qualitative methods; and
- the generalisability of results can be increased through the use of mixed methods.

In this investigation, the researcher conducted interviews to obtain narrative data which was used to add meaning to the quantitative data. The researcher believed that the use of only quantitative or only qualitative methods would not address the research questions successfully, and the integration of both was needed.

The explanatory sequential follow-up design was used during this investigation. This type of mixed methods design is two-phased (Figure 4.1), and starts with collecting and analysing the quantitative data set before collecting and analysing the qualitative data set (Creswell & Plano Clark, 2007). This design is followed when the qualitative results help explain and clarify the quantitative findings (Ivankova et al., 2006), and places the emphasis on the quantitative data (Guest, 2012). This type of design takes place in two phases, and the researcher has to decide which quantitative results must be explained further. Allowing therefore sufficient time for both phases as well as thorough planning, may be challenges when using the explanatory design (Creswell & Plano Clark, 2007). The straightforwardness of this type of design, collecting one set of data at a time, is one of the strong points of the explanatory design (Creswell & Plano

Clark, 2007). During the current investigation, the researcher collected and analysed the quantitative data sets before conducting interviews to selected individuals (qualitative). This method was followed because the researcher believed that the qualitative data sets would help refine and clarify the quantitative data sets. This straightforward, two-phased design made it easy for the researcher, who was also responsible for the LS module, to collect and analyse the data sets.

In the following sections, attention will be given to the study population, quantitative and qualitative data collection techniques, quantitative and qualitative data analysing techniques, as well as the ethical aspects involved.

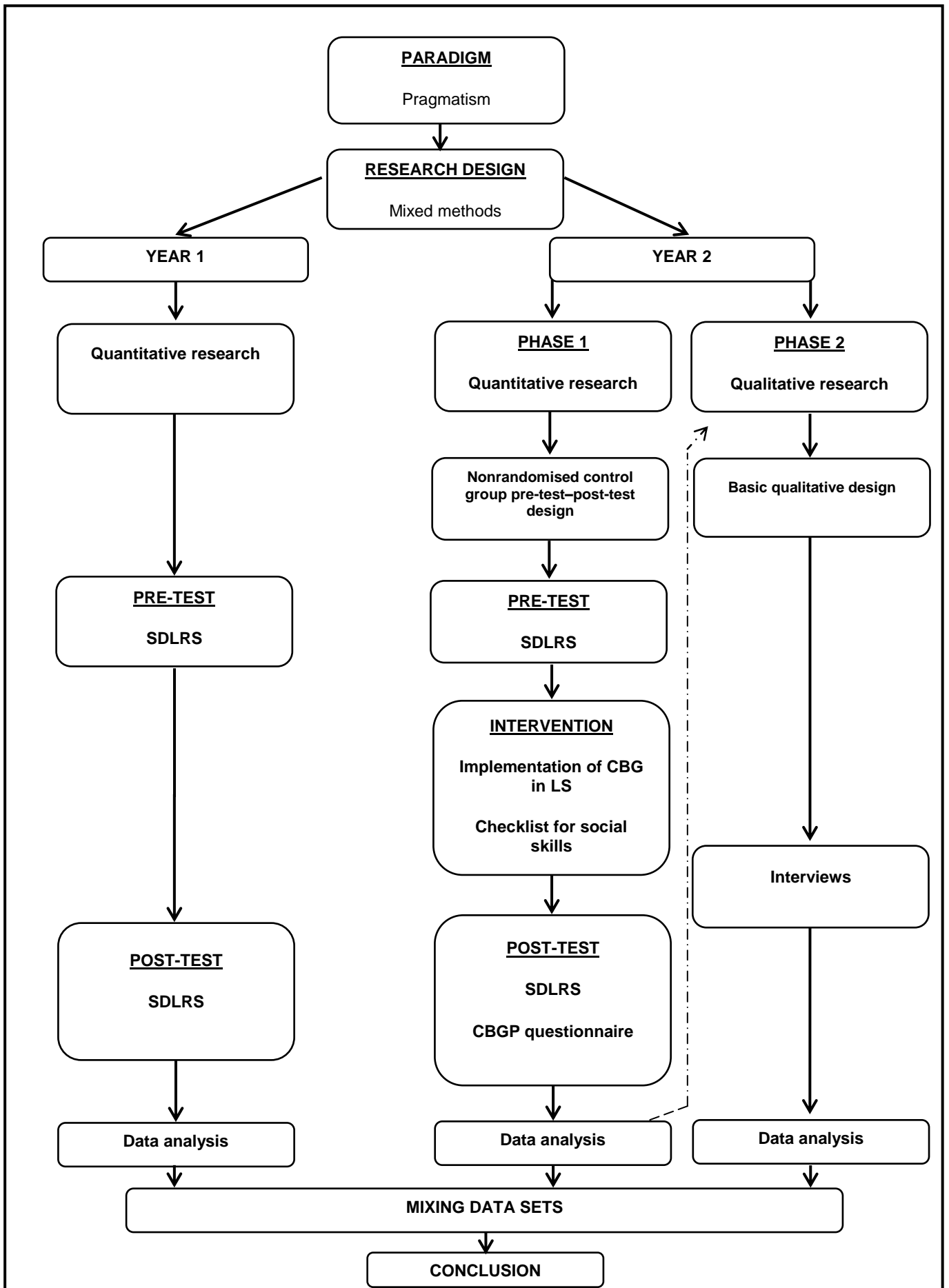


Figure 4.1 Research paradigm, design and methodology

4.3. Study population

According to Maree and Pietersen (2010), a study population refers to all the units (e.g. people) from whom data is collected in order to answer the research question. For the purpose of this study, first-year students who enrolled for the Life Sciences (LS) module (LIFE 111) at a South African tertiary institution were selected by means of convenience sampling as study population. Convenience sampling, according to McMillan and Schumacher (2006), occurs when participants are selected on the basis of being available.

The researcher assumed a participatory role in the empirical investigation as she was responsible for the LS module at the tertiary institution where the research was conducted. The researcher also took responsibility for administering the self-directed learning readiness scale (SDLRS) and cooperative base group perception (CBGP) questionnaires during the quantitative phase of the investigation. Furthermore, the researcher conducted the interviews with the randomly selected individuals. For these reasons, extensive verification procedures were used to ensure the accuracy of all findings. All research procedures were carefully audited by the researcher's academic supervisors, as well as the Statistical Consultation Services of the tertiary institution involved.

Table 4.1 outlines the study population for both the control and the experimental groups.

Table 4.1 Study population for control and experimental groups

	YEAR 1	YEAR 2	
	CONTROL GROUP	EXPERIMENTAL GROUP	
		QUANTITATIVE	QUALITATIVE
Study population	LIFE 111 students	LIFE 111 students	LIFE 111 students
Number of participants (n)	81	89	7

4.4. Research method: Implementation of cooperative base groups as intervention

As previously discussed (see 3.4), the facilitator had a very distinct role when implementing CBGs. The way the roles and responsibilities were carried out by the researcher during this investigation will be discussed in the next sections (see 4.4.1 – 4.4.4).

4.4.1. Planning

Making pre-instructional decisions regarding the size of each CBG, the composition thereof, as well as the way students were going to be assigned to their groups, took place first. After

studying relevant literature, the researcher decided to allocate four students to each CBG. To ensure that the groups were as heterogeneous as possible, the researcher made use of a numbering system for assigning students. Because the researcher knew beforehand that approximately 89 students enrolled for LS, she made four copies of the numbers 1 to 23 and shuffled the numbers. Before the students entered the lecture hall, the researcher pasted copies of the numbers on the desks (see Figure 4.2), so that all four similar numbers were together. As students walked into the lecture hall, the researcher stood at the door and gave each student a random number (1 to 23). The students were instructed to sit at the desk resembling their specific numbers. All the students, for example, with a number 4 on their papers went to a desk with a four pasted on it.

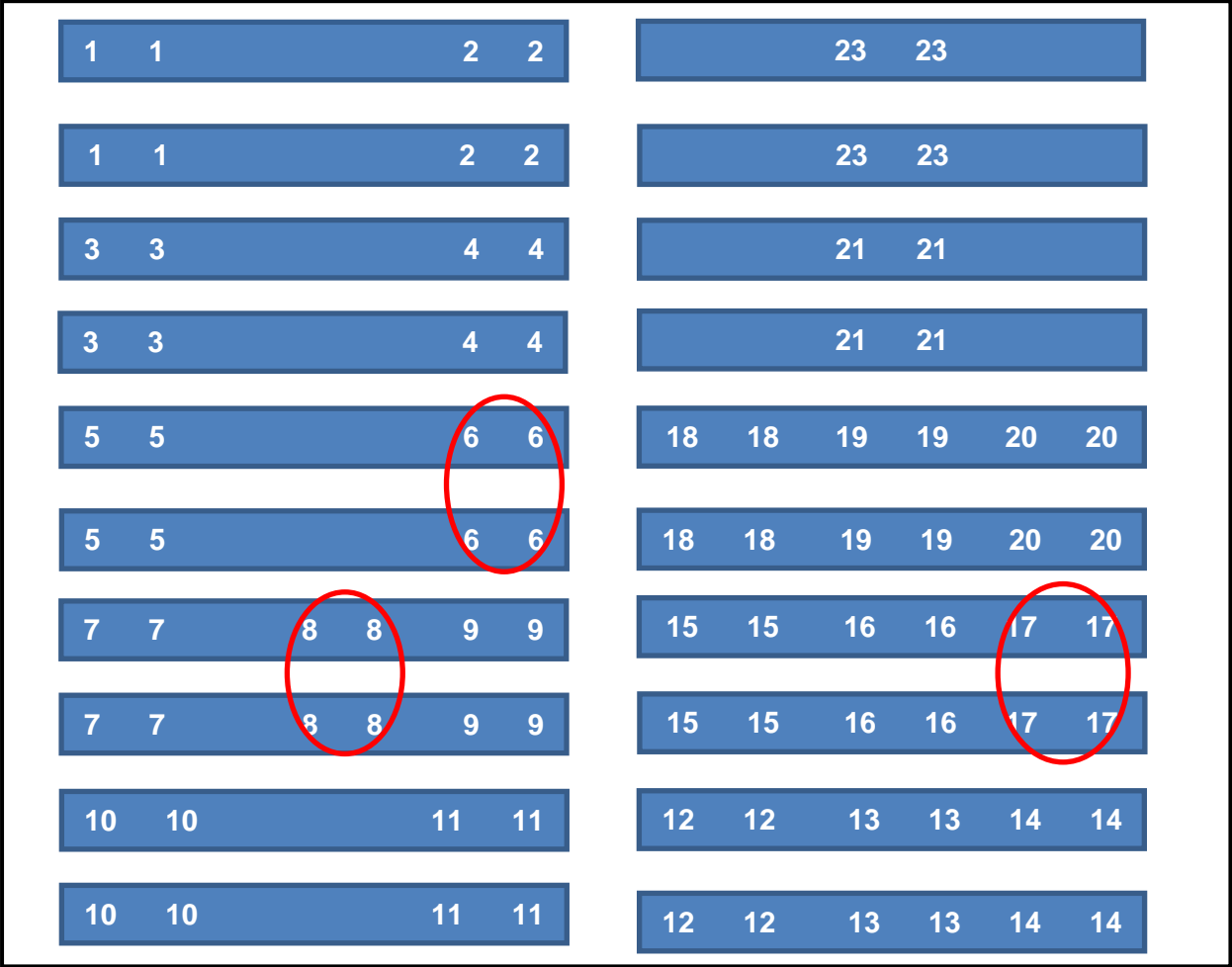


Figure 4.2 Illustration of how students were assigned to their cooperative base groups

A total of 23 CBGs were formed, of which 20 groups consisted of four students, while the remaining three groups each consisted of three students.

As there were several tasks that needed to be completed by the group members of each CBG (3.4.1.1), a folder was prepared by the researcher. Each CBG folder contained the following documentation (Appendix A):

- (A:1) Planning
- (A:2) Personal information of group members
- (A:3) Individual learning contracts
- (A:4) Group learning contract
- (A:5) Attendance sheet
- (A:6) Mark sheet
- (A:7) Group membership grid
- (A:8) Checklist for social skills
- (A:9) Positive feedback form

In order to ensure that the five cooperative learning fundamentals were present within the CBGs, various strategies, as outlined in Table 4.2, were used.

Table 4.2 Methods by which the researcher ensured the presence of the cooperative learning elements (see Table 3.3)

Cooperative learning elements	Ensuring its presence within the cooperative base groups
Positive interdependence	CBG members had to decide on a group name and motto together Limited resources were given to each group Self-disclosure and administrative tasks were done as a group Group contracts were completed as a group
Individual accountability	Limited resources were given to each group Group contracts were completed as a group Groups were small Tests and exams were written individually
Face-to-face promotive interaction	Groups were small A permanent meeting place was provided
Small-group skills	Checklist for social skills was completed periodically
Group processing	Time was allocated for reflection and group processing Methods were provided to enable group processing

After all students had taken their seats in their respective groups, an agenda was handed out to each group. The agenda (see Figure 4.3) contained the sequence of tasks that the groups had

to perform during that particular meeting. The researcher was responsible for setting the agendas for each base group meeting.

The agenda handed out to the students after assigning them to their groups (see Figure 4.3), instructed them to decide on a cover page for their CBG folder. The cover page had to display a name decided on by the group as well as a group motto. This task helped to establish positive interdependence amongst the members of each CBG.

Agenda – 10/02/2014
Collect folders
Greet each other and introduce yourselves to the rest of the group
Complete the Personal Information Sheet and also WEEK 2's "share something personal"
Take the Personal Learning Contract and complete "personal goals" and "my responsibilities" at home _____
<i>Decide as a group on a time and venue to work on the cover page of the folder (Group name and motto!!) _____</i>

Figure 4.3 Agenda handed out during first cooperative base group meeting

Because limited resources strengthen not only positive interdependence within a CBG, but individual accountability as well, each group had only one folder. This meant that group members were dependent on each other for completing several of the tasks within the folder.

Although students worked in a cooperative environment, they still achieved alone, strengthening individual accountability. Students wrote tests and examination papers individually.

In order to ensure positive face-to-face interaction, the researcher kept the CBGs small. Most of the lecture halls at the Faculty of Education at the particular tertiary institution, have fixed desks and chairs. These lecture halls present a challenge for facilitators implementing any type of cooperative learning strategy, as it is difficult for students to form groups where they can face each other. After the first CBG meeting, students indicated that they experienced difficulty in scheduling time for out-of-class CBG meetings. The researcher therefore decided to set a scheduled LS class per week aside for a CBG session. After the students also pointed out that the allocated lecture halls was not appropriate for CBG meetings, the researcher scheduled the weekly CBG meeting on the grass outside a lecture hall. This area provided ample space for students to get together in their CBGs to complete tasks outlined in the agendas. Because

there were no benches or chairs on the grass, students sat comfortably in their groups, facing each other. This type of seating arrangement made two-way communication possible.

A checklist for social skills (CSS) was compiled by the researcher, which the members of each group had to complete periodically. During weeks 3, 6 and 11, students were instructed to complete the checklist for each of the other students within their CBG. Student A therefore completed the checklist for students B, C and D, etc. The checklist was easily completed by ticking next to the skills exhibited by group members. It should be noted that the researcher made use of formal and informal cooperative learning during classes. The CSS was completed after the CBGs had worked together on a specific task.

Ensuring that the groups reflected on how well they were functioning as a CBG, the researcher allocated time for group processing by placing it on the agenda of several meetings. Besides allocating time for group processing, relevant tools/instruments were given to CBGs in order to simplify and aid reflection. The researcher took time to read through each CBG's folder documentation, asked appropriate questions, and prompted students to reflect on their cooperative base group's functioning.

4.4.2. Introducing cooperative base groups to the students

During the implementation of the CBGs, introducing CBGs to the students was a crucial step for the researcher. During the first week of classes, the researcher spent sufficient time discussing not only her teaching philosophy, but also cooperative learning, what was expected of the students, as well as what the students could expect from the researcher.

4.4.3. Observing and intervening

During each CBG meeting that took place on the grass outside a lecture hall, the researcher walked among the different groups whilst observing how they interacted. Much effort was put into learning the names of the students and getting to know the students better. This was accomplished by spending a couple of minutes with each CBG during every 'class-on-the-grass'. If the researcher noticed that a group member was absent frequently, or that a group was struggling, she intervened by talking to the particular group(s). If groups felt that they needed help with communication or with a specific group member, the researcher invited all members of that group to a meeting.

4.4.4. Assessment and evaluation

Great care was taken to read through the documentation that the students had to complete during each meeting. By doing so, the researcher gained insight into each of the CBGs.

Reading through the positive feedback forms, as well as observing how the respective CBGs function, enabled the researcher to adapt her intervention accordingly.

4.5. Quantitative research

According to Maree and Pietersen (2010), “quantitative research is a process that is systematic and objective in its ways of using numerical data from only a selected subgroup of a universe (or a population) to generalise the findings to the universe that is being studied” (p. 145).

Quantitative research designs can be classified as either experimental or non-experimental, where an experimental design is characterised by a cause-and-effect question (Maree & Pietersen, 2010) and represents research in which the researcher manipulates one or more independent variables (Teddlie & Tashakkori, 2009). According to Teddlie and Tashakkori (2009), participants within experimental research are randomly assigned to treatments or interventions. Because participants within this investigation were not randomly assigned to the intervention, a nonrandomised control group pre-test–post-test design was followed (Dimitrov & Rumrill Jr, 2003). During this type of research design, both the control and experimental groups take a pre- and post-test, but only the experimental group are subjected to the intervention. All the students who enrolled for LIFE 111 in 2013 and 2014 took the SDLRS pre- and post-test, while only the 2014 LIFE 111 students were exposed to the CBGs.

Non-experimental designs, on the other hand, are mainly used in descriptive studies and do not involve any manipulation (Maree & Pietersen, 2010).

Figure 4.4 represents the quantitative research design followed during this investigation. This is discussed in subsequent sections (see 4.5.1).

4.5.1. Quantitative research design

As previously discussed (see 4.4), the specific type of experimental design followed during this investigation, is called the nonrandomised control group pre-test – post-test design and, according to Maree and Pietersen (2010), the pre-test-post-test design with a control group is the most commonly used type of experimental design. This type of experimental design is similar to non-equivalent groups’ pre-test–post-test control group design, as stated by McMillan and Schumacher (2006). In this design, all participants of both the control and experimental groups are first measured on the dependent variable (Maree & Pietersen, 2010). As evident from Figure 4.4, all participants within this investigation were subjected to a pre-test. After the experimental group had been exposed to the intervention, both groups were measured once again on the dependent variable (Maree & Pietersen, 2010). It is important to keep in mind that

this study took place over a period of two years, of which the first year's (2013) participants formed the control group, and they were not subjected to the CBG intervention.

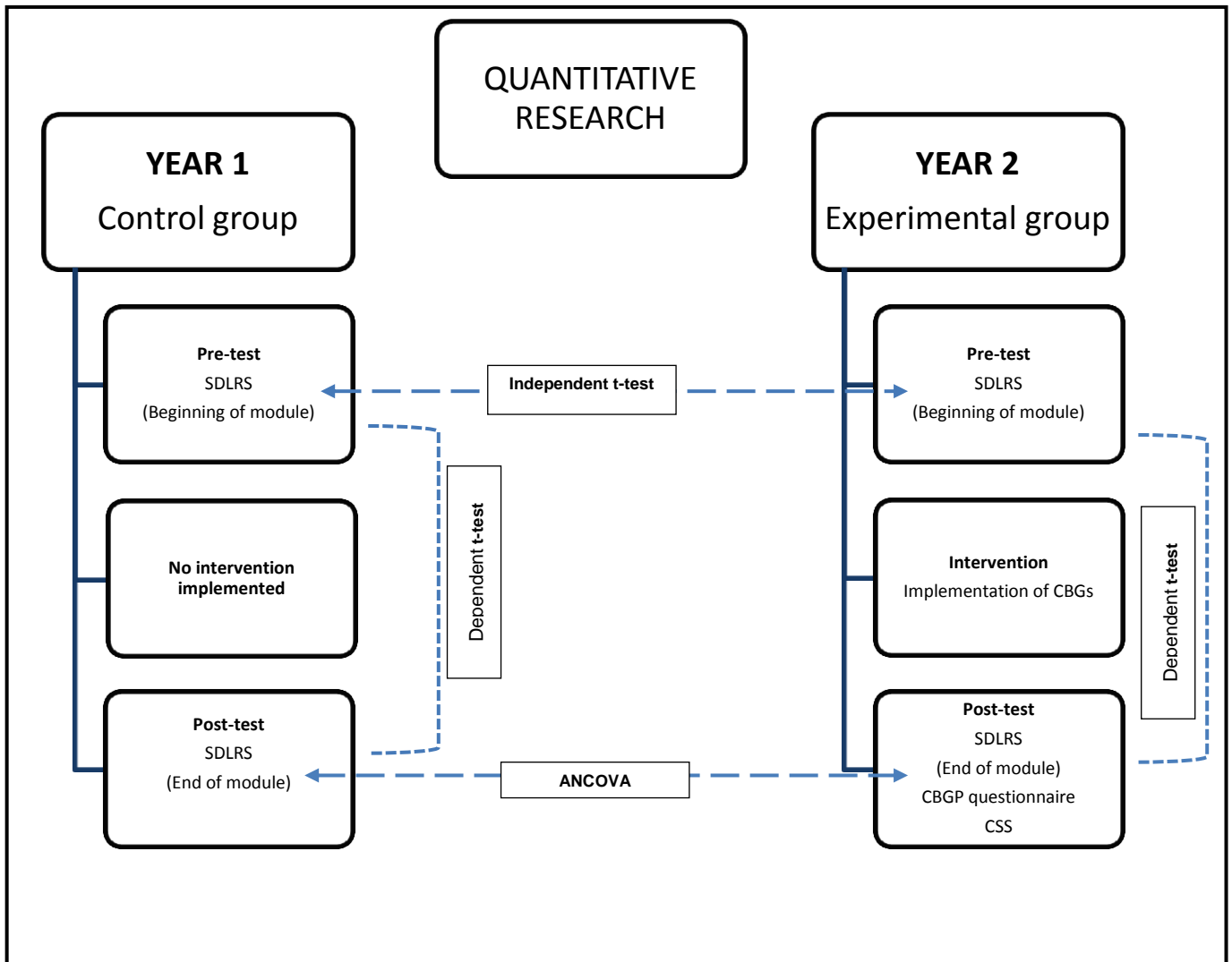


Figure 4.4 Quantitative research design

4.5.2. Participants

This investigation was conducted over two years (2013 and 2014). The students who enrolled for LIFE 111 in 2013 were selected for the control group, while the LIFE 111 students of 2014 formed the experimental group. Because the control and experimental groups came from two different cohorts, compensation was built into the design in order to minimise the negative influence on validity and reliability, namely inferential statistics (e.g. ANCOVA), which was performed to partial out the effect of differences in pre-tests between the two groups from the different years (see 4.5.6.1).

4.5.3. Data collection procedure and measuring instruments

According to Maree and Pietersen (2010), questionnaires are the most commonly used data collection procedure. Although this type of procedure has the advantage of a high response rate, Maree and Pietersen (2010) caution that this method can be costly when making use of standardised tests, and also point out that the conditions in which the questionnaire is administered cannot be controlled by the researcher.

4.5.3.1. Self-Directed Learning Readiness Scale

As previously discussed (see 2.2.5), there are several instruments that can be used to measure an individual's SDL readiness.

The self-directed learning readiness scale (SDLRS) of Guglielmino (1978) was the questionnaire used in this investigation. The SDLRS was ordered from Guglielmino and Associates, and therefore we were granted permission to use the questionnaires. This questionnaire consists of fifty-eight items that are scored using a five-point Likert-type scale (see 2.2.5). The five-point Likert-type scale used in the current research comprised the following:

1. Almost never true of me; I hardly ever feel this way
2. Not often true of me; I feel this way less than half of the time
3. Sometimes true of me; I feel this way about half the time
4. Usually true of me; I feel this way more than half the time
5. Almost always true of me; there are very few times when I don't feel this way

An individual's SDLRS score is a measure of his or her current level of readiness for SDL (see 2.2.5), and is converted to the following categories:

- 'above average' if the score is between 227 and 290;
- 'average' if the score is between 202 and 226; and
- 'below average' if the score is between 58 and 201 (Guglielmino, 1978).

Participants in both the control and experimental groups received the SDLRS at the beginning of a LS class, and had to complete the questionnaire in class. Participants completed the questionnaires at the beginning of the semester (pre-test), and at the end of the semester (post-test).

As the researcher was also the facilitator for the LIFE 111 module, she administered the questionnaires herself. The numbers of completed questionnaires for both the control and the experimental groups are reflected in Table 4.3 below:

Table 4.3 Number of Self-Directed Learning Readiness Scale questionnaires completed

Group	Possible participants	Participants who completed both SDLRS questionnaires (pre- and post-test)
Year 1 (Control group)	81	45
Year 2 (Experimental group)	89	53

After completing the SDLRS pre-test in year 2 of the investigation, the first-year Life Sciences students also completed the CBGP questionnaire. This questionnaire will be discussed in section 4.5.3.2.

4.5.3.2. Cooperative base group perception questionnaire

The cooperative base group perception (CBGP) questionnaire was developed to gather data regarding the participants' perceptions of the implemented CBGs (see Appendix E), as this was one of the identified sub-aims of this investigation. This questionnaire contained twenty items to which students had to respond by making use of a four-point Likert-type scale. When designing a questionnaire it is important that the researcher keep the type of data to be generated in mind, as well as the statistical procedures that will be used to analyse the data (Maree & Pietersen, 2010).

Relevant literature regarding the purpose of CBGs, the support CBGs provide, as well as the basic cooperative learning (CL) elements were studied before formulating the twenty items. Determining what the students thought about helping each other and working together as a group, whether they valued CBGs and having 'class-on-the-grass' meetings, whether they perceived themselves as individually accountable, as well as being positively interdependent with their group members were aspects of CBGs that the researcher tried to address in the CBGP questionnaire. The instructions of the CBGP questionnaire were kept brief and to the point, as suggested in literature (Maree & Pietersen, 2010), instructing participants to read through each of the twenty items carefully before choosing a response. Although no time limit was placed on answering the CBGP questionnaire, participants were prompted not to spend too much time on any one item.

Participants had to respond to each of the items by means of a four-point Likert-type scale, which allowed participants to choose a directive without the option of choosing a neutral score. The categories for the Likert-type scale were as follows:

1. Strongly disagree
2. Somewhat disagree
3. Somewhat agree
4. Strongly agree

All items in the CBGP questionnaire dealt with aspects of CBGs, necessary for its success (see Appendix B). The internal reliability of the CBGP questionnaire was measured by making use of Cronbach’s alpha coefficient, and will be outlined in section 4.5.4, while the factor analysis of the CBGP questionnaire will be outlined in section 4.5.5.

Only participants in the experimental group completed this questionnaire, and it was handed out and taken in by the researcher during a LS class at the end of the module.

Table 4.4 Number of cooperative base group perception questionnaires completed

Group	Possible participants	Participants who completed CBGP questionnaire
Year 2 (Experimental group)	89	87

Of the 89 participants enrolled for the LIFE 111 module, 87 participants completed the CBGP questionnaire, and all completed questionnaires were used for statistical analysis.

4.5.3.3. Checklist for social skills

According to Johnson and Johnson (2013), checklists are used to ensure that “something is not left out or forgotten” (p. 357). For the purpose of this investigation, as previously mentioned in 1.4.3.2.1, a CSS was developed, which listed the behaviours and actions associated with much-needed social skills, making sure that specific social skills were not left out or forgotten. The checklist (see Appendix A:9) consisted of fourteen social skills associated with cooperative learning, and was completed three times (weeks 3, 6 & 11) by the experimental group participants. The checklists formed part of the documentation that the participants had in their CBG folders. Each of the four base group members had to tick next to the social skill(s) they observed in each of the other members in their group. Each member’s ticks were added together to get a numerical value out of 42, which was re-calculated to a value out of 10. This was done to ease the statistical analysis that followed. In order to determine the internal

reliability of the CSS, the Cronbach's alpha coefficient was used. This will be outlined in section 4.5.5.

The validity and reliability of the research instruments used are vital aspects in quantitative research, and unreliable instruments pose a threat to external validity (Nieuwenhuis, 2010b). The validity and reliability of the SDLRS will be discussed in sections 4.5.4 and 4.5.5.

4.5.3.4. Academic achievement Point Score

The Academic achievement Point Score (APS) is a variable based on students' marks obtained during their final school year, and is used by South African universities for admission purposes. During the present investigation, the APS of the first-year students was used as a benchmark for ability and to ensure that the data was comparable.

4.5.4. Validity

According to Pietersen and Maree (2010a), an instrument's validity refers to the degree to which it measures what it sets out to measure. Face validity, content validity, construct validity and criterion validity are different types of validity used by researchers. Content validity of the SDLRS was established by Guglielmino's (1978) Delphi technique that involved a panel of 14 experts in a three-round survey. Construct validity refers to the extent to which the items within the instrument measure the constructs (Pietersen & Maree, 2010a). Face validity was added to the CBGP questionnaire through critical feedback from experts in the field of cooperative learning, as well as from the Statistical Consultation Services. Factor analysis is a statistical technique used to determine construct validity of an instrument. Factor analysis sets out to determine which items of a questionnaire "belong together", are answered similarly and therefore measure the same factor (Pietersen & Maree, 2010a, p. 219). In this investigation, factor analysis, by means of principal component analysis (extraction method) and oblimin rotation with Kaiser Normalization, was done to determine whether the CBGP questionnaire measured what it set out to measure.

When doing factor analysis, correlations need to be tested. This is done to determine the strength of the relationship between the factors (Connolly, 2007). The correlation coefficient will take a value between 0 and 1, or -1 in the case of a negative correlation (McMillan & Schumacher, 2006).

The results of the factor analysis, as well as the correlations between factors, are discussed in detail in section 5.3.2.

4.5.5. Reliability

Internal reliability is a measure of the extent to which a number of items, formulated to measure a specific construct, have a high degree of similarity (Pietersen & Maree, 2010a). Cronbach's alpha coefficient is used to measure the internal reliability of an instrument (Pietersen & Maree, 2010a). Cronbach's alpha coefficient is based on the inter-item correlations (Pietersen & Maree, 2010a). A high alpha coefficient is an indication that there is a strong correlation between the different items; therefore, their internal reliability is high. If the items are poorly correlated with each other, the alpha coefficient will be low. Guidelines for the interpretation of Cronbach's alpha coefficient are as follows (Pietersen & Maree, 2010a):

- 0.90 = high reliability;
- 0.80 = moderate reliability; and
- 0.70 = low reliability.

Cronbach's alpha coefficient for the SDLRS in this investigation was measured at 0.78, which indicates a moderate reliability. According to various authors, the SDLRS normally has an internal reliability coefficient of 0.72 to 0.96 (Delahaye & Smith, 1995; Durr, 1992; Long & Agyekum, 1984; McCune & Guglielmino, 1991; Posner, 1990). The Cronbach's alpha coefficient for the respective factors identified within the CBGP questionnaire ranged from 0.718 to 0.912. This will be discussed in 5.3.3. The CSS measured a Cronbach's alpha coefficient of 0.857. A high degree of similarity among the fourteen items within the CSS was necessary to ensure that it measured what it was supposed to measure.

The next section contains a detailed discussion of the quantitative data analysis.

4.5.6. Quantitative data analysis

Descriptive statistical techniques are used in order to organise, analyse and interpret quantitative data.

The term **descriptive statistics** refers to various statistical methods used to "organise and summarise data in a meaningful way", and can be presented either graphically or in a numerical way (Pietersen & Maree, 2010b, p. 183).

As soon as research is done to summarise and describe collected data, as well as to generalise or draw conclusions regarding a certain population, inferential statistics are needed (Pietersen & Maree, 2010b).

Both the descriptive and inferential statistics used, will be discussed in the sections that follow.

4.5.6.1. Statistical techniques and methods

The data collected during the quantitative phase of this investigation was analysed by means of descriptive and inferential statistics. Independent and dependent t-tests were used and p-values and effect sizes were calculated.

In order to determine the statistical and practical significance, the p-value and effect sizes were calculated. The p-value is the probability value used to determine whether there is a statistically significant difference between data from a random sample (Pietersen & Maree, 2010b). When the calculated p-value is <0.05 , it is an indication that there are statistically significant differences.

The effect sizes, calculated by using Cohen's d-value, calculate the difference between two means and the relationship between variables (Pietersen & Maree, 2010b). The interpretation of Cohen's d-value is as follows (Pietersen & Maree, 2010b):

- $d = 0.2$: small effect;
- $d = 0.5$: medium effect; and
- $d = 0.8$: large effect.

Because the researcher did not make use of random sampling, and because the groups were small, the p-values are only included in the tables for the sake of completeness and will not be interpreted. The focus will be on the interpretation of d-values.

An independent t-test is used to determine whether the mean value of a variable in one group of subjects is different from the mean value of the other group of subjects (McMillan & Schumacher, 2006). In this investigation, the independent t-test was used to determine differences between the pre-test of the control group (year 1) and the pre-test of the experimental group (year 2). This was done in order to determine whether there were any statistically and practically significant differences between the two groups at the beginning of the respective years (see Figure 4.4). In order to determine the practical significant differences, the d-values were calculated. The d-value (effect sizes) indicated the practical significance of the differences between the two groups.

A dependent t-test was used to match and compare the pre- and post-tests of year 1, whilst taking into consideration that the participants were not independent (McMillan & Schumacher, 2006). This was done in order to establish whether there were any statistically and practically significant differences between the SDL readiness of the students before the module commenced and after the semester during which no intervention took place. The dependent t-

test was also done between the pre-test and post-test of the experimental group (year 2). This was done in order to establish whether there were any statistically and practically significant differences between the self-directed readiness of the students from the beginning of the LS module to the end of the LS module, with the implementation of CBGs as intervention. To determine the practical significance of the differences, the effect sizes were calculated.

An ANCOVA (analysis of covariance) test was performed between the results of the post-tests of the control and experimental groups, controlling for pre-test and APS (see 1.5.3.2.2) differences. This was done to determine whether there is a practical significant difference between the mean scores of the two groups' post-test.

Pearson's correlation coefficients were calculated to investigate the interrelationship between the CSS, CBGP questionnaire factors and the SDLRS post-test of the experimental group. The interpretation of the correlation coefficients is as follows:

- $r = 0.1$: small correlation;
- $r = 0.3$: medium correlation; and
- $r = 0.5$: large correlation.

The qualitative research design and its contribution within this investigation will be discussed in the next section.

4.6. Qualitative research

As previously mentioned (see 4.2), the purpose of the qualitative data was to add meaning to the quantitative data, as well as to obtain answers to the sub-questions of this investigation which relates to the first-year LS students' perception of CBGs and its contribution to SDL competencies. The qualitative data of this investigation was also vital in providing answers to five of the six sub-aims of this investigation and contribute to answering the research question. This was done through the integration of the quantitative and qualitative results (see Figure 4.1).

In its simplest form, qualitative research can be defined as procedures associated with the "gathering, analysis, interpretation, and presentation of narrative information" (Teddlie & Tashakkori, 2009, p. 343). A basic qualitative design was followed during this investigation and data was obtained through open-ended semi-structured interviews. Figure 4.5 reflects the qualitative design followed during this investigation.

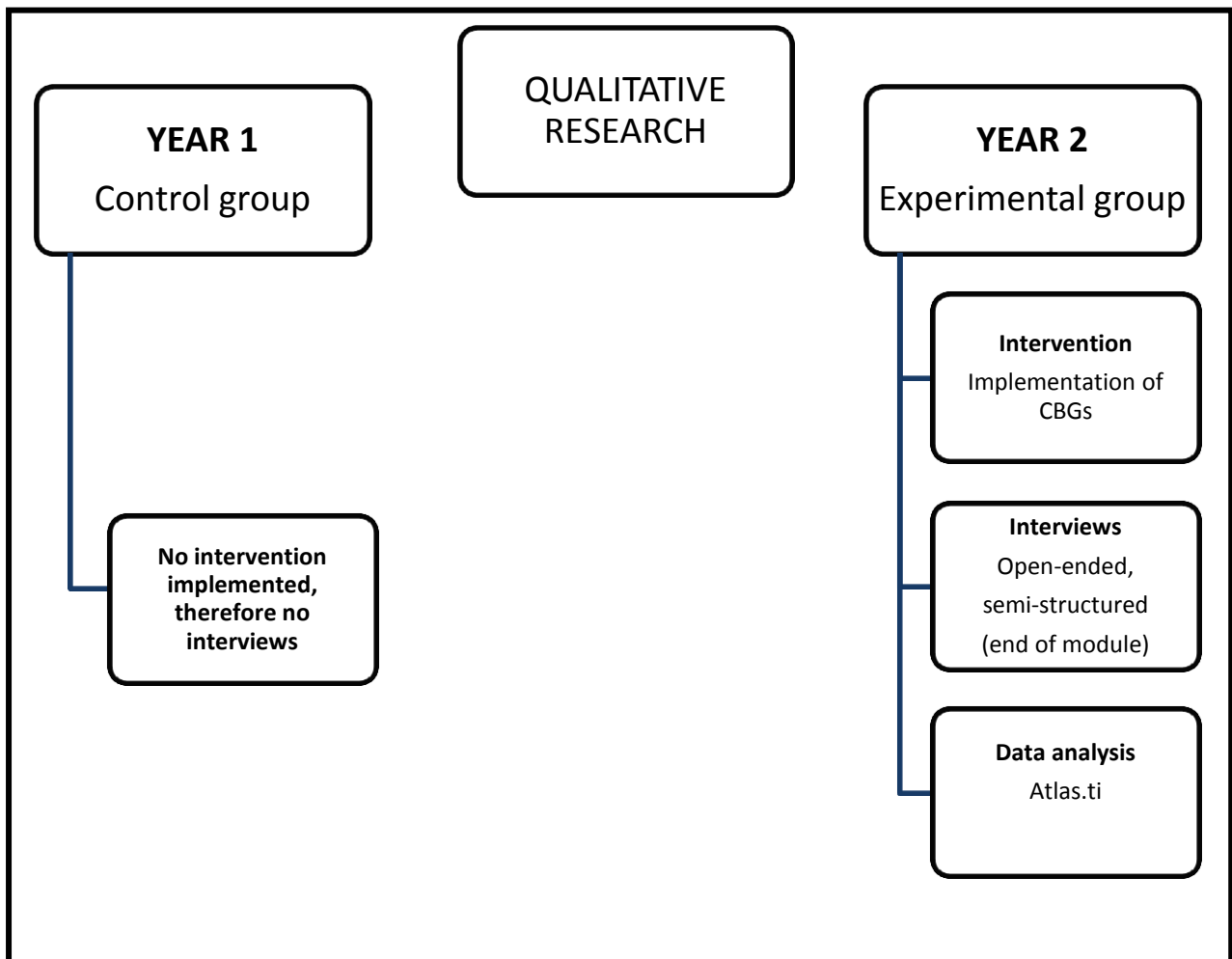


Figure 4.5 Qualitative research design

4.6.1. Qualitative research design

Merriam (2009) is of the opinion that when a study fails to fit within a phenomenological, grounded theory, narrative analysis, critical or ethnographic study, it may be classified as being a basic qualitative study. Within a qualitative research environment, “the researcher is the primary instrument for data collection”, which occurs by means of interviews, observations or document analysis (Merriam, 2009, p. 15).

According to Merriam (2009), researchers making use of a basic qualitative research design, do so in order to gain an understanding of how individuals make sense of their life experiences. In this investigation, the researcher wanted to understand what the implementation of CBGs meant to the Life Sciences students.

4.6.2. Participants

Seven students from the experimental group were selected by means of simple random sampling to participate in the qualitative phase of this investigation. Simple random sampling is the most familiar type of probability sampling (Merriam, 2009).

4.6.3. Data gathering procedure

In this investigation, the interviews played an important part in understanding how the participants experienced and interpreted the CBGs and how these contributed towards the participants' SDL competencies.

According to Merriam (2009), data is simply "bits and pieces of information in the environment" (p. 85). Within education, interviews are the most common form of collecting these bits and pieces of information (Merriam, 2009). DeMarrais (2004) defines interviews as engaged conversations between researcher and participants. During this process, the researcher focuses on questions that relate to the particular research study.

The face-to-face interviews were conducted by the researcher herself at the end of the LS module. After the students had been randomly selected, the researcher invited each student via e-mail as well as telephonically to participate in this phase of the investigation. The interviews were recorded by the researcher in order to ensure accurate analysis.

Semi-structured interviews are interviews that require the participants to answer predetermined questions (Nieuwenhuis, 2010b), as specific data is required from the participants (Merriam, 2009). During the interviews, the following four questions were asked to each of the seven students:

1. Please tell me what the personal support that you may or may not have received within the base groups, mean to you.
2. Tell me about the degree to which you had the confidence to function within the base groups.
3. What was your experience with the folders? (How would you change it? Was it valuable? Could the base groups have functioned without it?)
4. Tell me what you think the value of the base groups was, if any.

4.6.4. Qualitative data analysis

The process of making sense out of the data collected is known as **data analysis** (Merriam, 2009).

Merriam (2009) explains that coding is a way of organising and managing qualitative data, and is done to ensure that specific pieces of data can be easily retrieved. The easiest way of coding is by making use of a transcript (Gibbs, 2010). Computers and Qualitative Data Analysis Software (CQDAS) are computer programs aiding the organisation and categorisation of the collected data (Gibbs, 2010; Merriam, 2009). For analysing the qualitative data in this investigation, the researcher made use of Atlas.ti, a type of CQDAS. Importing and displaying rich texts, constructing code lists, retrieving text that had been coded, examining coded text, and writing memos that can be linked to the codes and documents, are some of the features of Atlas.ti (Gibbs, 2010).

Coding involves the identification and recording of one or more text passages that represent the same idea, and this can be done through descriptive codes, categories or analytic codes (Gibbs, 2010). The way thematic codes are developed, as well as on which of them the focus will be, depends on the aim of the research (see 1.3). According to Pietersen and Maree (2010b), there are three steps to be followed when coding text, namely open coding, axial coding and selective coding. **Open coding** entails the identification and naming of segments of meaning from the transcribed data. **Axial coding** refers to the process during which relationships between categories are identified. Lastly, **selective coding** entails selecting and identifying the main category and linking it to other categories (Nieuwenhuis, 2010a). According to Gibbs (2010), coding can be either concept-driven or data-driven. When using concept-driven coding, also referred to as a priori coding (Nieuwenhuis, 2010a), researchers first construct a collection of codes based on literature. This type of coding is useful when attempting to test or expand existing theories. Researchers who choose not to start with any preconceptions based on pre-existing theory, will make use of data-driven coding (Gibbs, 2010), also referred to as inductive coding (Nieuwenhuis, 2010a). Letting the codes emerge from your data is a characteristic of data-driven coding. Because these two coding approaches are not exclusive (Nieuwenhuis, 2010a), “researchers move backwards and forwards between both sources of inspiration during their analysis” (Gibbs, 2010, p. 46).

For this investigation, the following procedures were followed during the qualitative data analysis process:

- Interviews were recorded by means of audio recording.
- Responses from the interviews were transcribed.
- The entire transcribed text was read in order to obtain an overall impression of the content.
- The text was coded. Segments consisting of sentences were assigned to specific codes. The researcher moved from descriptive coding to categorisation and to more

analytic codes in an attempt to address the research aims. During this investigation, the researcher started with a concept-driven approach. The researcher kept an open mind and attempted not to become too tied to the initial codes, extracting from the data what was happening.

- The text was read once again by the researcher, and the coding process was repeated.
- Once the coding process had been completed, it was possible for the researcher to categorise the data into themes.
- Themes were refined and further categorised into families according to the research aims.
- Data were compared.

The ethical aspects applicable to this investigation, for both quantitative and qualitative methods, are discussed in the next section.

4.7. Ethical aspects

Protecting the rights and interests of the subjects studied, is vital when information is acquired (Mouton, 2009). Universities, amongst others, develop and enforce codes of conduct in order to regulate members of their research community (Mouton, 2009), and the current investigation was conducted in accordance with the ethical codes of North-West University's (NWU) ethical committee.

The following ethical issues were taken into account:

- All participants were informed about the nature of the investigation.
- All participants completed an informed consent form, and were made aware of their right to refuse to be interviewed and to answer any questions.
- All participants were made aware of their right to withdraw from the interviews at any stage.
- Interviews were held during the day, never during mealtimes and participants were not interviewed for extended periods of time.
- The investigation formed part of an existing SDL project, for which permission was granted by the ethical committee of the NWU.
- Permission was attained from the parties concerned for the use of the SDLRS.
- The participants' privacy, anonymity and confidentiality were respected throughout the investigation. The confidentiality of the participants was ensured by keeping their identities secret.

- Although participation in this investigation was voluntary, none of the participants was at a disadvantage for not participating. The intervention implemented within this investigation formed part of the researcher's teaching–learning strategy; therefore, all participants in the experimental group were exposed to being part of a CBG.
- Audio tapes of the interviews were treated confidentially, and were analysed by the researcher and supervisors only. The researcher and supervisors were well aware of their obligation of keeping all data confidential.
- The researcher, the supervisors to the investigation and the Statistical Consultation Services of NWU were the only individuals who had access to the data.
- All data will be stored safely in accordance with the time period set by the NWU's ethical committee.

4.8. Summary

The first section of this chapter gave an outline of the research design and methodology followed during the investigation from a pragmatic perspective. A detailed discussion of the key components of the mixed methods approach, as well as justification of its suitability for this investigation, followed. The research design for both the quantitative and qualitative phases of this investigation were outlined and discussed in detail. The SDLRS, a CBGP questionnaire, a CSS, as well as semi-structured interviews were used to collect and gather data from the first-year Life Sciences students during the course of this investigation. Procedures that were followed during the data collection and gathering were discussed, followed by a detailed description of the quantitative and qualitative data analysis procedures. Finally, the ethical aspects for both the quantitative and qualitative methods were outlined. In the next chapter, a discussion of the analysis and interpretation of the collected data (quantitative and qualitative) will be presented.

CHAPTER 5

RESULTS AND ANALYSIS

5.1. Introduction

In this chapter, a discussion of the analysis of the quantitative and qualitative results, obtained according to the research design described in Chapter 4, is presented. During the current research, statistical analysis was undertaken by the Statistical Consultation Services of the NWU (Potchefstroom Campus), and the results provide information regarding the quantitative research done during this investigation. The transcribed interviews, analysed with the aid of Atlas.ti, provided information regarding the qualitative research.

The results of this investigation will be discussed on the basis of the research questions set in Chapter 1 (see 1.3.2).

5.2. Impact of cooperative base groups on the first-year Life Sciences students' self-directed learning readiness

The following research sub-question will be discussed in this section:

- To what extent does the implementation of CBGs have an impact on the first-year Life Sciences students' SDL readiness?

In order to answer the above-stated research question, the researcher made use of descriptive and inferential statistics to analyse the quantitative data collected. According to Maree and Pietersen (2007), descriptive statistics are used to organise and summarise data in a way that is meaningful. Inferential statistics involve procedures that enable the researcher to make fair and realistic decisions in terms of the population based on the sample (Creswell, 2012). For this investigation, t-tests and univariate analysis of covariance (ANCOVA) tests were done to indicate any statistical difference between the control group (year 1) and the experimental group (year 2).

During the current investigation, the researcher made use of the Self-Directed Learning Readiness Scale (SDLRS) to determine the first-year Life Sciences students' level of SDL readiness. The SDLRS is a standardised questionnaire developed by Guglielmino (1978) by means of a Delphi Survey (see 2.2.5). This questionnaire was administered at the beginning and at the end of the LS module of year 1 and year 2 (see Figure 4.2), in order to establish whether the intervention (CBGs) had an influence on the students' SDL readiness.

The analysis of the SDLRS data for the control group and the experimental group will be presented in sections 5.2.1 – 5.2.6.

5.2.1. Self-Directed Learning Readiness Scale: pre-tests of control and experimental groups

During this investigation, the first-year Life Sciences students completed the SDLRS pre-tests at the beginning of year 1 (control group) and at the beginning of year 2 (experimental group). The group statistics for both years are presented in Table 5.1.

Table 5.1 Independent t-test: Self-Directed Learning Readiness Scale pre-tests of control and experimental groups

Group	N	Mean	Std. deviation	p	d
Control	45	214.58	20.85	0.57	0.11
Experimental	53	217.25	24.45		

The results from the independent t-test reported in Table 5.1 show a small effect size ($d = 0.11$). This result is an indication that there was no practically significant difference between the pre-tests of the control and the experimental groups with regard to their SDL readiness. Mean scores for both groups falls within the ‘average’ SDL category (see 4.5.3.4).

An independent t-test was also done between the APS of the control and experimental groups, in order to establish whether the APS of the two groups were similar. A similar APS would have been an indication that the two groups were comparable. The results are presented in the table below:

Table 5.2 Independent t-test: Academic achievement Point Score of the control and experimental groups

Group	N	Mean	Std. deviation	p	d
Control	41	32.44	5.31	0.01	0.47*
Experimental	48	28.48	8.44		

* medium effect

Table 5.2 presents the results from the independent t-tests done to establish possible differences between the APS of the respective years, and indicates a medium effect size ($d = 0.47$). The experimental group’s mean APS is significantly lower than that of the control group. The post-test results were therefore adjusted for differences in the APS of the two groups.

5.2.2. Self-Directed Learning Readiness Scale: pre- and post-tests of control and experimental groups

For this investigation, the first-year Life Sciences students completed the SDLRS post-tests at the end of year 1 (control group) and at the end of year 2 (experimental group). This was done to establish whether or not the intervention had an influence on the first-year Life Sciences students' SDL readiness. The group statistics for both years are presented in Table 5.3.

Table 5.3 Dependent t-test: Self-Directed Learning Readiness Scale pre- and post-tests of the control and experimental groups

Group		Mean	N	Std. deviation	p	d
Control	SDLRS_pre	214.58	45	20.85	0.15	0.21
	SDLRS_post	210.11	45	24.35		
Experimental	SDLRS_pre	217.25	53	24.45	0.11	0.15
	SDLRS_post	213.57	53	23.04		

Table 5.3 above presents the results from the dependent t-tests done to establish possible differences between the pre- and post-tests of the respective years. The effect size for the control group's pre- and post-test was 0.21, while the effect size for the experimental group's pre-and post-test was 0.15. The low d-values are an indication that there were no practically significant differences between the pre-tests and post-tests of the two groups. In both groups, the post-test SDLRS scores decreased.

An ANCOVA, controlling for pre-test scores and APS, was used to determine whether the means between the post-tests of the respective groups were statistically and practically different. Table 5.4 shows an indication of the mean responses for each factor, adjusted for differences in APS and SDLRS pre-test scores.

Table 5.4 ANCOVA: post-test of the control group and post-test of the experimental group

Group	Adjusted mean	N	Mean square error	p	d
Control	211.88	45	318.22	0.71	0.08
Experimental	213.39	53			

No practical significant difference ($d = 0.08$) was measured between the post-tests of the respective groups, indicating that the intervention had no significant influence on the SDL readiness of the first-year Life Sciences students. The researcher wanted to determine whether or not this was also the case within the 'below average', 'average', and 'above average' SDLRS

categories (see 1.5.3.2.3). In order for the researcher to establish whether there were any differences between the respective post-tests of the control and experimental groups with regard to the categories of the SDLRS, dependent t-tests were done. The results are presented and discussed in the following sections.

5.2.3. Difference between Academic achievement Point Scores and pre-tests of the control and experimental groups per Self-Directed Learning Readiness Scale category

Independent t-tests were done in order to determine the difference between the control and experimental groups with regard to APS and pre-tests. This was done for the different SDLRS categories. The results are presented in Table 5.5.

Table 5.5 Independent t-test: Academic achievement Point Score and pre-tests of the control and experimental groups per Self-Directed Learning Readiness Scale category

Category	Variable		N	Mean	p	d
Below average	APS	Control	11	32.91	0.00	1.00**
		Experimental	10	20.10		
	SDLRS pre	Control	12	190.67		
		Experimental	13	186.85		
Average	APS	Control	22	32.14	0.22	0.34*
		Experimental	21	30.14		
	SDLRS pre	Control	23	214.13		
		Experimental	23	214.32		
Above average	APS	Control	8	32.63	0.59	0.22
		Experimental	17	31.29		
	SDLRS pre	Control	10	244.30		
		Experimental	17	244.47		

* small effect

** large effect

With regard to the APS of the Life Sciences students who scored themselves within the 'below average' SDLRS category, there was a practical significant difference of large effect between the control and experimental groups ($d = 1.00$). It was evident from the mean scores that the control group had a higher APS than the experimental group, which might have been an indication that the control group was academically stronger than the experimental group. It is further indicated in Table 5.5 that there was a small practically significant difference between the control and experimental groups when looking at the SDL readiness scores of the students in the 'below average' SDLRS category, with the control group obtaining a higher mean score in

the pre-test than the experimental group. When comparing the students' APS in the 'average' SDLRS category there appeared to be a practical significant difference of small effect between the control and the experimental group. The experimental group had a lower APS than the control group. No practical significant differences between the SDLRS pre-tests of students within the 'average' and 'above average' SDLRS categories could be found.

5.2.4. Difference between pre- and post-tests of the control group per Self-Directed Learning Readiness Scale category

Dependent t-tests were done to establish possible differences between the pre-test SDLRS and post-test SDLRS of the control group. This was done for each of the categories of the SDLRS (see 2.2.5). The results for all three these categories are presented in Figure 5.1 and Table 5.6 below, and will be outlined in this section. The SDLRS pre-test and post-test mean values per SDLRS category are graphically presented below (Figure 5.1).

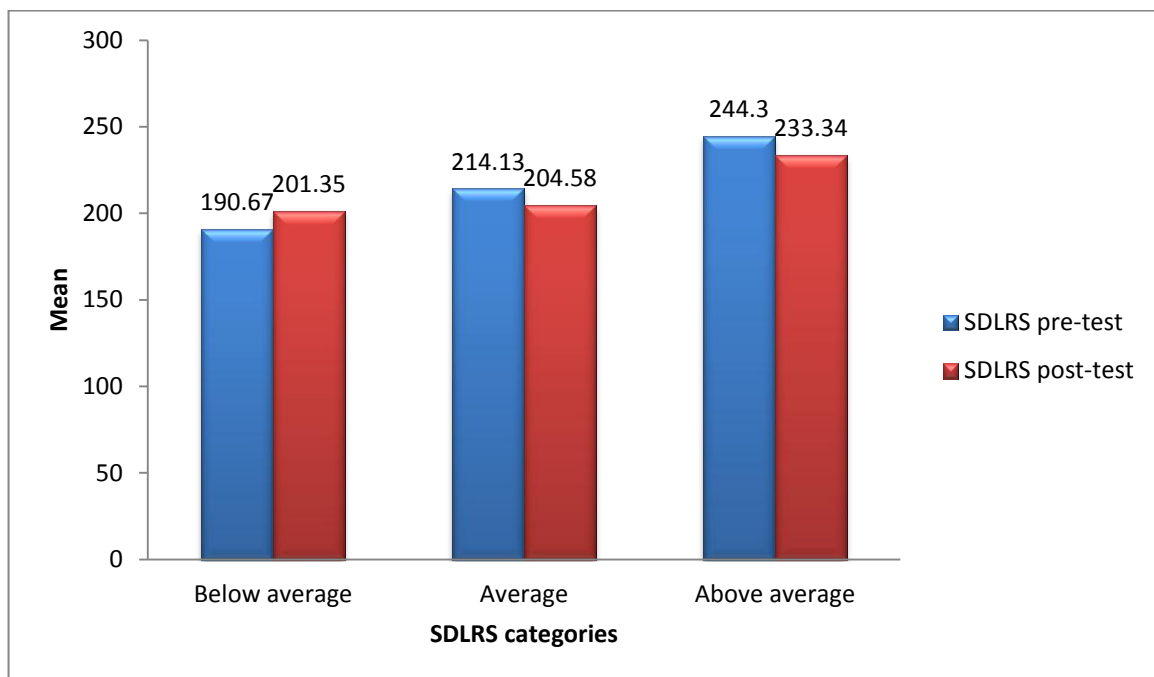


Figure 5.1 Self-Directed Learning Readiness Scale pre-test and post-test mean values per Self-Directed Learning Readiness Scale category of the control group

The mean is one of the measures of central tendency and is used in descriptive statistics to describe the arithmetic average for a set of values. At a first glance of Figure 5.1, the decrease in mean values in the 'average' and 'above average' SDLRS categories, as well as the increase in mean values of the 'below average' SDLRS category, is visible. In order to establish whether the increase or decrease in mean values was of practical significance, a dependent t-test was done for each SDLRS category (see Table 5.6).

As seen in Table 5.6 below, the d-value for the 'below average' SDLRS category is 1.01. This d-value can be classified as a large effect, implying that there is a practically significant difference between the scores of students in the 'below average' SDLRS category of the control group with regard to their SDLRS pre- and post-test. Thus, more students in the 'below average' category scored themselves higher in the SDLRS post-test than in the SDLRS pre-test. The d-values for the 'average' and 'above average' categories are 1.27 and 1.06 respectively. A practical significant difference was obtained from the SDLRS pre- and post-test data of the students with 'average' and 'above average' SDLRS scores of the control group. It should be noted that the post-test scores decreased in these two SDLRS categories. It could thus be concluded that only control group students in the 'below average' SDLRS category had a slight improvement on their perceived SDLRS scores after completion of their post-tests.

Table 5.6 Dependent t-test: Control group pre-test and post-test within the Self-Directed Learning Readiness Scale categories

Category		Mean	N	Std. deviation	t	df	p	d
Below average	SDLRS_pre	190.67	12	10.52	-1.79	11	0.10	1.01*
	SDLRS_post	201.35		20.48				
Average	SDLRS_pre	214.13	23	7.53	2.66	22	0.01	1.27*
	SDLRS_post	204.58		21.07				
Above average	SDLRS_pre	244.30	10	10.36	1.77	9	0.11	1.06*
	SDLRS_post	233.34		22.85				

* large effect

The results from the above-mentioned dependent t-tests were compared with the dependent t-test results from the experimental group to explore the impact of the CBG intervention on the self-directed readiness of the first-year Life Sciences students.

5.2.5. Difference between pre- and post-tests of the experimental group per Self-Directed Learning Readiness Scale category

Dependent t-tests were done to establish possible differences between the pre-test SDLRS and post-test SDLRS of the experimental group. This was done for each of the categories of SDLRS (see 2.2.5). The results for all three these categories are presented in Figure 5.2 and Table 5.7, and will be outlined in this section.

The SDLRS pre-test and post-test mean values per SDLRS category are graphically presented below (Figure 5.2).

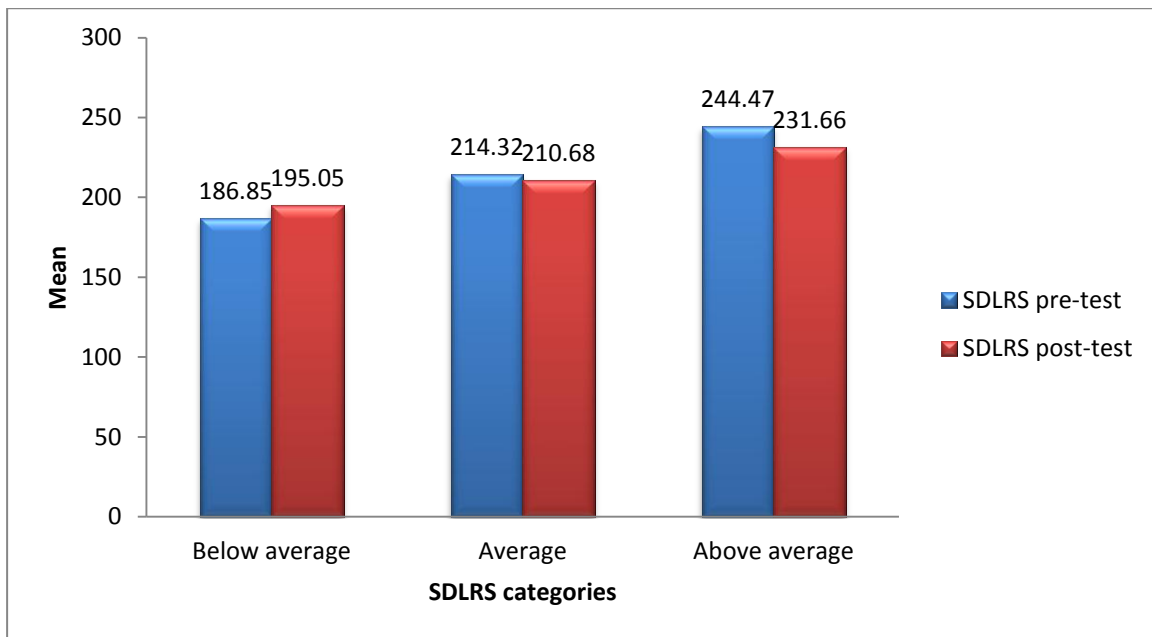


Figure 5.2 Self-Directed Learning Readiness Scale pre-test and post-test mean values per Self-Directed Learning Readiness Scale category of the experimental group

In Figure 5.2, an increase in mean value for the ‘below average’ category from the pre-test to the post-test is visible. A decrease in mean values for both the ‘average’ and ‘above average’ categories is evident, which indicates that students scored themselves lower in the post-test within these categories than in the pre-test.

Table 5.6 presents the results from the dependent t-tests, which were done in order to establish practically significant differences between the SDLRS pre- and post-tests within each SDLRS category.

As can be seen from Table 5.7, the d-value for the ‘below average’ SDLRS category was 0.69. This d-value can be classified as a medium effect, implying that there was a practically significant difference between the pre- and post-test of students in the ‘below average’ category. These students’ SDLRS scores improved in the post-test. The d-values for the ‘average’ and ‘above average’ categories were 0.46 and 0.91 respectively. Both these d-values were negative and indicated that the SDLRS scores of students in the ‘average’ and ‘above average’ categories decreased significantly in the post-test. Thus, fewer students in the ‘average’ and ‘above average’ categories scored themselves lower in the SDLRS post-test as opposed to the pre-test.

Table 5.7 Dependent t-test: Experimental group pre-test and post-test within the Self-Directed Learning Readiness Scale categories

Category		Mean	N	Std. deviation	t	df	p	d
Below average	SDLRS_pre	186.85	13	11.83	-2.69	12	0.02	0.69*
	SDLRS_post	195.05		15.36				
Average	SDLRS_pre	214.32	23	7.98	1.14	22	0.27	0.46*
	SDLRS_post	210.68		16.23				
Above average	SDLRS_pre	244.47	17	14.12	3.12	16	0.01	0.91**
	SDLRS_post	231.66		23.41				

* medium effect

** large effect

The results from the above-mentioned dependent t-tests were compared with the dependent t-test results from the control group to explore the impact of the CBG intervention on the self-directed readiness of the first-year Life Sciences students. The difference between the post-tests of the control and experimental groups will be discussed in section 5.2.6.

5.2.6. Difference between post-tests of the control and experimental groups per Self-Directed Learning Readiness Scale category

An ANCOVA, controlling for pre-test scores and APS, was done to determine whether there were any differences between post-tests of the respective groups by compensating for differences in APS and pre-tests. The following table presents the results for the ANCOVA.

Table 5.8 ANCOVA: post-tests of the control and experimental groups within the Self-Directed Learning Readiness Scale categories

Category	Group	N	Adjusted mean	Mean square error	p	d
Below average	Control	12	198.70	314.93	0.88	0.08
	Experimental	13	197.22			
Average	Control	23	205.81	274.75	0.35	0.29*
	Experimental	23	210.65			
Above average	Control	10	233.56	372.84	0.90	0.06
	Experimental	17	232.48			

* Small effect

The adjusted means of the control group were higher in both the 'below average' and 'above average' SDLRS categories. The d-values for the 'below average' and 'above average' SDLRS category were both small ($d = 0.08$ and $d = 0.06$ respectively), and indicated no practical

significant difference. The adjusted means of the experimental group within the 'average' SDLRS category were higher when compared with the control group ($\bar{x} = 210.65$ and $\bar{x} = 205.81$ respectively). The d-value for the 'average' SDLRS category was 0.29, which indicated a small practically significant difference between the control and experimental groups. This suggests that, on average, the students with an average SDLRS score improved on their SDL readiness after the CBG intervention. This improvement was of small practical significance.

All of the above-mentioned results were presented in order to explore the impact of CBGs on the first-year Life Sciences students' SDL readiness. After differences in pre-tests and APS had been compensated for, a small, practical significant difference was found between the post-tests in the 'average' SDLRS category of the control group (year 1) and the experimental group (year 2). This is an indication that the implementation of CBGs might have had an influence on the SDL readiness of the first-year Life Sciences students within the 'average' SDLRS category. No indication could be found of any improvement in terms of SDL readiness in the other SDLRS categories or in the experimental group as a whole.

5.3. First-year Life Sciences students' perception of cooperative base groups

The following research sub-question will be discussed in this section:

- What was the first-year Life Sciences students' perception of CBGs?

In order to answer the above-stated research question, the researcher will present and discuss the quantitative results obtained from the CBG perception (CBGP) questionnaire, and the qualitative results obtained from the interviews.

The CBGP questionnaire consisted of twenty questions aimed at establishing the first-year Life Sciences students' perception of the CBGs. Students answered the questionnaire at the end of the intervention by means of a four-point Likert-type scale. The descriptive statistics as well as validity and reliability of the instrument will be discussed next. The transcribed interviews were coded with the aid of Atlas.ti, and responses about the students' perception of CBGs are presented and discussed.

5.3.1. Descriptive statistics

Table 5.9 below presents the frequency distribution of the students' responses to the CBGP questionnaire. The percentages listed in Table 5.9 relate to those students who answered the question.

Table 5.9 Frequency distribution of student responses to the cooperative base group perception questionnaire

Item no.	Item	1	2	3	4	Mean	Std. deviation
		(Strongly disagree) f (%)	(Somewhat disagree) f (%)	(Somewhat agree) f (%)	(Strongly agree) f (%)		
1	The base group helped me to respect other persons' opinions	1 (2%)	9 (10%)	23 (26%)	54 (62%)	3.49	0.73
2	Sharing something personal with the group each week has helped me to support my group members	15 (17%)	25 (29%)	32 (37%)	15 (17%)	2.56	0.97
3	Because I was in a base group, I regularly attended LIFE 111 classes	10 (11%)	11 (13%)	32 (36%)	35 (40%)	3.06	0.97
4	Because I shared my marks with the rest of the base group, I wanted to work harder	6 (7%)	6 (7%)	26 (30%)	48 (56%)	3.34	0.89
5	To be part of a base group made me less anxious about LIFE 111	12 (14%)	15 (17%)	24 (28%)	36 (41%)	2.99	1.06
6	Because I was part of a base group, I learned to receive help	3 (3%)	12(14%)	31 (36%)	41 (47%)	3.26	0.83
7	Because I was part of a base group, I learned to be helpful	3 (3%)	9 (11%)	36 (41%)	39 (45%)	3.29	0.79
8	The base group provided me with academic support	10 (12%)	16 (18%)	30 (34%)	31 (36%)	2.97	0.98
9	I enjoyed being in a base group	10 (12%)	12 (14%)	29 (33%)	36 (41%)	3.06	1.02
10	To be in a base group is valuable	8 (9%)	9 (10%)	35 (41%)	34 (40%)	3.13	0.93
11	Because I was in a base group, I performed better in LIFE 111	7 (8%)	23 (27%)	31 (36%)	25 (29%)	2.81	0.93
12	In our base group all the members always worked together	18 (20%)	17 (20%)	25 (29%)	27 (31%)	2.71	1.12
13	Although I was in a base group I was still responsible for my own achievement	0	0	12 (14%)	74 (86%)	3.87	0.34
14	To be part of a base group taught me to communicate better	6 (7%)	11 (13%)	36 (42%)	32 (38%)	3.14	0.91
15	Because the base group met weekly, we worked better together	6 (7%)	18 (21%)	29 (34%)	33 (38%)	3.05	0.94
16	By evaluating the effectiveness of the base group, I became more aware of what our group needs in order to function better	3 (3%)	16 (19%)	39 (45%)	28 (33%)	3.09	0.81
17	I feel that our base group must meet more outside of class time	17 (20%)	26 (30%)	23 (26%)	21 (24%)	2.56	1.05
18	The 'class-on-the-grass' was better than gathering in a lecture hall	6 (7%)	12 (14%)	18 (21%)	49 (58%)	3.31	0.96
19	Regularly giving and receiving feedback to the base group members, helped me to focus on their positive aspects	5 (6%)	13 (15%)	35 (41%)	33 (38%)	3.12	0.89
20	I learned to handle conflict better because I was part of a base group	9 (11%)	15 (17%)	32 (37%)	30 (35%)	2.97	0.98

When comparing the positive responses of the students (categories 3 and 4) with the negative responses of students (categories 1 and 2), it can be seen that all the questions were positively answered by the students. This already gives a good indication of the students' positive perception of the CBGs. However, it is striking that only 54% of the students were positive about sharing something personal with their cooperative base group members (see item 2). Furthermore, only 65% thought that the CBGs contributed to their increased academic achievement (item 11) and 60% indicated that their cooperative base group members always worked together (item 12). The class was divided (50%, see item 17) on whether they must meet more outside of class time.

Of great importance to this investigation is the fact that, despite students had to work in their CBGs, everyone (100%) still felt responsible for their own learning (item 13). The students (88%) further feel that CBGs helped them to respect each other (item 1), that they (86%) wanted to work harder because they had to share their work with group members (item 4), and that they learned to give (86%) and receive (83%) help (items 7 and 6 respectively). The majority of students (81%) is of opinion that being in a CBG is valuable (item 10), and 74% indicated that they enjoyed being in a CBG (item 9). Eighty percent of the students felt that they could communicate better because of their involvement in CBGs (item 14), and 72% is of opinion that CBGs enabled them to handle conflict better (item 20).

5.3.2. Factor analysis of the cooperative base group perception questionnaire

The purpose of factor analysis is to explain the maximum variation with a small number of constructs. The CBGP questionnaire consisted of twenty questions, which were organised into five constructs. According to the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, this investigation had a value of 0.872. Enough data was therefore obtained for factor analysis. Bartlett's test of sphericity supports this result, as a value of less than 0.001 is evidence of sufficient correlation between items. All factors with a value greater than 1 are, in compliance with Kaiser's criterion, extracted. Community after extraction for this investigation, varied between 0.493 (item 16) and 0.849 (item 13). It was not necessary to remove any of the items from the CBGP questionnaire. The following table reflects a brief summary of the KMO (Kaiser-Meyer-Olkin) measure of adequate sampling, Bartlett's test of sphericity, as well as the correlation matrix for this investigation.

Table 5.10 KMO and Bartlett's test for the cooperative base group perception questionnaire

KMO measure of adequate sampling	0.87
Bartlett's test for sphericity	913.49
df	190
Significance (p-value)	0.000

According to (Kaiser, 1974), values greater than 0.5 can be accepted, whilst (Hutcheson & Sofroniou, 1999) state that values between 0.8 and 0.9 are great. For this investigation, the KMO value of 0.872 is an indication that enough data was obtained for factor analysis. Furthermore, the p-value indicated by Bartlett's test of sphericity is an indication of sufficient correlation between items for factor analysis.

In this investigation, five factors were extracted. Table 5.11 contains the variance displayed by these factors.

Table 5.11 Total variance explained by five factors

Factor component	Initial eigenvalues		
	Total	% of variance	Cumulative %
1	8.181	40.91	40.91
2	1.856	9.28	50.18
3	1.475	7.38	57.56
4	1.160	5.80	63.36
5	1.006	5.03	68.39

The pattern matrix for the items included in the CBGP questionnaire is outlined in Table 5.12. If an item had a factor loading above 0.3 on more than one factor, it was positioned in the factor where interpretability was best.

Table 5.12 Pattern matrix: first-year Life Sciences students' responses

Pattern matrix					
	Factor				
	1	2	3	4	5
Q5	.855				
Q11	.852				
Q8	.721				
Q9	.717	.233			
Q12	.680		.232		.268
Q10	.613	.215			.252
Q15	.520	.394			
Q20	-.255	.800			
Q1	.329	.668			
Q6	.302	.658			-.251
Q14		.607	-.273		
Q19		.559		-.207	.342
Q2		.538		-.245	.273
Q16	.206	.420			.260
Q4	.203		-.845		
Q17	-.280		-.634		.292
Q7	.383	.284	-.511		
Q3	.444		-.470	-.261	
Q13				.919	
Q18					.863

Table 5.12 indicates the items per factor. Based on the pattern matrix, the following five factors were identified: academic gain, social skills, positive interdependence, Q13 referred to the students being responsible for their own achievement, and Q18 referred to the 'class-on-the-grass' which took place once a week. Once all the items had been placed according to the highest loading in terms of factors, items 13 and 18 formed factors four and five respectively.

Factor 1 consisted of items regarding academic achievement, i.e. being less anxious about the content of the module (item 5), receiving academic support from peers (item 8), and the motivation to perform better academically (item 11). Items 9 and 10 indicate that students enjoyed and valued their base group's contribution towards their own academic achievement and gain. It seems that base group members who had regular meetings (item 15) contributed towards the members working together (item 12) and ultimately to the academic success of the students.

The items within factor 2 addressed social aspects. Items 1, 6, 14 and 20 addressed respect for other students' opinions, receiving help from fellow group members, better communication, and better conflict management, respectively. All of these are skills described in the literature (see 2.3.2.1.4) as being crucial for the success of cooperative groups. Providing support to group members (item 2), being able to evaluate the functioning of the base groups in order to identify aspects needed for better functioning (item 16), as well as focusing on the positive aspects of group members (item 19) are all social skills needed for processing the functioning of the base groups.

Factor 3 consisted of items 3, 4, 7 and 17, and addressed the highly valued positive interaction between group members. Positive interdependence is vital for the success of cooperative groups (see 2.3.2.1.1). Attending classes regularly because of base group membership (item 3) and wanting to work harder because of sharing marks with fellow base group members (item 4) indicated positive interdependence among members. Item 7 addressed the ability to help fellow group members. This would not have happened had the interaction between base group members not been positive or promotive.

Factor 4 addressed the responsibility being taken by the students for their own achievement, and consisted of item 13. Being able to function in a cooperative group whilst taking ownership of own learning is an important aspect of cooperative learning. Although students work together on various tasks, acting out the 'sink-or-swim' principle, each student needs to be individually accountable for his or her own learning and achievement.

The last factor (factor 5) dealt with a cooperative learning environment in which face-to-face interaction was promoted. The 'class-on-the-grass' took place once a week and allowed seating arrangements necessary for promotive face-to-face interaction.

All the factors demonstrated good internal reliability. The Cronbach alphas for factors 1, 2 and 3 were 0.912, 0.861 and 0.718 respectively (see Table 5.14).

5.3.3. Correlations

Pearson's correlation coefficients were calculated to investigate the interrelationships between the CBGP questionnaire factors. The factor correlation matrix is specified in Table 5.13, and indicates the extent to which different factors correlated with one another.

Table 5.13 Factor correlation matrix for identified factors

Component/factor	Factor correlation matrix				
	Academic gain	Social skills	Positive promotive interaction	Responsible for own achievement	Class-on-the-grass
Academic gain	1.000	0.604***	0.388**	-0.014	0.215*
Social skills	0.604***	1.000	0.555***	-0.003	0.257*
Positive promotive interaction	0.388**	0.555**	1.000	-0.067	0.134*
Responsible for own achievement	-0.014	-0.003	-0.067	1.000	0.200*
Class-on-the-grass	0.215*	0.257*	0.134*	0.200*	1.000

* Small correlation
 ** Medium correlation
 *** High correlation

“Academic gain” indicated a high correlation with “Social skills” and a medium correlation with “Positive promotive interaction” ($r = 0.604$ and $r = 0.388$ respectively). “Academic gain” also correlated with “Class-on-the-grass” ($r = 0.215$). These results indicate the strong relationship between the students’ perceptions of their academic gain, positive promotive interaction and the role of social skills. For factor 4 (“Responsible for own learning”), there were no correlation with any of the other identified factors except for a small correlation with “Class-on-the-grass” ($r = 0.200$). “Class-on-the-grass” further had a small correlation with “Academic gain” ($r = 0.215$), “Social skills” ($r = 0.257$) and “Positive promotive interaction” ($r = 0.134$). “Positive promotive interaction” indicated a medium correlation with “Social skills” ($r = 0.555$), which is an indication that an increase in the students’ perceived social skills will result in increased positive promotive interaction (and vice versa).

The construct validity of this instrument was indicated by the total percentage of the variance explained, high communalities, as well as the extent to which the pattern matrix could be interpreted. Cronbach alpha coefficients were calculated for each construct in order to determine the reliability of the CBGP questionnaire. The Cronbach alpha coefficient was calculated for each combination of questions in order to illustrate the level of internal consistency. According to Pietersen and Maree (2007), a value of 0.9 indicates a high degree of reliability, 0.8 an average reliability, and 0.7 a low degree of reliability. Table 5.14 contains the mean, standard deviation, and Cronbach alpha coefficient for each of the five factors.

Table 5.14 Cronbach's alpha coefficients, means and standard deviation for identified factors based on first-year Life Sciences students' responses to the cooperative base group perception questionnaire

Items	Factor number	Factor	Cronbach alpha coefficient	Mean of inter-item correlation	Mean	Std. deviation
5, 8–12, 15	1	Academic gain	0.912	0.598	2.96	0.80
1, 2, 6, 14, 16, 18, 20	2	Social skills	0.861	0.470	3.09	0.64
3, 4, 7, 17	3	Positive promotive interaction	0.718	0.407	3.07	0.69
13	4	Responsible for own academic achievement			3.87	0.34
18	5	'Class-on-the-grass'			3.31	0.96

Factor 4 (“Responsible for own academic achievement”) and factor 5 (“Class-on-the-grass”) each consisted of a single question, and therefore no value for the Cronbach alpha coefficient is indicated. Factor 4 had the highest mean with a value of 3.87, whilst “Academic gain” (factor 1) had the lowest mean with a value of 2.96.

Although descriptive statistics indicated the first-year Life Sciences students' positive perception of CBGs, these results were strengthened by the subsequent qualitative results.

5.3.4. Students' interview responses regarding their perception of cooperative base groups

Semi-structured interviews were held with seven students at the end of the LIFE 111 module in year 2 (experimental group).

Upon analysing the data from the interviews, the following themes concerning the students' perception of CBGs were identified:

- caring and committed relationships;
- academic value;
- interdependence;
- personal value;
- valuable and fun;

- social skills;
- heterogeneity;
- ‘class-on-the-grass’;
- folder.

Table 5.15 presents the themes, codes and some quotes for the data grouped in the ‘perception of CBGs’ family.

Table 5.15 Themes, codes and quotes associated with the students’ perception of cooperative base groups

Family	Theme	Codes	Some quotes
Perception of CBGs	Caring and committed relationships	Became friends Continued friendship	“It was not a base group; it was a group of friends.” “We are still in our group and still talk.”
	Academic value	Before a test Kept you calm Provided academic support Learned from each other Sharing marks	“... it was really nice, we really supported each other, especially before a test.” “You arrive as a first-year student, you are so scared and don’t know what to expect, and so [CBGs] basically calmed me.” “... what you don’t understand, another person understands better; so helping each other results in bettering your marks.” “I think it was a good thing to let students work together ... we all come from different provinces, so we learned different things and had different class situations. And now we can learn from each other.” “... and it was motivational because now everyone in the group could see your marks, and it motivates you to do better ...”
	Interdependence	Had confidence in each other Responsibility towards others Work better alone Worked together	“... and you had confidence in each other. You knew that if you had an assignment that had to be handed in on Monday, you could trust that the other person did her part.” “... when you are in a base group you are under pressure to come prepared to class because you know there are people that you are to explain to.” “... I have to say, I work better alone.” “... it helped, like the little bit everyone knew and we used to split the work. That is how we did it, split the work. Like you concentrate on this, you concentrate on that, but you should know everything. But then you should master one thing and then when we come together, we share it, so that helped a lot.”
	Personal value	Asking for help Comfortable and safe Making it personal	“We were free to ask one another anything in the group. When you didn’t understand you could always ask. You felt free, you didn’t feel scared or anything.” “At least you know that you have somewhere to hide...it helped like ... for LIFE, it helped me. I don’t want to lie. It really helped me.” “... there was one day that I came very sad and I came and said that I need a hug and it was almost like everyone loved me. I felt so loved ... the thing is working. So, ja, I like the fact that ma’am ask you how do you feel, what do you feel like ... ja that was awesome.”

Table 5.15 Themes, codes and quotes associated with the students' perception of cooperative base groups (continued)

Family	Theme	Codes	Some quotes	
Perception of CBGs	Valuable and fun	It helped	"Yes, I learned a lot. It helped, tremendously. We used the GIG [Group-Individual-Group] method of writing a test once, and it helped tremendously."	
		It meant a lot	"It meant a lot to me because it doesn't matter what we did, we had a WhatsApp group, and we could always ask."	
		Not necessary	"No, I don't think I would have missed something. I think it would have still gone well."	
		Continued implementation	"I actually think that we should have base groups for the LIFE 121 module as well."	
		Enjoyed it	"Yes, I enjoyed it. I like group work because then I feel that I don't go through stuff alone."	
		No change to CBGs	"So definitely, yes. It was a good thing. I wouldn't change it."	
	Social skills	Accommodated each other	Giving and receiving help	"So, we helped one another, yes. Especially with the terms, you know the Mader [textbook used for LIFE 111]. I normally helped where I could with the translations."
			Communication	"Yes, yes, our communication system was really good."
			Resolving conflict	"Yes, if it [conflict] was sorted out ... it would have definitely been better ... nobody ever put in the effort."
'Class-on-the-grass'	Class-on-the-grass valuable	More class, less class-on-the-grass	"... in the beginning there weren't enough time for the base groups, but the grass, that one period that we got worked perfectly."	
			"I would have preferred more class [instead of allocating a whole period to the CBGs]."	
Folder	Positively experienced		"...I would say it was a good thing, I am not sure that I would change anything."	
			"We got to know each other this way."	
	Negatively experienced		"I think it is a good thing to have students work together [on the CBG folder], in that way we get to know each other."	
		"Ok, fine, to be honest, I didn't like the folders [CBG folder]. It was just too much paperwork"		

Each of the identified themes will be discussed in order to paint a picture of how students perceived being part of a CBG.

- Caring and committed relationships

The majority of students who were interviewed indicated that CBGs enabled friendships among group members. It was further indicated that their friendships continued beyond the CBG intervention.

- Academic value

Most of the students who were interviewed indicated that CBGs provided them with academic support, especially before writing a test. Students were of the opinion that being part of a CBG kept them calm, and eased their integration into tertiary education. The majority of students also indicated that within the CBGs, they learned from each other, and it was specified that sharing their marks with their CBGs played a role in their motivation and academic achievement. Student 3 said, "... we had to make graphs, and it was motivational because now everyone in the group could see your marks, and it motivates you to do better ..."

- Interdependence

Various students indicated that they felt responsible for their CBG members, that they had confidence in their members, and that they realised they had to work together in order to master the content. Student 7 specified that she worked better alone, but also indicated that she felt responsible towards the CBG members and that they worked together.

- Personal value

Students indicated that they valued the personal support within their CBGs, and that they felt comfortable and safe within their CBGs. Various students indicated that they could ask for help within their respective CBGs. Student 2 said, "We were free to ask one another anything in the group. When you didn't understand you could always ask. You felt free, you didn't feel scared or anything."

- Valuable and fun

The majority of students indicated that they enjoyed being part of a CBG, and that it helped them personally as well as academically. Although Student 7 indicated that she did not see the necessity of CBGs. The same student however indicated the need for continued implementation of the CBGs. Students pointed out that CBGs were disliked initially, but students also indicated that they valued being part of CBGs, and explicitly mentioned that CBGs, as they experienced it, needed no change.

“I didn’t like it at first because now you have to meet with new people and Ma’am just gave me like a number and that number was your group. And you like ... OK ... who are these people, and ok, I was in an awesome group” (Student 2).

- Social skills

Various students who were interviewed indicated that giving and receiving help was a big part of the CBG in which they were. Students also gave an indication that they accommodated each other within their respective CBGs, with Student 4 saying, “... we took each other’s opinions into account, which was nice ...” Student 7 specified that good communication did not exist within her CBG and that no one within the CBG put in any effort to resolve the conflict. This perception was not shared by any of the other students who were interviewed.

- Heterogeneity

The diversity brought to each CBG because of the heterogeneous nature of the groups was acknowledged by several students. Student 8 said, “For me it was very valuable, someone else thinks of something else that you did not think of.”

- Class-on-the-grass

Although none of the questions, which were asked during the interviews, explicitly dealt with the ‘class-on-the-grass’, some participants indicated that the ‘class-on-the-grass’ was valuable. Student 7 on the other hand, pointed to her need for less ‘class-on-the-grass’, and said, “I would have preferred more class.”

- Folder

The majority of students perceived that the CBG folder is an important part of CBGs. Although some students indicated that the amount of paperwork was daunting, several students stated that the CBG folder aided the development of relationships amongst group members.

From the abovementioned findings it is evident that the first-year LS students perceived the CBGs as a valuable and fun experience, of academic and personal value. The students were of opinion that caring and committed relationships were formed, social skills were developed, interdependence experienced. The “class-on-the-grass” and the CBG folder were positively perceived by some students and negatively by others.

The contribution of students' perception of CBGs towards their self-directed learning (SDL) competencies will be discussed in the next section.

5.4. Extent to which the first-year Life Sciences students' perception of cooperative base groups contributed to their self-directed learning competencies

Because good social skills play a vital role in both CL and SDL (see 2.4), attention will first be given to the results of the checklist for social skills (CSS) in order to answer the following research sub-question:

- To what extent does the first-year Life Sciences students' perception of CBGs contribute to their SDL competencies?

5.4.1. Checklist for social skills

The CSS was one of the documents included in the folders of each CBG (see 4.5.3.3 and appendix A:8). This checklist comprised fourteen different social skills, and students had to indicate whether they observed the specified skills amongst their CBG members. The checklist was completed three times during this investigation, namely at weeks 3, 6 and 11 of year 2 (experimental group). In order to correlate the observed social skills with other quantitative data, the social skills for each student were summarised as a mark out of ten. Table 5.16 presents the descriptive statistics on students' CSS scores and will be discussed subsequently.

Table 5.16 Descriptive statistics of the checklist for social skills at weeks 3, 6 and 11 respectively

Checklist for social skills (CSS)	Mean	Std. deviation	N	Min	Max
CSS 1 (Week 3)	8.60	2.71	70	4	14
CSS 2 (Week 6)	8.61	2.07	70	3	13
CSS 3 (Week 11)	9.17	2.94	65	2	14

From Table 5.16 it is evident that the students displayed good social skills as from CSS 1, with a mean value of 8.60. All the students identified good social skills within their groups, as there were always more than 8 out of a possible 14 social skills indicated, and several students indicated that all 14 social skills could be identified within their CBGs. Although a slight increase is visible from CSS 1 to CSS 3, indicating that the social skills of the students improved

as the intervention continued, there is still room for improvement. A longer CBG implementation period may have resulted in social skills being developed even further.

5.4.2. Correlations between the checklist for social skills, the cooperative base group perception questionnaire factors and the Self-Directed Learning Readiness Scale post-test

Pearson's correlation coefficients were calculated to investigate the interrelationships between the CSS, the CBGP questionnaire factors and the SDLRS post-test of the first-year Life Sciences students. The factor correlation matrix is reflected in Table 5.17, and indicates the extent to which different factors correlated with one another.

Table 5.17 Factor correlation matrix of the checklist for social skills, cooperative base group perception questionnaire factors and the Self-Directed Learning Readiness Scale post-test

Component/Factor		Checklist for social skills (CSS)	Self-Directed Learning Readiness Scale post-test
Cooperative base group perception questionnaire factors	Academic gain	0.157*	0.008
	Social skills	0.120*	0.307**
	Positive promotive interaction	0.195*	0.099
	Responsible for own achievement	-0.041	-0.160
	Class-on-the-grass	0.029	0.001

* Small correlation

** Medium correlation

There appears to be a small correlation between the CSS and the following CBGP questionnaire factors: “Academic gain” ($r = 0.157$), “Social skills” ($r = 0.120$) and “Positive promotive interaction” ($r = 0.195$). A medium correlation ($r = 0.307$) was found between factor 2 (“Social skills”) and the SDLRS post-test (experimental group). It seemed that students realised the importance of CBGs for the development of social skills. The higher the participating students’ perception of their social skills was, the higher their SDL readiness was. Good interpersonal/social skills also comprise one of the characteristics of a self-directed learner (see 2.2.4).

In the following section, the interview responses of the randomly selected first-year LS students will be analysed. The analysed interview responses and the CSS data will be used in order to

establish the extent to which the perception of CBGs contributed to the students' SDL competencies.

5.4.3. Students' interview responses

Qualitative results from the interviews will be discussed next in order to provide further clarity when interpreting the quantitative results.

After the interviews had been recorded, the data was transcribed and analysed with the aid of Atlas.ti. Themes and codes applicable to the research question were identified. A self-directed learner possesses various specific competencies enabling the individual to become a lifelong learner (see 2.2.4 & 2.4). Self-directed learner competencies, described in literature and highlighted in Chapter 2, formed the foundation for the thematic coding of the interviews. Once the data from the interviews had been analysed, the following themes concerning the students' SDL competencies were identified:

- viewing peers are seen as resources;
- giving and receiving help;
- taking initiative;
- taking responsibility;
- developing social skills; and
- motivation.

The responses of the first-year Life Sciences students will be discussed in the paragraphs following Table 5.18. Table 5.18 presents the themes, codes and some quotes for the data grouped in the SDL competencies family.

Table 5.18 Themes, codes and quotes associated with the students' self-directed learning competencies

Family	Theme	Codes	Some quotes
Self-directed learning competencies	Peers are seen as resources	Before a test	"It was really nice; we really supported each other, especially before a test."
		Provided academic support	"I think it really helps you academically because if there is something that you don't understand, someone else in the group understands it better than you. So, then it helps you."
		Heterogeneity	"It was a bit difficult because we were half Afrikaans and half English ... so, most of the Afrikaans [students] worked together most of the time and the English [students] worked together." "It worked fine for everyone. Because sometimes there are certain things, when we are reading, that we find in English and not in Afrikaans, and sometimes it is the other way around. So, we helped one another. It was nice. We would ask them what the Afrikaans was, and what is going on here and they helped us. "
		Learned from each other	"So, we got along very well and we supported each other and explained the work to each other, so it was very valuable."
		Uniqueness	"What was very valuable to me is that someone else always thinks of something that you didn't think of."
		Work better alone	"... I have to say, I work better alone."
	Giving and receiving help	Asking for help	"Anytime, we could ask one another any time questions, and ... there was no time limit like 12 am lights out, no."
		Assistance	"And if they didn't understand something, we would then help them."
		Working together	"... it [group work] helped to complete tasks, for example the practicums, and that everyone do their part to complete stuff ..."
	Taking initiative	Additional resources	"... we used Google to help us as well ..."
WhatsApp group		"... we created a WhatsApp group where everyone could share their thoughts. Maybe if someone is confused you could say I am not fine with this, if you are not able to attend classes you just say on the group and we will tell you what we did in class and all of that."	
Taking responsibility	Preparing for class	"Sometimes you come here, when you are in a base group you are under pressure to come prepared to class because you know there are people that you are to explain to."	
Social skills	Accommodated each other	"... and we took each other's opinions into account, which was nice."	
	Communication	"We were very straightforward with each other. We didn't experience a lot of conflict, actually never."	
Motivation	Sharing marks	"... it [sharing marks] was motivational because now everyone in the groups could see your marks, and it motivated you to do better ..."	

- Peers are seen as resources

Academic support, especially before writing a test, learning from each other, as well as acknowledging each group member's unique contribution to the CBG, is an indication that students recognised their CBG members as resources. Although most students indicated that they learned from their CBG members, Student 7 specified that she did not see the CBG members as resources, as this student indicated that she preferred working alone. Even though the majority of students who were interviewed indicated that the uniqueness of each CBG member was used as resource to strengthen the group, some students specified that different languages within their groups were problematic. The students, who indicated that language was a problem, were Afrikaans-speaking students in CBGs with Afrikaans- and English-speaking students. On the other hand, a number of students indicated the value of having both Afrikaans-speaking and English-speaking students in the same CBG. An Afrikaans-speaking student (Student 8) said, "We spoke Afrikaans to them. They spoke English to us." Student 8 further stated that her group could ask for translations from the English group members, and could assist them with help when they needed it later on.

- Giving and receiving help

Various students indicated that they could ask for the assistance of their CBG members at any time. Several students indicated that they valued the fact that they could provide and accept help from their fellow CBG members.

- Taking initiative

Students unexpectedly formed groups on WhatsApp (a communication application for smartphones) to stay in contact. No mode of communication was specified by the researcher, implying that students took the initiative to form communication platforms in order to stay in touch so that "everyone could share their thoughts".

- Taking responsibility

Several students stated that they felt responsible for their CBG members' academic achievement, and Student 2 said, "... we felt obliged to do something because we knew how is it going to look if I come [to class] empty-handed ..."

- Social skills

Although it seemed that there was an initial struggle to communicate, it was indicated that students accommodated each other and some groups had good

communication systems. Student 8 said, “We didn’t experience a lot of conflict, actually never.” Another student (Student 7), who stated that her fellow group members did not communicate well, also indicated that none of the group members put in any effort to resolve the conflict amongst the members.

- Motivation

It was indicated that the sharing of marks within CBGs motivated students to work even harder and to perform better academically.

The abovementioned findings indicate that students’ perception of CBGs contributed to several much needed SDL competencies.

The contribution that personal support, students’ active involvement in evaluating their own and their peers’ ideas, as well as the CBG folder within CBGs made towards SDL competencies is discussed in section 5.5.

5.5. Contribution of personal support, students’ active involvement and the cooperative base group folder to first-year Life Sciences students’ self-directed learning competencies

The following research sub-questions will be discussed in this section:

- How does the personal support within the CBGs contribute to the first-year Life Sciences students’ SDL competencies?
- How does the active involvement of the first-year Life Sciences students’ evaluation of their own and their peers’ ideas within the CBGs, contribute to their SDL competencies?
- How does the CBG folder contribute to the first-year Life Sciences students’ SDL competencies?

In attempting to answer the above-stated research questions, the researcher presents the analysed qualitative results, which were obtained from the semi-structured interviews. See Chapter 4 (4.6.3 – 4.6.4) for a detailed discussion of the procedure followed during the conduction and analysis of the interviews.

CBG members provide each other with personal support (Johnson et al., 2008), and are actively involved in the evaluation of each other’s ideas (Gillies, 2007). CBG folders are a means of ensuring the presence of the basic elements of cooperative learning (see Table 3.2). The aim

of this section is to establish the contribution of each of the above-mentioned factors, present within CBGs, on the SDL competencies of the first-year Life Sciences students.

Table 5.19 below presents the themes, codes and some quotes for the data grouped within the following families 'personal support', 'active involvement in evaluating ideas', and 'folder'.

Table 5.19 Central themes in coding for the influence of personal support, active involvement in evaluating ideas, and the cooperative base group folder on the students' self-directed learning competencies

Family		Themes	Codes	Some quotes
Folder	Active involvement in evaluation	Giving and receiving help	Comfortable and safe	"At least you know that you have somewhere to hide ... It helped like for LIFE [LS], it helped me. I don't want to lie. It really helped me."
			Assistance	"So, we helped one another ..."
			Making it personal	"... and if something was wrong, and you had the boldness to write it down [in file folder], you could help each other."
			Worked together	"... we worked together ... I really tried to do my part."
		Social skills	Accommodated each other	"... we took each other's opinions into account, which was nice."
			Communication	"... we got along very well."
			CSS	"... then you would say no that person doesn't have communication skills, yet nothing has been done about that."
			Folder	"... it started a nice conversation within the group ... and everything was interesting."
		Peers are seen as resources	Folders provide academic support	"... so when you worked together, you would know how this person is like and how the other one is not like. So that ... helped."
			Language	"... there weren't communication between the Afrikaans and English students." "No! We spoke Afrikaans to them and they spoke English to us."
Learned from each other	"We study ... together."			
Heterogeneity	"Everyone made a unique contribution to the group."			
Work better alone	"... I have to say, I work better alone."			
Diagnosing learning needs	Progress	"The portfolios help. They help keep track of how far are you guys, how much you understand."		

Table 5.19 indicates that the personal support within CBGs, active involvement in evaluating own and peers' ideas, as well as folder all contributed towards the following SDL competencies:

giving and receiving help and social skills. Active involvement in evaluating their own and their peers' ideas further contributed towards peers being seen as resources. The CBG folder also contributed towards diagnosing their learning needs. Giving and receiving help, social skills, seeing peers as resources and diagnosing learning needs are some of the characteristics of a self-directed learner (see Chapter 2). A discussion of the identified themes will follow.

- Giving and receiving help

Students indicated the importance of making the CBGs personal, and Student 5 said, "Like this other time, one of our base group members was really sick ... so she didn't write the first test, so we talked to her about that, how she was feeling and all that." Student 7 indicated that sharing something personal was not necessary, but later contradicted herself when mentioning that it was interesting to learn more of the people who were in the same CBG. The comfortable and safe environment which was established within the CBGs seemed to have enabled the students to give and receive help. Some students specified that they were supported personally within their respective base groups. Through working together on the CBG folder documentation and learning to accommodate each other, students indicated that the folder enabled them to give and receive help from peers. Students mentioned that they learned to take each other's opinions into account, and others pointed out that they worked together to complete set tasks.

- Social skills

Students indicated that the CBG folder allocated to each CBG provided personal support. This might have contributed to their social skills, as students had to share something personal each week via the folder (see 4.4.1 – 4.4.4). In this regard, the folder appeared to have enabled the students to learn how to accommodate each other. The CSS was mentioned by several students, and it was specified that the CSS was given to students too frequently. It should be pointed out, however, that the CSS had to be completed only three times during the semester (see 4.4.1 – 4.4.4). Although the researcher provided three separate opportunities for the students to make use of the CSS, and intervened when poor social skills were identified, it was indicated that the CSS was not sufficiently reinforced with the following responses, "OK, communication skills, then you say no that person doesn't have communication skills, yet nothing has been done about it", and "I felt that if you have a lack in something ... ma'am did nothing to stimulate the fact that person lack something ...". Students gave an indication that the folders were a necessary part of CBGs. Student 6 said, "No, no, because in this way you got to know each other." In

getting to know one another through the folder documentation, the students had to communicate and therefore gained valuable social skills. Student 7 indicated that the folders were unnecessary and did not contribute in any way. It should be mentioned that the same student also indicated that the CBG of which she was part, did not communicate well and did not try to resolve the conflict within the group. Student 7 however also indicated that the folders were a necessary part of the CBGs, therefore contradicting her earlier statement regarding the need of the CBG folder.

Although a number of students indicated that they valued the sharing of something personal within the CBGs, it was mentioned that the CBG folder was a big responsibility, while students also indicated that the folders required too much paperwork and it also took too much time to complete the necessary documentation. Student 5 said, "... the thing is that it's a lot of papers". This might be why Student 7 said that she supported more class instead of 'class-on-the-grass'. Students recommended that the folders should not be assembled beforehand, but that the CBGs should receive the necessary documents a day or a week in advance. Students mentioned that the amount of documentation within the folders was a bit confusing, but also indicated that it was interesting and helpful.

Several of the responses made by the students regarding the value of the CBG folder and the documentation therein need to be pointed out. Enjoying the folders and sharing more than was expected, were aspects highlighted by the first-year Life Sciences students. Student 3 said, "... it started a nice conversation within the group ... and we were excited to do it. Our group always wrote something extra that wasn't really asked, like something personal ...". Student three's response is an indication of increased motivation and curiosity, as well as the eagerness to communicate with each other. These are vital skills needed to be a self-directed learner (see 2.4). The value of the agendas during each CBG meeting was also mentioned by the students.

- Peers are seen as resources

It seemed that different opinions arose about how students experienced the different languages within the CBGs. These students utilised the opportunity to improve their own communication skills, thus recognising their peers as resources. It was indicated by several students that each CBG member made a unique contribution to his or her respective CBG. Although Student 7 indicated that she worked better alone, implicating that she did not see her fellow CBG members as resources, the

majority of students indicated that they learned from their peers. Students indicated that the folders provided them not only with personal support, but also with academic support. In providing each other with academic support, students recognised their CBG members as resources:

... there are some people that can't say stuff. So, if the person say something on the file, then you would know, fine, then you will understand if this person has a problem and what was the cause of the problem. When you work together, you would know what this person is like and what the other person is not like (Student 4).

- Diagnosing learning needs

It was pointed out that the folders enabled students to keep track of their academic progress. This implies that the folders played a vital role in diagnosing the learning needs of students. Student 3 said, "The portfolios help. They help keep track of how far are you guys, how much you understand." Furthermore, it was indicated that the folders helped students to focus on thinking of themselves. The student said, "I never experienced it before, it was new to me. So I enjoyed it because it made you think about yourself, which I think is a good thing."

Because one student had predominantly negative interview responses (Student 7), a detailed profile was compiled and compared to another student's profile (Student 8) who indicated predominantly positive interview responses.

Further analysis of the responses of Students 7 and 8 will be discussed in the next section. These students were selected to represent highly negative and highly positive responses respectively. A profile for each of the students and their respective CBGs will be given.

5.6. Highly negative and highly positive perceptions: profile of students

Table 5.20 below reflects a summary of the profile of a student who perceived being part of a CBG as a negative experience, as well as the profile of a student who perceived being part of a CBG as a positive experience. The table also gives an indication of what these students' overall perceptions of CBGs were, as well as their SDL competencies.

Table 5.20 Highly negative and highly positive perceptions: profile of students

	Student 7: Negative experience	Student 8: Positive experience
CBG number	CBG 8	CBG 16
Language spoken by the CBG members	Afrikaans	Afrikaans and English
Students' overall perception of CBGs	Not a necessity No personal support provided Enjoyed working together, but preferred working alone	Safe environment Enabled long-term friendships Provided academic and personal support Enjoyed working together
SDL competencies displayed by the student	Giving and receiving help	Peers were seen as resources Giving and receiving help Social skills

Student 7 was one of four Afrikaans-speaking students in CBG 8. Because Student 7 took some time off before entering tertiary education, she was older than the rest of the CBG 8 members. It is worth mentioning that two of the four students in this particular CBG passed the LS module, of which Student 7 was not one. Upon analysing the interview responses of Student 7, it became clear that this student perceived CBGs as highly negative. This student pointed out that she did not grasp the necessity of CBGs. The reason for this perception might have been this student's view that the members of group 8 did not provide each other with personal support. Although Student 7 did not indicate the absence of academic support, the presence thereof was not explicitly mentioned either. Student 7 displayed an important SDL competency, namely being able to give and receive help. Based on Student 7's indication that the members of group 8 experienced conflict amongst themselves and that none of the members were willing to try and resolve the conflict, it might be concluded that the members never learned to accommodate each other. The lack of good social skills might have affected the provision of personal and academic support within the group. The CBGs were given the opportunity to evaluate their effectiveness as a group. This took place on three separate occasions during the time that CBGs were implemented. Interestingly enough, the members of group 8 never indicated that they struggled with communicating or that they experienced conflict. The only aspect that they identified as a limitation to the optimal functioning of their CBG was the absenteeism of a particular group member. The question now is why the experience of Student 7 was so much different from that of group 8 as a whole, and what might have caused her negative opinion towards CBGs. Student 7 might not have been motivated towards working in a cooperative group, because she was older than the rest of the group. The

fact that Student 7 took time off before entering tertiary education, might have had an influence on her preference for working alone.

Student 8 was one of two English-speaking students in CBG 16. All four students within this CBG passed the LS module. After analysing the responses of Student 8, it became clear that this student perceived being part of a CBG as a highly positive and beneficial experience. Student 8 mentioned that being part of CBG 16 was an “awesome” experience and that it eased the transition from school to university, providing its members with academic and personal support. Student 8 also indicated that the members of CBG 16 formed a WhatsApp group, which acted as an additional communication platform. Although two of the four students in group 16 were Afrikaans-speaking, Student 8 recognised the uniqueness of each of her fellow group members and indicated that they learned from each other. Student 8 did not mention that group 16 experienced any conflict. This might have been the case because the group members felt comfortable and safe within the group, and because Student 8 indicated that group members communicated honestly and openly with each other. Student 8 mentioned in her interview that she lacked the reinforcement of social skills. The student pointed out that once social skills had been found to be lacking in one group member, nothing was done to rectify the problem. This implies that the CSS not only made students in group 16 aware of the necessary social skills, but also enabled them to realise the need thereof. It was also indicated by Student 8 that the members of group 16 became friends and enjoyed working together. Upon evaluating the effectiveness of group 16, the students indicated that everyone was honest, worked hard and understood each other. The willingness to help fellow group members was also specified. Respect for group members’ time and not attending CBG meetings, were identified as limitations to their group’s optimal functioning.

The difference in these two students’ responses may be due to various factors. The lack of personal support within group 8 might have influenced the negative responses of Student 7. It was evident that group 16 had better social skills than group 8, which might have been the result of the honest and open manner in which the members of group 16 communicated. The personal support within group 16 might have enabled the students to become friends, which was not the case for group 8. The fact that the students in CBG 16 saw each other as resources, making use of each group member’s uniqueness, might have contributed to maintaining academic support within the CBG.

5.7. Summary

The aim of this chapter was to report and discuss the findings from both the quantitative and qualitative research processes. The quantitative data for the control and experimental groups

was analysed using statistical tests including independent t-tests and dependent t-tests. The qualitative data, gathered from the experimental group of this investigation, was analysed using Atlas.ti. The first-year Life Sciences students perceived the CBG intervention as a highly positive experience, which provided them with academic and personal support. Giving and receiving help, seeing peers as resources, developing good social skills, taking initiative, motivation and diagnosing own learning needs, are the characteristics of a self-directed learner, and here the CBGs made a contribution. Upon further analysis of the interviews, two students' responses (one highly negative and one highly positive) were singled out and discussed in detail. Chapter 6 will report on the findings of this investigation, provide conclusions of the most important facets, and conclude with recommendations for further investigation.

CHAPTER 6

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1. Introduction

The general aim of the current research was to investigate the impact of the implementation of cooperative base groups (CBGs) on first-year Life Sciences students' self-directed learning (SDL) competencies. In attempting to answer this aim, the researcher identified the following sub-aims:

- to establish the first-year Life Sciences students' perception of CBGs;
- to investigate the contribution of the first-year Life Sciences students' perception of CBGs towards their SDL competencies;
- to investigate the contribution of personal support within the CBGs towards the first-year Life Sciences students' SDL competencies;
- to investigate the contribution of active involvement in evaluation of own and peers' ideas within CBGs towards the first-year Life Sciences students' SDL competencies;
- to investigate the contribution of the CBG file folder towards the first-year Life Sciences students' SDL competencies; and
- to determine whether the implementation of CBGs significantly influenced the first-year Life Sciences students' perceived SDL readiness.

A detailed account of the findings of this investigation will follow in this chapter. Conclusions regarding the different research sub-aims will be described, additional findings discussed, limitations pointed out, and lastly, recommendations for further investigations will be made.

6.2. Findings

The findings regarding the six sub-aims of this investigation will be discussed individually in each of the sections below.

6.2.1. Students' perception of cooperative base groups

Chapter 3 comprised a description of the body of knowledge concerning CBGs. Various aspects of CBGs were addressed, including the responsibilities of facilitators and students (see 3.4.1 & 3.4.2) in ensuring the success of CBGs. The researcher compared CBGs with an umbrella, pointing out that failure to work together within a CBG will have the same effect as an unopened umbrella on a rainy day (see Figure 3.1). Taking into account the described aspects

of CBGs, the results of the CBGP questionnaire, as well as narratives gathered during the interviews, the following findings reflecting the majority of the students' perceptions of CBGs are presented. The aim of this section is to give a summary of the general trend of the findings, and to emphasise that the solitary negative case was highlighted in the previous chapter (see 5.6).

Although some participants indicated that they did not know what to expect from CBGs, and although these participants hoped that the researcher knew what she was doing, being part of CBGs was perceived as a predominantly positive experience, and participants had positive attitudes about their involvement in the CBG intervention (see 5.3). No resistance was observed or sensed when the researcher assigned the students to their groups and explained the implementation thereof. The researcher observed the participants' creativity and enthusiasm in coming up with the CBG names and mottos, which might have indicated that they enjoyed being part of CBGs. Although literature regarding students' perceptions of CBGs is scant, Johnson et al. (2008) state that positive attitudes towards cooperative efforts can be attributed to students' active participation in CL (see 2.3.4). We can thus conclude that the students' positive attitudes towards CBGs in this investigation might be an indication that the CBGs had active participation amongst their members.

Although they were part of a CBG, the participants accepted responsibility for their own learning (see 5.3). Care was taken during the implementation of the CBGs to ensure the presence of individual accountability through, for example, individual test taking (see 4.4.1). The majority of participants perceived that all members worked together (see Table 5.9); and, as a result, social loafing seems to have been prevented. This might have been because individual accountability was carefully built into the design of the CBG intervention.

The participants were of the opinion that they were motivated to work harder (see 5.3) because they had to share their marks with the rest of the CBG, and they had to keep track of their own as well as their group's marks. According to Johnson et al. (2008), greater motivation will enable students to take on difficult tasks. It might possibly be that, sharing their marks with CBG members on a regular basis by means of the CBG folder would motivate students to take on complex tasks.

Participants experienced that being in a CBG enabled them to learn to respect the CBG members' opinions, to give and receive help within their CBGs, to improve their communication skills, and to deal with conflict within their CBGs more efficiently (see 5.3). From the discussion of CL (see 2.3), it is clear that being able to respect the opinion of others, giving and receiving help, good communication skills, and conflict management are important interpersonal and small-group skills necessary for high-quality cooperation. Therefore it can be concluded that

high quality cooperation existed in majority of the CBGs implemented in this investigation. The participants experienced academic and personal support within their CBGs, and were also of the opinion that being part of a CBG led to their improved academic achievement (see 5.3). The participants were of the opinion that they attended the Life Sciences classes more regularly because they were in CBGs (see 5.3). The first-year Life Sciences students' increased class attendance might well be attributed to their involvement in CBGs, as suggested by Johnson et al. (2008). Participants' perception of their increased academic achievement could be the result of their perceived academic and personal support. According to Johnson et al. (2008), academic and personal support will result in increased academic achievement (see 3.4.1.1), thus confirming this finding.

Participants reported being able to provide their fellow CBG members with personal support (see 5.3). The participants were of the opinion that providing personal support was possible because they regularly had to share something personal within their CBGs (see 5.3). The participants got to know their fellow CBG members on an increasingly personal level because they had to complete regular self-disclosure tasks, and formed caring relationships with fellow CBG members. From the interviews it became clear that CBGs did not discriminate against race, gender or culture. Rather, CBGs provided group members with a 'base group culture', enabling each CBG to form a new identity. According to Johnson et al. (2008), sharing something personal will help to form caring and dedicated interpersonal relationships. The fact that the researcher took time to read through the personal information of each student, as reported in the CBG folder documentation, as well as the 'something personal' form that group members had to share weekly, added value to the perceived feeling of safety and comfort within the CBGs. The participants appreciated that not only their peers showed an interest in their personal well-being, but their facilitator as well. This might have contributed towards the participants' positive attitude towards and perception of CBGs.

The participants perceived the CBG folders as a necessity for optimal functioning of CBGs because it provided them with the opportunity to get to know each other better, therefore setting the stage for sharing and working together (see 5.3). The researcher also observed that some CBGs re-arranged their CBG folders to meet the needs of their members. This might be an indication of their willingness to take initiative, and their enjoyment of being part of the intervention. Despite the positive feedback on the CBG folder, some participants were of opinion that the folder contains too much paperwork.

6.2.2. Extent to which students' perception of cooperative base groups contributed to their self-directed learning competencies

Chapter 2 contains a detailed description of a self-directed learner as well as the competencies that self-directed learners must have (see 2.2). The participants' perception of CBGs contributed to several SDL competencies (see 5.3). Seeing peers as resources, giving and receiving help, taking initiative, and possessing social skills were the SDL competencies identified (see 2.2.4 & 2.4). Being able to see fellow CBG members as resources, being able to give and receive help, and possessing social skills were outcomes that students indicated after working in CBGs (see 5.4). Possessing good social skills was, amongst others, highlighted as a characteristic of a self-directed learner (see 2.2). A checklist for social skills (CSS) was one of the documents included within the CBG folder (see 4.4), and was used as a tool for measuring the presence of much-needed social skills.

Because of the correlation between the participants' social skills (as obtained from CBGP questionnaire) and their SDLRS post-test (see Table 5.17), it appears that the presence of good social skills within CBGs influenced students' SDL competencies. Good social skills amongst CBG members seemingly influenced academic support as students indicated that they helped each other when they struggled to understand the work (see Table 5.15). This result is in line with literature, as Johnson et al. (2008) state that the presence of good social skills increases students' academic achievement.

The participants remarked that they were able to share their ideas with the rest of their CBG, they were committed to their fellow CBG members' learning, and they reported that they learned to respect their fellow CBG members' opinions (see 5.4). If students learn to share their ideas with peers, commit to each other's learning and respect each other's opinions, positive interpersonal relationships are developed (see 2.3.4). This investigation established that caring and committed relationships were present amongst the participants' respective CBGs (see 5.3), and it is known that caring and committed relationships provide academic and personal support (see 3.4.1.1). Therefore it can be concluded that the interpersonal relationships within the CBGs enabled the participants to see their fellow CBG members as resources for learning (5.4.3). Participants were able to give and receive help and to develop social skills within their CBGs, because positive interpersonal relationships were formed amongst CBG members. Being able to take initiative when diagnosing own learning needs, formulating learning goals, and identifying resources for learning, are necessary characteristics of a self-directed learner (see Table 2.1). The participants took initiative, not only in searching for additional resources for learning, but also in making use of additional communication platforms (see Table 5.18). The following response is an indication of how participants took initiative in this regard:

... we formed the [WhatsApp] group on that first day already, and sometimes irritated each other with all the questions that were asked. But we really supported each other. Especially before a test we would ask each other questions ... we really supported each other (Student 2).

Therefore it can be concluded that CBGs enabled the participants to develop much needed skills, which will enable them to become self-directed in their learning.

6.2.3. Contribution of personal support within cooperative base groups to students' self-directed learning competencies

The CBG folder consisted of a number of documents, some of which enabled the students to get to know each other personally (see 4.4.1). As the participants got to know each other on a personal level by means of the self-disclosure tasks, caring and committed relationships formed (see 5.5). These relationships, which comprised one of the three main outcomes of cooperative efforts, resulted in, amongst others, being able to give and receive academic and personal support, committing to each other's learning, as well as learning to share and respect each other's ideas (see 2.3.4 and 5.5). The personal support that participants received within their CBGs (see 5.5) contributed towards the development of two SDL competencies, namely being able to give and receive help, and developing good social skills.

6.2.4. Contribution of active involvement to students' self-directed learning competencies

Participants' active involvement in evaluating their own and their CBG members' ideas contributed to the following SDL competencies: giving and receiving help, peers seen as resources, and social skills (see 5.5). Active involvement within CBGs was assured by the presence of the basic elements of CL (see 2.3.2.1 & 3.4.1.1). Participants felt comfortable and safe within their CBGs, because they got to know their CBG members personally and formed caring relationships (see 5.5). It was also indicated that the CBGs enabled the participants to take each other's opinions into account and to accommodate each other (see 5.5). The unique contribution that each CBG member made to his or her CBG was also pointed out by the participants (see 5.5). According to Johnson et al. (2008), positive interpersonal relationships result in respecting each other's opinions and providing helpful criticism (see 2.3.2.1.4 & 2.3.4). The current investigation confirmed this finding by Johnson et al. (2008).

6.2.5. Contribution of the cooperative base group folder to students' self-directed learning competencies

Qualitative data analysis indicated that the CBG folder enabled students to keep track of their academic progress (see Table 5.19), which links to the SDL competency of evaluating learning outcomes (see 2.4). The documentation within the CBG folder was designed to act as a tool for ensuring the presence of positive interdependence, individual accountability, small-group skills and group processing (see 4.4.1). The folders enabled the students and facilitator to manage the necessary documentation. Seeing peers as resources, giving and receiving help, diagnosing own learning needs as well as acquiring social skills were additional SDL competencies to which the CBG folders contributed (see 5.5). The CBG members' perceived ability to see fellow group members as resources, to give and receive help, as well as to develop good social skills, might be attributed to good intergroup relations between CBG members. Regular CBG meetings and the heterogeneous nature of CBGs not only enabled the students to develop small-group skills, but it also promoted intergroup relations and established bonds between students from diverse backgrounds (see 5.5).

6.2.6. Influence of the implementation of cooperative base groups on students' self-directed learning readiness

The implementation of CBGs in the first-year Life Sciences module did not have an influence on the students' perceived SDL readiness, as measured by means of the SDLRS (see 5.2). Several reasons might have contributed to this finding, for example, the short period of CBG implementation or the fact that first-year students coming from a teacher-centred school environment did not realise the demands of tertiary education within a SDL environment, therefore scoring themselves too high in the pre-test. This study can only conclude that no practical significant difference was evident between students' SDL readiness scores before and after the CBG intervention. Regardless of this finding, the qualitative data indicated that several competencies of a self-directed learner were identified among the participants (see 5.4 & 5.5). In addition, other studies have documented an initial drop in SDLRS scores at the beginning of a new and challenging educational program (Posner, 1990, 1991; Premkumar et al., 2013a, 2013b). The combination of moving from a teacher-centred program to one in which the students had to assume more responsibility for their own learning, combined with moving from campus (for most of the students), and the realisation that their academic competition was greater may have shaken their confidence in their academic abilities and their perception of their readiness for self-directed learning. However, the skills and attitudes they were building in the CBGs are likely to serve as a foundation for increased SDL readiness in later endeavours. In Posner's study (1990), for example, SDLRS scores declined slightly in the early stages of an

alternative program requiring greater student responsibility for learning, rose slightly for those students who had completed an initial long-term independent project, and jumped significantly for those who had completed a second long-term independent project. The students' perceived academic competence and preference for challenge in learning situations followed a similar pattern.

6.3. Conclusions arising from this investigation

Figure 6.1 below aims to provide a brief overview of CBGs according to relevant literature, the manner in which CBGs were implemented within this investigation, and the empirical data obtained in this investigation. The figure lastly contains an indication of this investigation's contribution to the CBG body of knowledge.

Studying literature on the characteristics of CBGs, with the five CL elements embedded within the groups, revealed that the formation of caring and committed relationships amongst members provides a foundation for good social skills development. The caring and committed relationships were largely the result of the heterogeneous nature of these small groups, as well as regular CBG meetings to complete tasks within the CBG folder. Academic and personal support were provided within CBGs as a result of caring and committed relationships, and this led to students being less anxious and resulted in improved class attendance (see Table 5.9)

The researcher ensured heterogeneity by randomly assigning 3 or 4 students to each CBG. Time was spent on setting the stage for the implementation of CBGs within the LS module, and the researcher explained her rationale in great detail to her audience. This was done, however, without explaining SDL, or linking SDL and CBGs in any way. Care was also taken to ensure the presence of the five CL elements within the CBG intervention. Each CBG received a folder that consisted of pre-determined tasks, which had to be completed during weekly meetings in accordance with the agendas. The effectiveness of the CBGs was periodically evaluated by the members and a CSS had to be completed on various occasions. Although the researcher primarily made use of individual test taking, the GIG method was also used.

According to the empirical findings of this investigation, the participants enjoyed being part of CBGs. The participants were of the opinion that sharing their marks with their fellow CBG members acted as motivation to work harder. Although the participants were in CBGs, they perceived being responsible for their own learning. Participants perceived that caring and committed relationships were formed within and because of CBGs, and they learned to respect their fellow CBG members' opinions. The participants were of the opinion that they received academic and personal support within their CBGs, and that they were given the opportunity to develop good social skills within their CBGs. The heterogeneous nature of the CBGs was

positively perceived, and the participants were of the opinion that an area promoting face-to-face interaction was better for CBG meetings than a normal lecture hall (see Table 5.15).

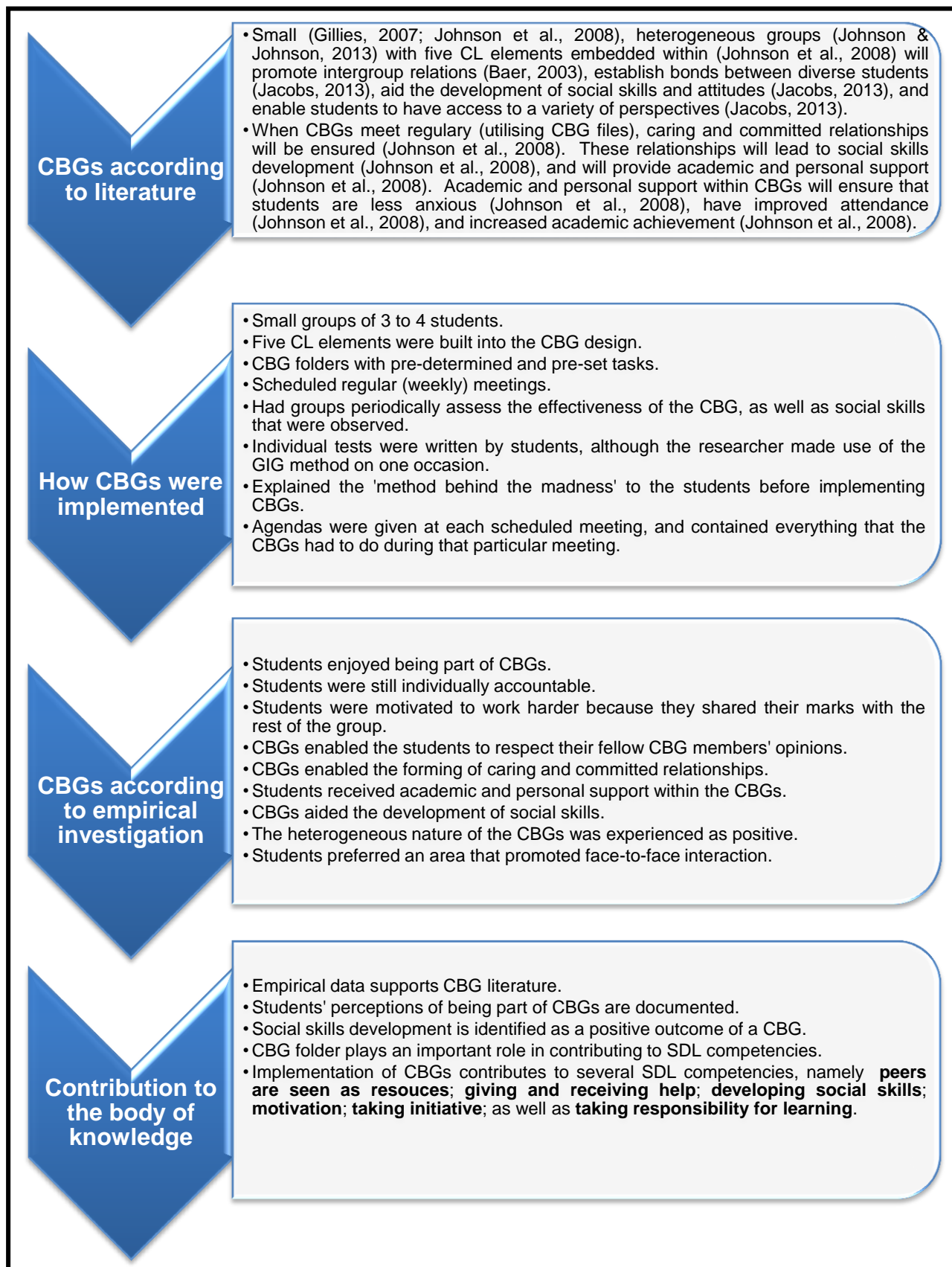


Figure 6.1 Contribution of the results of the current investigation

The following aspects contribute towards the body of literature regarding the implementation of CBGs:

- Literature regarding the implementation of CBGs, students' experience of CBGs, as well as empirical data of such studies is scant. This investigation was at the forefront of providing insight as to how students perceived being part of CBGs. Not only did this investigation provide supportive evidence of the benefits of CBGs, but also benefits thereof according to the CBG members themselves. Knowing what students thought of CBGs, as well as how they experienced being part of such groups, will enable future facilitators to refine their planning and implementation.
- This investigation not only provides evidence of the major role that the CBG folder played in contributing to the first-year LS students' SDL competencies, but also provides insight into how students perceived the CBG folder. Students' experience of the CBG folder documentation will enable future facilitators to refine the content of the CBG folder, all the while ensuring the presence of the five CL elements.

The above-mentioned conclusions can guide future implementation of CBGs, and hopefully the findings of this investigation will also motivate more facilitators to make use of CBGs to develop SDL skills.

6.4. Limitations

The researcher identified the following as possible limitations to this investigation:

- It is unfortunate that the duration of this investigation could not be prolonged, as longer implementation of CBGs might have enriched the data. The researcher could not extend this investigation to the second semester as a different facilitator was allocated for the second-semester module. This could have had an influence on the research findings, as all variables would not have been the same.
- Because the participants' participation in this investigation was voluntary, the researcher had no control over the number of students completing the SDLRS pre- and post-tests. Some students who completed the SDLRS pre-test decided not to complete the SDLRS post-test or did not attend the last class meeting where they had to complete the post-test.
- The participants did not know what SDL was, or how self-directed they were in their learning. This, together with the fact that the SDLRS tested students' perceived SDL and not their actual readiness towards SDL, could have resulted in students

completing the SDLRS according to what they thought the researcher wanted to see. These factors might have influenced their SDLRS pre-test scores.

- It is unfortunate that the researcher could not determine the change of participants' opinions regarding CBGs. The perception of CBGs could not be determined before the intervention because little, if any, correctly implemented CL is being used in South African schools. As a result, students' reference to CL might have been to general group work without the presence of the five CL elements, and might have resulted in a negative perception of cooperative learning. It should be pointed out that CBGs, as implemented within this investigation, were the participants' first acquaintance with CBGs.

6.5. Recommendations

The following recommendations, specific to the implementation of CBGs and in general, are offered for further and future research:

- Specific to CBG implementation
 - It is important to set the stage before implementing CBGs. This is especially crucial if facilitators wish to implement CBGs within first-year modules/classes.
 - Random selection of 4 students per CBG works well.
 - Regular feedback on the functioning of the CBGs is vital. This does not necessarily mean that the students must complete a feedback form. Asking appropriate questions to the students/CBGs and reading the CBG folder will enable the facilitator to receive feedback on the functioning of CBGs.
 - Students should know that the facilitator is available for meetings with CBGs, if group members should struggle.
 - Reading through the CBG folder on a regular basis will enable the facilitator to get to know the students and the groups. Students also value the fact that the facilitator takes time to read through their CBG folder, which will ensure caring and committed relationships being formed between the students and the facilitator.
 - If the facilitator observes that students struggle to find time to schedule out-of-class CBG meetings, it works well if the facilitator schedules a time during which all the CBGs could meet at the same time. If possible, a scheduled class on the timetable can be set aside for the weekly CBG meetings.
 - Regular CBG meetings at the beginning and at the end of a class are not always possible. This is especially the case in institutions where lecture halls are

equipped with fixed desks and chairs. In these cases, weekly CBG meetings outside scheduled classes are recommended.

- It is important that CBG meetings take place in an area where students are able to face one another. Regular lecture halls with fixed desks and chairs will not necessarily promote face-to-face promotive interaction, especially in the case of large classes. Large classes with many students will find it difficult to orientate themselves in a manner which is optimal for communicating and completing the CBG folder documentation.
- The five CL elements should always be part of any CBG intervention.
- Handing out a pre-set CBG folder, containing documents which aid the presence of the CL elements, is overwhelming to students. It is therefore recommended that students be given the opportunity to compile their own CBG folder within their groups. While keeping the five CL elements in mind, the facilitator should give guidelines on some of the documents that are needed and only facilitate and monitor the process. Some vital documents, like the CSS should rather be given to the CBGs, as it contains specific skills that need to be observed.
- The CSS should be completed regularly. It is not only an effective way to enable students to assess their groups' social skills, but also make students more aware of the need for social skills.
- Keeping track of academic achievement by means of a mark sheet within the CBG folder, increases students' motivation.
- Sharing something personal and completing the group membership grid within the CBGs, are important for the development of caring and committed relationships amongst CBG members.
- The GIG method of writing a test works well within CBGs.
- General recommendations
 - It might be expedient to expand this investigation to other modules or disciplines.
 - Future research might comprise conducting a longitudinal investigation where it would be possible to make more accurate conclusions regarding the effect of the implementation of CBGs on students' SDL readiness.
 - Further investigation of the implementation of CBGs in an online-environment is vital. Future research need to come up with ways to ensure the presence of all five basic elements of CL when making use of CBGs in an online-environment, especially face-to-face promotive interaction. When elaborating on the possibility of making use of an electronic CBG folder, it emerged from the interviews conducted during the current research that the participants preferred face-to-face

CBG meetings where they could complete the CBG file folder documentation together.

- Assessment strategies that measure what has been learned are not adequate for acquiring 21st-century lifelong learning skills. In the current research, participating students indicated that the GIG method of assessment enabled the learning process to go beyond simply writing an individual test. Further investigation into alternative assessment-for/as-learning strategies, within CL to promote SDL, should be encouraged. The use of assessment-for/as-learning strategies, like the GIG method for example, should be strongly encouraged in tertiary institutions as the GIG method has the potential to aid not only the development of good social skills, but of SDL competencies as well.

6.6 Final remarks

The overarching aim of this investigation was to determine the effect of CBGs on the participants' readiness to undertake self-direction in their learning. Being ready to self-direct one's learning implies the presence of essential personality traits. Although it was found that CBGs had no significant influence on the participants' levels of self-directed readiness, the findings of qualitative research showed that CBGs contributed towards specific SDL competencies. It can thus be concluded that in the current study, the use of CBGs had an influence on the participants' social skills, motivation, as well as their ability to give and receive help, see peers as resources, take initiative and responsibility for own learning, all of which are characteristics of a self-directed learner.

REFERENCE LIST

- Abrami, P., Chambers, B., Poulsen, C., D'Apollonia, S., & Howden, J. (1995). *Classroom connections: Understanding and using cooperative learning*. Canada: Harcourt Brace.
- Almala, A. (2005). A Constructivist Conceptual Framework for a Quality e-Learning Environment. *Distance Learning*, 2(5), 9-12.
- Baer, J. (2003). Grouping and Achievement in Cooperative Learning. *College Teaching*, 51(4), 169-175.
- Baker, D. F., & Campbell, C. M. (2005). When is there strength in numbers?: A study of undergraduate task groups. *College Teaching*, 53(1), 14-19.
- Barry, R., & Rees, M. (2006). Is (self-directed) learning the key skill for tomorrow's engineers? *European Journal of Engineering Education*, 31(1), 73-81.
- Bertucci, A., Conte, S., Johnson, D., & Johnson, R. (2010). The Impact of Size of Cooperative Group on Achievement, Social Support, and Self-Esteem. *The Journal of General Psychology*, 137(3), 256-272. doi: 10.1080/00221309.2010.484448
- Blumberg, P. (2005). Why self-directed learning is not learned and practiced in veterinary education. *Journal of Veterinary Medical Education*, 32(3), 290-296.
- Borich, G. (2000). *Effective Teaching Methods* (Fourth Edition ed.). Upper Saddle River, NJ: Pearson Education.
- Bransford, J., Brown, A., & Cocking, R. (2000). *How people learn: Brain, mind, experience and school*. Washington: National academy press.
- Brinkworth, R., McCann, B., & Matthews, C. (2009). First year expectations and experiences: Student and teacher perspectives. *Higher Education*, 58(2), 157-173.
- Brockett, R. (1985). Methodological and substantive issues in the measurement of self-directed learning readiness. *Adult Education Quarterly*, 36(1), 15-24.
- Brockett, R., & Donaghy, R. (2005). *Beyond The Inquiring Mind: Cyril Houle's Connection to Self-Directed Learning*. Paper presented at the 46th Annual Adult Education Research Conference, Athens, GA.
- Brockett, R., & Hiemstra, R. (1991). *Self-Direction in Adult Learning: Perspectives on Theory, Research, and Practice*. *Routledge Series on Theory and Practice of Adult Education in North America*. New York: Routledge, Chapman and Hall, Inc.

- Brookfield, S. (2009). Self-directed learning. In R. Maclean & M. Wilson (Eds.), *International handbook of education for the changing world of work* (pp. 2615-2627). Dordrecht, The Netherlands: Springer.
- Brooks, M., & Brooks, J. (1999). The Courage to be constructivist. *Educational Leadership*, 57(3), 18-24.
- Brownlee, J., Walker, S., & Lennox, S. (2009). The first year university experience: Using personal epistemology to understand effective learning and teaching in higher education. *Higher Education*, 58(5), 599-618.
- Bullock, S. (2013). Using digital technologies to support Self-Directed Learning for preservice teacher education. *Curriculum Journal*, 24(1), 103-120. doi: 10.1080/09585176.2012.744695
- Bybee, R. (2002). Scientific Inquiry, Student Learning, and the Science Curriculum. In R. Bybee (Ed.), *Learning Science and the Science of Learning* (pp. 25-35). Arlington, Virginia: NSTA Press.
- Bybee, R., Carlson-Powell, J., & Trowbridge, L. (2008). *Teaching secondary school science: Strategies for developing scientific literacy*. New Jersey: Pearson: Merrill Prentice Hall.
- Cavanagh, M. (2011). Students' experiences of active engagement through cooperative learning activities in lectures. *Active Learning in Higher Education*, 12(1), 23-33.
- Cheng, S., Kuo, C., Lin, K., & Lee-Hsieh, J. (2010). Development and preliminary testing of a self-rating instrument to measure self-directed learning ability of nursing students. *International Journal of Nursing Studies*, 47, 1152-1158.
- Chuprina, L., & Durr, R. (2006). Self-directed readiness as a predictor of cultural adaptability in expatriate managers. *International Journal of Self-Directed Learning*, 3(1), 13-23.
- Cohen, M. (2010). Cooperative Learning in Educational Psychology. In B. Millis (Ed.), *Cooperative learning in higher education* (pp. 69-89). Sterling, Virginia: Stylus Publishing, LLC.
- Connolly, P. (2007). *Quantitative Data Analysis in Education*. London: Routledge.
- Cooper, J., Prescott, S., Cook, L., Smith, L., & Mueck, R. (1990). *Cooperative learning and college instruction*. California: California State University.
- Cottell, P. (2010). Cooperative Learning in Accounting. In B. Mills (Ed.), *Cooperative Learning in Higher Education* (pp. 11-34). Sterling, Virginia: Stylus Publishing, LLC.
- Coutinho, S., & Neuman, G. (2008). A model of metacognition, achievement goal orientation, learning style and self-efficacy. *Learning Environments Research*, 11, 131-151.

- Creswell, J. (2003). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. California: Sage Publications, Inc.
- Creswell, J., & Plano Clark, V. (2007). *Designing and Conducting Mixed Methods Research*. California: Sage Publications, Inc.
- Crowe, M., & Hill, C. (2006). Setting the Stage for Good Group Dynamics in Semester-Long Projects in Science. *Journal of College Science Teaching, January/February*, 32-35.
- Dana, N., & Yendol-Silva, D. (2003). *The reflective educator's guide to classroom research: Learning to teach and teaching to learn through practitioner inquiry*. Thousand Oaks, CA: Corwin Press.
- Dat-Tran, V. (2013). Theoretical Perspectives Underlying the Application of Cooperative Learning in Classrooms. *International Journal of Higher Education, 2(4)*, 101-115.
- Davis, B. (1993). *Tools for Teaching*. San Francisco: Jossey-Bass Publishers.
- Davis, C., Bailey, C., Nypaver, M., Rees, T., & Brockett, R. (2010). Learning projects of graduate students: an update of Tough's study. *International Journal of Self-Directed Learning, 7(1)*, 14-28.
- De Corte, E. (2003). Designing learning environments that foster the productive use of acquired knowledge and skills. In E. De Corte, L. Verschaffel & N. Entwistle (Eds.), *Powerful Learning Environments: Unravelling Basic Components and Dimensions* (pp. 21-34). Oxford: Elsevier.
- Delahaye, B., & Choy, S. (2000). The Learning Preference Assessment (Self-Directed Learning Readiness Scale). Review of the Learning Preference Assessment (LPA). In J. Maltby, C. Lewis & A. Hill (Eds.), *The handbook of psychological tests*. Wales, UK: Edwin Mellen Press.
- Delahaye, B., & Smith, H. (1995). The validity of the Learning Preference Assessment. *Adult Education Quarterly, 45*, 159-173.
- DeMarrais, K. (2004). Qualitative interview studies: Learning through experience. In K. DeMarrais & S. Lapan (Eds.), *Foundations for research* (pp. 51-68). Mahwah, NJ: Erlbaum.
- Deng, Y. (1995). *Adult Teaching and Self-directed Learning*. Wu-Nan, Taipei.
- Deutsch, M. (1962). *Cooperation and trust: Some theoretical notes*. Paper presented at the Nebraska symposium on motivation, Lincoln, NE.

- Deyo, Z., Huynh, D., Rochester, C., Sturpe, D., & Kiser, K. (2011). Readiness for Self-directed Learning and Academic Performance in an Abilities Laboratory Course. *American Journal of Pharmaceutical Education, 75*(2), 1-6.
- Dimitrov, D., & Rumrill Jr, P. (2003). Pretest-posttest designs and measurement of change. *Work, 20*, 159-165.
- Doymus, K. (2008). Teaching chemical equilibrium with the jigsaw technique. *Research in Science Education, 38*(2), 249-260.
- Dynan, L., Cate, T., & Rhee, K. (2008). The impact of learning structure on students' readiness for self-directed learning. *The Journal of Education for Business, 84*(2), 96-100.
- Ellinger, A. (2004). The concept of self-directed learning and its implications for human resource development. *Advances in Developing Human Resources, 6*(2), 158-177.
- Feilzer, M. (2009). Doing Mixed Methods Research Pragmatically: Implications for the Rediscovery of Pragmatism as a Research Paradigm. *Journal of Mixed Methods Research, 4*(1), 6-16.
- Felder, R., & Brent, R. (2007). Cooperative Learning. In P. Mabrouk (Ed.), *Active Learning: Models from the Analytical Sciences* (pp. 34-53). Washington, DC: American Chemical Society.
- Field, L. (1989). An investigation into the structure, validity and reliability of Guglielmino's Self-Directed Learning Readiness Scale. *Adult Education Quarterly, 39*(4), 235-245.
- Fisher, M., King, J., & Tague, G. (2001). Development of a self-directed learning readiness scale for nursing education. *Nurse Education Today, 21*(7), 516-525.
- Francom, G. M. (2010). Teach me how to learn: Principles for fostering students' self-directed learning skills. *International Journal of Self-Directed Learning, 7*(1), 29-44.
- Gagne, N., & Parks, S. (2013). Cooperative learning tasks in a Grade 6 intensive ESL class: Role of scaffolding. *Language Teaching Research, 17*(2), 188-209.
- Garrison, D. (1991). Critical thinking and adult education: A conceptual model for developing critical thinking in adult learners. *International Journal of Lifelong Education, 10*(4), 287-303.
- Garrison, D. (1997). Self-Directed Learning: Toward a comprehensive model. *Adult Education Quarterly, 48*(1), 18-34.
- Gibbons, P. (2002). *Scaffolding language, scaffolding learning: Teaching second language learners in the mainstream classroom*. Portsmouth, NH: Heinemann.

- Gibbs, G. (2010). *Analyzing Qualitative Data*. London: Sage.
- Gillies, R. (2007). *Cooperative Learning: Integrating Theory and Practice*. California: Sage Publications Inc.
- Gillies, R. (2014). Cooperative Learning: Developments in Research. *International Journal of Educational Psychology*, 3(2), 125-140. doi: 10.4471/ijep.2014.08
- Gillies, R., & Boyle, M. (2010). Teachers' reflections on cooperative learning: Issues of implementation *Teaching and Teacher Education*, 26, 933-940.
- Gillies, R., & Boyle, M. (2011). Teachers' reflections of cooperative learning (CL): a two-year follow-up. *Teaching Education*, 22(1), 63-78.
- Grissom, S., Beck, L., Simon, B., & Chizhik, A. (2013). *Alternatives to Lecture: Revealing the Power of Peer Instruction and Cooperative Learning*. SIGCSE'13. Denver, Colorado.
- Grow, G. (1991). Teaching learners to be self-directed. *Adult Education Quarterly*, 41(3), 125-149.
- Guest, G. (2012). Describing Mixed Methods Research: An Alternative to Typologies. *Journal of Mixed Methods Research*, 7(2), 141-151.
- Guglielmino & Associates, L. (2012). The Self-Directed Learning Readiness Scale (SDLRS) Also Known as the Learning Performance Assessment (LPA). Retrieved 12 August, 2013
- Guglielmino, L. (1978). *Development of the self-directed learning readiness scale*. (Doctoral), University of Georgia. (6467A)
- Guglielmino, L. (2008). Why self-directed learning? *International Journal of Self-Directed Learning*, 5(1), 1-13.
- Guglielmino, L. (2013). The case for promoting self-directed learning in formal educational institutions. *South African Education Journal (SA e-DUC)*, 10(2), 1-18.
- Guglielmino, L., & Guglielmino, P. (1991). *Expanding your readiness for self-directed learning: A workbook for the Learning Preference Assessment*. King of Prussia, PA: Organization Design and Development, Inc.
- Guglielmino, L., & Klatt, L. (1994). Self-directed learning readiness as a characteristic of the entrepreneur. In H. a. A. Long (Ed.), *New ideas about self-directed learning* (pp. 161-174). Norman, OK: Oklahoma Research Center for Continuing Professional and Higher Education of the University of Oklahoma.

- Guglielmino, L., & Long, H. (2011). Perspectives: The International Society for Self-Directed Learning and The International Self-Directed Learning Symposium. *International Journal of Self-Directed Learning*, 8(1), 1-6.
- Haak, D., HilleRisLambers, J., Pitre, E., & Freeman, S. (2011). Increased Structure and Active Learning Reduce the Achievement Gap in Introductory Biology. *Science*, 332(1213).
- Haigh, M., & Kilmartin, M. (2009). Student perceptions of the development of personal transferable skills. *Journal of Geography in Higher Education*, 23(2), 195-206.
- Harvey, B., Rothman, A., & Frecker, R. (2006). A confirmatory factor analysis of the Oddi Continuing Learning Inventory (OCLI). *Adult Education Quarterly*, 56(3), 188-200.
- Hiemstra, R. (2003). More Than Three Decades of Self-Directed Learning: From Whence Have We Come? *Adult Learning*, 14(5), 5-8.
- Hilton, J., Kopera-Frye, K., & Millis, B. (2007). Techniques for student engagement and classroom management in large (and small) classes. *Journal of Teaching in Marriage and Family*, 6, 490-505.
- Ho, C. (1998). Facilitation to self-directed learning: a reflection of teaching experiment on contract learning. *National Science Council Journal: Humanity and Social Sciences*, 8(3), 417-426.
- Hornby, G. (2010). The effectiveness of cooperative learning with trainee teachers. *Journal of Education for Teaching*, 35(2), 161-168.
- Houle, C. (1961). *The inquiring mind*. Madison, WI: The University of Wisconsin Press.
- Hutcheson, G. D., & Sofroniou, N. (1999). *The Multivariate Social Scientist: Introductory Statistics Using Generalized Linear Models*: SAGE Publications.
- Ivankova, N., Creswell, J., & Stick, S. (2006). Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice. *Field Methods*, 18(1), 3-20.
- Jacobs, G. (2013). And, Out of Class Too: The Who, What, When, Where, Why, and How of Students Learning Together Outside of Class.
<http://independent.academia.edu/GeorgeJacobs>
- Jaques, D., & Salmon, G. (2007). *Learning in Groups: A Handbook for face-to-face and online environments* (4 ed.). Abingdon, Oxon: Routledge.
- Johnson, D. (1970). *The social psychology of education*. New York: Holt, Rinehart & Winston.
- Johnson, D., & Johnson, F. (2013). *Joining Together: Group Theory and Group Skills* (11th ed.). Upper Saddle River, NJ: Pearson Education Inc.

- Johnson, D., & Johnson, R. (1994). An overview of cooperative learning. In J. Thousand, A. Villa & A. Nevin (Eds.), *Creativity and Collaborative Learning*. Baltimore: Brookes Press.
- Johnson, D., & Johnson, R. (2005). New developments in social interdependence theory. *Psychological Monographs*, 131, 285-360.
- Johnson, D., & Johnson, R. (2008a). Cooperative learning and preventing bullying. *The Cooperative Learning Institute*, 23(1), 1-4.
- Johnson, D., & Johnson, R. (2008b). Social Interdependence Theory and Cooperative Learning: The Teacher's Role. In R. Gillies, A. Ashman & J. Terwel (Eds.), *Teacher's Role in Implementing Cooperative Learning in the Classroom* (pp. 9-37). New York, USA: Springer.
- Johnson, D., & Johnson, R. (2009a). An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning. *Educational Researcher*, 38(5), 365-379.
- Johnson, D., & Johnson, R. (2009b). Making cooperative learning work. *Theory into practice*, 38(2), 67-73.
- Johnson, D., Johnson, R., & Johnson Holubec, E. (2008). *Cooperation in the classroom* (Eighth Edition ed.). Edina, Minnesota: Interaction Book Company.
- Johnson, R., & Onwuegbuzie, A. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, 33(7), 14-26.
- Kagan, S. (2001). Teaching for Character and Community. *Educational Leadership*, 50(2), 50-55.
- Kaiser, H. (1974). An index of factorial simplicity. *Psychometrika*, 39(1), 31-36. doi: 10.1007/BF02291575
- Kasworm, C. (1983). Self-Directed Learning and Lifespan Development. *International Journal of Lifelong Education*, 2(1), 29-46.
- Kek, M., & Huijser, H. (2011). Exploring the combined relationships of student and teacher factors on learning approaches and self-directed learning readiness at a Malaysian university. *Studies in Higher Education*, 36(2), 185-208.
- Knowles, M. (1975). *Self-Directed Learning: A Guide for Learners and Teachers*. New York: NY: Association Press.
- Kramarski, B., & Michalsky, T. (2009). Investigating Preservice Teachers' Professional Growth in Self-Regulated Learning Environments. *Journal of Educational Psychology*, 101(1), 161-175.

- Krause, K., & Coates, H. (2008). Students' engagement in first-year university. *Assessment & Evaluation in Higher Education*, 33(5), 493-505.
- Kyndt, E., Raes, E., Lismont, B., Timmers, F., Cascallar, E., & Dochy, F. (2013). A meta-analysis of the effects of face-to-face cooperative learning. Do recent studies falsify or verify earlier findings? *Educational Research Review*, (article in press).
- Learner. [Def. 1]. (n.d.). In Merriam Webster Online, Retrieved from <http://www.merriam-webster.com/dictionary/learner>
- Ledoux, S. (2002). *Origins and Components of Behaviorology* (Second Edition ed.). Canton, NY: ABCs.
- Lipson Lawrence, R. (2002). A Small Circle of Friends: Cohort Groups as Learning Communities. *New Directions for Adult and Continuing Education*, 95, 83-92.
- Long, H. (1989). Self-directed learning: Emerging theory and practice. In H. A. Long (Ed.), *Self-Directed Learning: Emerging Theory and Practice* (pp. 1-11). University of Oklahoma.
- Long, H., & Agyekum, S. (1984). Teacher ratings in the validation of Guglielmino's Self-Directed Learning Readiness Scale. *Higher Education*, 13, 709-715.
- Lord, S. M., Chen, J. C., Stolk, J., Nottis, K., Stefanou, C., & Prince, M. (2010). *Role of Faculty in Promoting Lifelong Learning: Characterizing Classroom Environments*. Paper presented at the Education Engineering (EDUCON), Madrid.
- Lou, Y., Abrami, P., Spence, J., Poulsen, C., Chambers, B., & D'Apollonia, S. (1996). Within-class grouping: A meta-analysis. *Review of Educational Research*, 66, 423-458.
- Loyens, S., Magda, J., & Rikers, R. (2008). Self-Directed Learning in Problem-Based Learning and its Relationships with Self-Regulated Learning. *Educational Psychology Review*, 20, 411-427.
- Lunberg, C. (2003). Nontraditional college students and the role of collaborative learning as a tool for science mastery. *School Science and Mathematics*, 103, 10-17.
- Lunetta, V., Hofstein, A., & Clough, M. (2007). Learning and teaching in the school science laboratory. In S. Abell & N. Lederman (Eds.), *Handbook of research on science education* (pp. 393-441). New Jersey: Lawrence Erlbaum Associates.
- Lunyk-Child, O., Crooks, D., Ellis, P., Ofosu, C., O'Mara, L., & Rideout, E. (2001). Self-directed learning: faculty and student perceptions. *Journal of Nursing Education*, 40(3), 116-123.
- Maree, K., & Pietersen, J. (2010). The quantitative research process. In K. Maree (Ed.), *First steps in research*. Pretoria: Van Schaik Publishers.

- Marlow, B., & Page, M. (2005). *Creating and sustaining the constructivist classroom* (2nd ed.). Thousand Oaks, CA: Corwin Press.
- Mayes, T. (2009). Quality Enhancement Themes: The First Year Experience (E. Themes, Trans.) (pp. 1-25). Mansfield: The Quality Assurance Agency for Higher Education.
- McCune, S., & Guglielmino, L. (1991). Validity generalization of the Self-Directed Learning Readiness Scale. In H. A. Long (Ed.), *Self-directed learning: Consensus and conflict* (pp. 147-154). Norman, OK: Oklahoma Research Center for Continuing Professional and Higher Education.
- McMillan, J., & Schumacher, S. (2006). *Research in education: evidence-based inquiry* (6th ed.): Pearson Publishers Inc.
- Mecer, N., Dawes, L., Wegerif, R., & Sams, C. (2004). Reasoning as a scientist: ways of helping children to use language to learn science. *British Educational Research Journal*, 30, 359-377.
- Merriam, & Webster. (Eds.). (2014).
- Merriam, S. (2001). Andragogy and Self-Directed Learning: Pillars of Adult Learning Theory. *New Directions for Adult and Continuing Education*(89), 3-13.
- Merriam, S. (2009). *Qualitative Research A Guide to Design and Implementation*. San Francisco, CA: Jossey-Bass.
- Merriam, S., & Caffarella, R. (1991). *LEARNING IN ADULTHOOD: A Comprehensive Guide* (A. Knox Ed.). San Francisco, California: Jossey-Bass Inc.
- Merriam, S., Caffarella, R., & Baumgartner, L. (2007). *Learning in Adulthood: a comprehensive guide* (Third Edition ed.). San Francisco, CA: Jossey-Bass.
- Mertens, D. (2003). Mixed models and politics of human research: The transformative-emancipatory perspective. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 135-166). CA: Sage: Thousand Oaks.
- Mestre, J., & Cocking, R. (2002). Applying the Science of Learning to the Education of Prospective Science Teachers. In R. Bybee (Ed.), *Learning Science and the Science of Learning* (pp. 13-24). Arlington, Virginia: NSTA Press.
- Michaelsen, L., & Sweet, M. (2011). Team-Based Learning. *New directions for teaching and learning*, 128, 41-51. doi: 10.1002/tl.467
- Millis, B. (2010). Why Faculty Should Adopt Cooperative Learning Approaches. In B. Mills (Ed.), *Cooperative learning in higher education: Across the Disciplines, Across the Academy* (1st ed., pp. 1-9). Sterling, Virginia: Stylus Publishing, LLC.

- Morgan, D. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research, 1*, 48-76.
- Moust, J., Robertsen, H., Savelberg, H., & De Rijik, A. (2005). Revitalizing PBL Groups: Evaluating pbl with study teams. *Education for Health: Change in Learning & Practice, 18*(1), 62-73.
- Mouton, J. (2009). *How to succeed in your Master's & Doctoral Studies*. Pretoria: Van Schaik Publishers.
- Muller, K. (2007). *Emotional intelligence and self-directed learning readiness among healthcare managers*. (Doctoral dissertation). (AAT 3266421)
- Murad, M. H., Coto-Yglesias, F., Varkey, P., Prokop, L. J., & Murad, A. L. (2010). The effectiveness of self-directed learning in health professions education: a systematic review. *Medical Education, 44*, 1057-1068.
- Nelson, C. (2010). Want Brighter, Harder Working Students? Change Pedagogies! In B. Mills (Ed.), *Cooperative learning in higher education* (pp. 119-139). Sterling, Virginia: Stylus.
- Nepal, K., & Stewart, R. (2010). *Relationship between self directed learning readiness factors and learning outcomes in third year project-based engineering design course*. Paper presented at the AaeE Conference, Sydney, Australia.
- Nieuwenhuis, J. (2010a). Analysing qualitative data. In K. Maree (Ed.), *First steps in research* (pp. 99-122). Pretoria: Van Schaick Publishers.
- Nieuwenhuis, J. (2010b). Qualitative research designs and data gathering techniques. In K. Maree (Ed.), *First steps in research* (pp. 70-97). Pretoria: Van Schaik Publishers.
- Nuhfer, E. (2010). Cooperative Learning in Geological Sciences. In B. Mills (Ed.), *Cooperative learning in higher education* (pp. 181-200). Sterling, Virginia: Stylus Publishing, LLC.
- O'Shea, E. (2003). Self-directed learning in nurse education: A review of the literature. *Journal of Advanced Nursing, 43*(1), 62-70.
- Oakley, B., Felder, R., Brent, R., & Elhajj, I. (2004). Turning Student Groups into Effective Teams. *Journal of Student Centered Learning, 2*(1), 9-34.
- Oddi, L. (1986). Development and validation of an instrument to identify self-directed continuing learners. *Adult Education Quarterly, 36*, 97-107.
- Oliveira, A., & Simões, A. (2006). Impact of socio-demographic and psychological variables on the self-directedness of higher education students. *International Journal of Self-Directed Learning, 3*(1), 1-12.

- Onwuegbuzie, A., Johnson, R., & Collins, K. (2009). Call for mixed analysis: A philosophical framework for combining qualitative and quantitative approaches. *International Journal of Multiple Research Approaches*, 3(2), 114-139.
- Oswald, D. (2003). *Instructional-design theory for fostering self-directed learning*. (Doctor of Philosophy), Indiana University. (3111914)
- Panitz, T. (2010). Cooperative Learning Structures Help College Students Reduce Math Anxiety and Succeed in Developmental Courses. In B. Millis (Ed.), *Cooperative learning in higher education* (pp. 57-68). Sterling, Virginia: Stylus Publishing, LLC.
- Parmelee, D., Michaelsen, L., Cook, S., & Hudes, P. (2012). Team-based learning: A practical guide: AMEE Guide No. 65. *Medical Teacher*, 34, 275-287. doi: 10.3109/0142159X.2012.651179
- Patrick, H., Bangel, N., Jeon, K., & Townsend, M. (2005). Reconsidering the issue of cooperative learning with gifted students. *Journal of the Education of the Gifted*, 29(1), 90-108.
- Petty, G. (2006). *Evidence Based Teaching*. Gloucestershire, U.K: Nelson-Thornes.
- Piaget, J. (1974). *Understanding causality*. (Trans. D. & M. Miles): WW Norton.
- Pietersen, J., & Maree, K. (2010a). Standardisation of a questionnaire. In K. Maree (Ed.), *First steps in research* (pp. 215-223). Pretoria: Van Schaik Publishers.
- Pietersen, J., & Maree, K. (2010b). Statistical analysis I: descriptive statistics. In K. Maree (Ed.), *First steps in research* (pp. 183-196). Pretoria: Van Schaik Publishers.
- Robertson, J. (2010). *Promoting self directed learning skills in first year students*. School for Mathematical and Computer Sciences. Herriot Watt University.
- Robinson, P., & Cooper, J. (2010). The Interactive Lecture in a Research Methods and Statistics Class. In B. Millis (Ed.), *Cooperative learning in higher education* (pp. 105-118). Sterling, Virginia: Stylus Publishing, LLC.
- Robson, C. (1993). *Real world research*. Oxford, UK: Blackwell.
- Rybczynski, S., & Schussler, E. (2011). Student Use of Out-of-Class Study Groups in an Introductory Undergraduate Biology Course. *CBE - Life Sciences Education*, 10, 74-82.
- Savin-Baden, M., & Major, C. H. (2004). *Foundations of problem-based learning*: McGraw-Hill International.
- Schul, J. (2011). Revisiting an Old Friend: The Practice and Promise of Cooperative Learning for the Twenty-First Century. *The Social Studies*, 102, 88-93.

- Seong, J., & Hong, D. (2013). Gender Diversity: How can we facilitate its positive effects on teams? *Social Behavior and Personality*, 41(3), 497-508.
- Shadle, S. (2010). Cooperative Learning in General Chemistry Through Process-Oriented Guided Inquiry Learning. In B. Mills (Ed.), *Cooperative learning in higher education* (pp. 35-52). Sterling, Virginia: Stylus.
- Sharan, Y. (2010). Cooperative Learning for Academic and Social Gains: valued pedagogy, problematic practice. *European Journal of Education*, 45(2), 300-313.
- Sharan, Y. (2014). Learning to cooperate for cooperative learning. *anales de psicologia*, 30(3), 802-807.
- Shaw, D. (2011). Promoting Professional Student Learning Through Study Groups: A Case Study. *College Teaching*, 59, 85-92.
- Shimazoe, J., & Aldrich, H. (2010). Group Work Can Be Gratifying: Understanding & Overcoming Resistance to Cooperative Learning. *College Teaching*, 58, 52-57.
- Slavin, R. E. (1983). Cooperative learning. *New York*.
- Snowman, J., & Biehler, R. (2003). *Psychology applied to teaching* (10th ed.). Boston: Houghton Mifflin.
- Sokolinski, R. (2010). Asking investigable questions. In U. Ramnarain (Ed.), *Teaching Scientific Investigations* (pp. 63-82). Gauteng, South Africa: Macmillan.
- Stetson, N. (2003). Using small-group development to facilitate cooperative learning base groups. In J. Cooper, P. Robinson & D. Ball (Eds.), *Small Group Instruction in Higher Education, Lessons from the Past, Visions of the Future*. Lewis St. Stillwater, OK: New Forums Press, Inc.
- Stockdale, S. (2003). *Development of an instrument to measure self-directedness*. (Doctor of Philosophy), University of Tennessee. (3092836)
- Stockdale, S., & Brockett, R. (2011). Development of the PRO-SDLS: A Measure of Self-Direction in Learning Based on the Personal Responsibility Orientation Model. *Adult Education Quarterly*, 61(2), 161-180.
- Student. [Def. 1]. (n.d.). In Merriam Webster Online, Retrieved from <http://www.merriam-webster.com/dictionary/student>
- Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research*. Thousand Oaks, CA: SAGE.

- Thornton, K. (2010). Supporting Self-Directed Learning: A Framework for Teachers. *Language Education in Asia*, 1(1), 158-170.
- Toffler, A. (1974). Learning for tomorrow. *New York: Vintage*.
- Tough, A. (1976). Self-planned learning and major personal change. *Adult Learning: Issues and Innovations. Northern Illinois: ERIC*.
- Toumasis, C. (2004). Cooperative study teams in mathematics classrooms. *International Journal of Mathematical Education in Science and Technology*, 35(5), 669-679.
- Tsay, M., & Brady, M. (2010). A case study of cooperative learning and communication pedagogy: Does working in teams make a difference? *Journal of Scholarship of Teaching and Learning*, 10(2), 78-89.
- Van Aswegen, S., Fraser, W., Nortje, T., Slabbert, J., & Kaske, C. (1993). *Biology Teaching: An information and study manual for students and teachers*. Pretoria: Acacia Books.
- Vhurumuku, E. (2010). Using scientific investigations to explain the nature of science. In U. Ramnarain (Ed.), *Teaching Scientific Investigations* (pp. 24-37). Gauteng, South Africa: Macmillan.
- Vygotsky. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: The Harvard University Press.
- Warburton, N., & Volet, S. (2012). Enhancing self-directed learning through a content quiz group learning assignment. *Active Learning in Higher Education*, 14(1), 9-22.
- Williamson, S. (2007). Development of a self-rating scale of self-directed learning. *Nurse Researcher*, 14(2), 66-83.
- Wong, H., & Wong, R. (2001). *How to be an effective teacher*. Mountainview, CA: Harry Wong Publications, Inc.
- Zevenbergen, R. (2004). Study Groups as a Tool for Enhancing Preservice Students' Content Knowledge. *Mathematics Teacher Education and Development*, 6, 3-18.
- Zsiga, P. (2007). *Self-directed learning readiness, strategic thinking, and leader effectiveness in directors of a national nonprofit organization*. (Doctoral dissertation), Florida Atlantic University. (AAT 3269548)

LIST OF APPENDICES

APPENDIX A: COOPERATIVE BASE GROUP FOLDER DOCUMENTATION.....	154
APPENDIX B: COOPERATIVE BASE GROUP PERCEPTION QUESTIONNAIRE	175
APPENDIX C: SEMI-STRUCTURED INTERVIEW QUESTIONS	180
APPENDIX D: LETTER FROM STATISTICAL CONSULTATION SERVICE OF THE NORTH-WEST UNIVERSITY	182
APPENDIX E: LETTER FROM LANGUAGE EDITOR	184
APPENDIX F: ETHICS APPROVAL OF PROJECT AT THE NORTH-WEST UNIVERSITY	186

APPENDIX A: Cooperative base group folder documentation

A:1 Planning

This form contains an outline of the semester. During the first class, the facilitator gave the students the dates on which tests were going to be written, practical investigations were going to be carried out, projects and assignments had to be submitted, as well as an outline of the study units.

A:2 Personal information of group members

Each student within the CBGs had to complete these forms. The personal information was completed during the first CBG meeting. Each week the students had to share something personal with the rest of their CBG members.

A:3 Individual learning contract

The individual learning contract had to be completed before each study unit began. The students completed it individually. After completing a study unit, the students had to reflect on whether or not they reached their individual goals.

A:4 Group learning contract

After the CBG members completed their individual learning contract (see A:3), the members had to discuss their goals within their CBGs and complete the group learning contract. After completing a study unit, the CBGs had to reflect on whether or not they reached their set goals.

A:5 Attendance sheet

A:6 Mark sheet

Group members had to complete the mark sheet within their CBGs by keeping the mark sheet up to date. The mark sheet contains all the CBG members' marks on one form.

A:7 Group membership grid

Each week, the facilitator included an unfinished sentence on the agenda. The sentences were formulated in such a way that in completing the sentence students learned more about each other. The following sentences were given during this investigation:

- *“The thing I need the most is ...”*
- *“I am most anxious about ...”*
- *“I do not think I will ever ...”*
- *“The one person I respect the most, is ... because ...”*
- *“When I think about skydiving, I ...”*
- *“I have never cried so much as when ...”*
- *“I had never laughed so much as the day ...”*
- *“My favourite time of the day is ...”*
- *“Let me tell you how I cope with stressful situations ...”*

A:8 Checklist for social skills

The checklist for social skills had to be completed by each student during weeks 3, 6 and 11. Students had to tick next to the skill each of the other group members portrayed. After ticking individually, CBG members had to discuss their checklist within their CBGs in order to reach consensus on which CBG member displayed the different social skills. Upon reaching consensus, the group’s checklist is completed.

A:9 Positive feedback form

This form was completed weekly by each individual CBG member where after it had to be discussed within the CBGs.

APPENDIX A:1 – Planning

Planning <u>LIFE 111</u> 2014									
Study Unit	Week	Date		Tests	Practicals	Practical Test	Worksheets	Assignments	Other
	1	03-Feb							
		4							
		5							
		6							
		7							
	2	10							
		11							
		12							
		13							
		14							
	3	17							
		18							
		19							
		20							
		21							
	4	24							
		25							
		26							
		27							
		28							
	5	03-Mar							
		4							
		5							
		6							
		7							
	6	10							
		11							
		12							
		13							
		14							
	7	17							
		18							
		19							
		20							
		21	Human Rights Day						
	8	24		Friday					
		25							
		26							
		27							
		28	Class ends						

Planning LIFE 111 2014

Study Unit	Week	Date		Tests	Practicals	Practical Test	Worksheets	Assignments	Other
W		07-Apr	/						
		8							
		9							
		10							
		11							
I		14							
		15							
		16							
		17							
		18	Good Friday						
L		21	Family Day						
		22							
		23							
		24							
		25							
		28	Public Holiday						
		29	School Holiday						
		30	School Holiday						
		01-May	Workers Day						
		2	School Holiday						
	9	5							
		6							
		7							
		8							
		9							
	10	12							
		13							
		14							
		15							
		16							
	11	19							
		20							
		21							
		22							
		23							
	12	26							
		27							
		28							
		29							
		30	Class ends						

APPENDIX A:2 – Personal Information of Group Members

Name & Surname	
Student Number	
Address in Potchefstroom	
Contact Details	
Major Subjects	
Something personal that you want to share with the group	
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	

APPENDIX A:3 – Individual learning contract

(to be completed individually before completing the group's contract)

STUDY UNIT 1	
Personal goals	
My responsibilities	
Reached or not reached	
Reflection	
STUDY UNIT 2	
Personal goals	
My responsibilities	
Reached or not reached	
Reflection	

STUDY UNIT 3

<i>Personal goals</i>	
<i>My responsibilities</i>	
<i>Reached or not reached</i>	
<i>Reflection</i>	

APPENDIX A:4 – Group learning contract

(to be completed as a group for each study unit- after individual contracts!)

STUDY UNIT 1	
Group goals	
Responsibilities to achieve goals	
How will the goals be reached?	
Reached or not reached	
Reflection	
Signatures	

STUDY UNIT 2

Group goals	
Responsibilities to achieve goals	
How will the goals be reached?	
Reached or not reached	
Reflection	
Signatures	

STUDY UNIT 3

Group goals	
Responsibilities to achieve goals	
How will the goals be reached?	
Reached or not reached	
Reflection	
Signatures	

APPENDIX A:5 – Attendance sheet

<i>Date & Section of work completed</i>	<i>Student 1</i>	<i>Student 2</i>	<i>Student 3</i>	<i>Student 4</i>

APPENDIX A:6 – Mark sheet

<i>Assessment</i>		<i>Date</i>	<i>Group members' marks</i>			
<i>Class Tests</i>	1					
	2					
	3					
	4					
	5					
<i>Practicals/Experiments</i>	1					
	2					
	3					
	4					
	5					

Assessment		Date	Group members' marks			
Worksheets	1					
	2					
	3					
	4					
Practical Test						
Other						

APPENDIX A:7 – Group membership grid

Names	Week 1	Week 2	Week 3
Names	Week 4	Week 5	Week 6

<i>Names</i>	<i>Week 7</i>	<i>Week 8</i>	<i>Week 9</i>
<i>Names</i>	<i>Week 10</i>	<i>Week 11</i>	<i>Week 12</i>

APPENDIX A:8 – Checklist for social skills

Social Skills	Week 3:				Week 6:			
	Student1	Student2	Student3	Student4	Student1	Student2	Student3	Student4
<i>Clarifies goals</i>								
<i>Gives direction to group's work</i>								
<i>Contributes ideas, opinions</i>								
<i>Requests other's ideas, opinions</i>								
<i>Summarizes, Integrates</i>								
<i>Encourages others' participation</i>								
<i>Supports, gives recognition</i>								
<i>Paraphrases</i>								
<i>Facilitates communication</i>								
<i>Relieves tension</i>								
<i>Respects rights of others</i>								
<i>Is willing to help others</i>								
<i>Follows directions</i>								
<i>Checks for understanding</i>								

Social Skills	Week 11:				Week :			
	Student1	Student2	Student3	Student4	Student1	Student2	Student3	Student4
<i>Clarifies goals</i>								
<i>Gives direction to group's work</i>								
<i>Contributes ideas, opinions</i>								
<i>Requests others' ideas, opinions</i>								
<i>Summarizes, Integrates</i>								
<i>Encourages others' participation</i>								
<i>Supports, gives recognition</i>								
<i>Paraphrases</i>								
<i>Facilitates communication</i>								
<i>Relieves tension</i>								
<i>Respects rights of others</i>								
<i>Is willing to help others</i>								
<i>Follows directions</i>								
<i>Checks for understanding</i>								

APPENDIX A:9 – Positive feedback form

(to be completed weekly)

	Week 1:	Week 2:
<i>I appreciate it when you...</i>		
<i>I admire you for...</i>		
<i>I enjoy it when you...</i>		
<i>You really helped the group when you...</i>		
<i>Other</i>		
	Week 3:	Week 4:
<i>I appreciate it when you...</i>		
<i>I admire you for...</i>		
<i>I enjoy it when you...</i>		
<i>You really helped the group when you...</i>		
<i>Other</i>		

	Week 5:	Week 6:
<i>I appreciate it when you...</i>		
<i>I admire you for...</i>		
<i>I enjoy it when you...</i>		
<i>You really helped the group when you...</i>		
<i>Other</i>		
	Week 7:	Week 8:
<i>I appreciate it when you...</i>		
<i>I admire you for...</i>		
<i>I enjoy it when you...</i>		
<i>You really helped the group when you...</i>		
<i>Other</i>		

	Week 9:	Week 10:
<i>I appreciate it when you...</i>		
<i>I admire you for...</i>		
<i>I enjoy it when you...</i>		
<i>You really helped the group when you...</i>		
<i>Other</i>		
	Week 11:	Week 12:
<i>I appreciate it when you...</i>		
<i>I admire you for...</i>		
<i>I enjoy it when you...</i>		
<i>You really helped the group when you...</i>		
<i>Other</i>		

APPENDIX B: Cooperative base group perception questionnaire

Questionnaire

Instructions: After reading each item, please indicate the degree to which you feel the statement is true of you. Please read each choice carefully and circle the **number** of the response which best expresses your feeling.

There is no time limit for the questionnaire. However, try not to spend too much time on any one item.

Your first reaction to the question will usually be the most accurate.

	ITEMS	Strongly disagree 1	Disagree somewhat 2	Agree somewhat 3	Strongly agree 4	Remarks
1	The Base group helped me to respect other persons' opinions	1	2	3	4	
2	Sharing something personal with the group each week has helped me to support my group members	1	2	3	4	
3	Because I was in a Base group, I regularly attended LIFE 111 classes	1	2	3	4	
4	Because I shared my marks with the rest of the Base group, I wanted to work harder	1	2	3	4	
5	To be part of a Base group made me less anxious about LIFE 111	1	2	3	4	
6	Because I was part of a Base group, I learned to receive help	1	2	3	4	

	ITEMS	Strongly disagree 1	Disagree somewhat 2	Agree somewhat 3	Strongly agree 4	Remarks
7	Because I was part of a Base group, I learned to be helpful	1	2	3	4	
8	The Base group provided me with academic support	1	2	3	4	
9	I enjoyed being in a Base group	1	2	3	4	
10	To be in a Base group is valuable	1	2	3	4	
11	Because I was part of a Base group, I performed better in LIFE 111	1	2	3	4	
12	In our Base group all the members always worked together	1	2	3	4	

	ITEMS	Strongly disagree 1	Disagree somewhat 2	Agree somewhat 3	Strongly agree 4	Remarks
13	Although I was in a Base group I was still responsible for my own achievement	1	2	3	4	
14	To be part of a Base group taught me to communicate better	1	2	3	4	
15	Because the Base group met weekly, we worked better together	1	2	3	4	
16	By evaluating the effectiveness of the Base group, I became more aware of what our group needs in order to function better	1	2	3	4	
17	I feel that our Base group must meet more outside of class time	1	2	3	4	
18	The "class-on-the-grass" was better than gathering in a lecture hall	1	2	3	4	

	ITEMS	Strongly disagree	Disagree somewhat	Agree somewhat	Strongly agree	Remarks
		1	2	3	4	
19	Regularly giving positive feedback to the Base group members, helped me to focus on their positive aspects	1	2	3	4	
20	I learned to handle conflict better because I was part of a Base Group	1	2	3	4	

APPENDIX C: Semi-structured interview questions

Semi-structured interview schedule

1. Please tell me what the personal support that you may or may not have received within the base groups, mean to you.
2. Tell me of the degree to which you had the confidence to function within the base groups
3. What is your experience with the folders? (How would you change it? Was it valuable? Could the base groups have functioned without it?)
4. Tell me what you think the value of the base groups was, if any.

**APPENDIX D: Letter from Statistical Consultation Service of the North-West
University**



Private Bag X6001, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
Web: <http://www.nwu.ac.za>

Statistical Consultation Services
Tel: +27 18 285 2447
Fax: +27 0 87 231 5294
Email: monique.vandeventer@nwu.ac.za

21 April 2015

Re: Thesis, Ms A Lubbe, student number: 12080454

We hereby confirm that the Statistical Consultation Services of the North-West University analysed the data involved in the study of the above-mentioned student and assisted with the interpretation of the results. However, any opinion, findings or recommendations contained in this document are those of the author, and the Statistical Consultation Services of the NWU (Potchefstroom Campus) do not accept responsibility for the statistical correctness of the data reported.

Kind regards

A handwritten signature in black ink, appearing to read 'SM Ellis'.

Dr SM Ellis (Pr. Sci. Nat)

Head: Statistical Consultation Services

Original details: Monique van Deventer(12256307) Q:\Algemeen - nie konsultasie\Stylblaai_ Style sheets\Brief verhandeling_Eng.docm
23 April 2014

APPENDIX E: Letter from language editor

Jackie Viljoen
Language Editor and Translator
16 Bergzicht Gardens
Fijnbos Close
STRAND 7140

Accredited member of the South African Translators' Institute No 1000017
Member of the Professional Editors' Group (PEG)
☎ +27+21-854 5095 📠 082 783 0263 📠 086 585 3740
Postal address: 16 Bergzicht Gardens, Fijnbos Close, STRAND 7140 South Africa

DECLARATION

I hereby certify that the **thesis** by **ANITIA LUBBE** was properly language edited but without viewing the final version.

Title of thesis:

Cooperative base groups in higher education: the impact on Life Sciences students' self-directed learning readiness



JACKIE VILJOEN
Strand
South Africa
28 April 2015

APPENDIX F: Ethics approval of project at the North-West University



Private Bag X6001, Potchefstroom
South Africa 2520

Tel: (018) 299-4900
Faks: (018) 299-4910
Web: <http://www.nwu.ac.za>

Ethics Committee
Tel +27 18 299 4852
Email Ethics@nwu.ac.za

1 July 2013

ETHICS APPROVAL OF PROJECT

The North-West University Ethics Committee (NWU-EC) hereby approves your project as indicated below. This implies that the NWU-EC grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the project may be initiated, using the ethics number below.

Project title: TEACHING AND LEARNING STRATEGIES TO PROMOTE SELF-DIRECTED LEARNING															
Project Leader: : Prof E Mentz															
Ethics number:	N	W	U	-	0	0	0	1	0	-	1	3	-	A	2
	Institution				Project Number					Year		Status			
	Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation														
Approval date: 2013/02/14							Expiry date: 2018/02/13								

Special conditions of the approval (if any): None

General conditions:

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, please note the following:

- The project leader (principle investigator) must report in the prescribed format to the NWU-EC:
 - annually (or as otherwise requested) on the progress of the project,
 - without any delay in case of any adverse event (or any matter that interrupts sound ethical principles) during the course of the project.
- The approval applies strictly to the protocol as stipulated in the application form. Would any changes to the protocol be deemed necessary during the course of the project, the project leader must apply for approval of these changes at the NWU-EC. Would there be deviated from the project protocol without the necessary approval of such changes, the ethics approval is immediately and automatically forfeited.
- The date of approval indicates the first date that the project may be started. Would the project have to continue after the expiry date, a new application must be made to the NWU-EC and new approval received before or on the expiry date.
- In the interest of ethical responsibility the NWU-EC retains the right to:
 - request access to any information or data at any time during the course or after completion of the project;
 - withdraw or postpone approval if:
 - any unethical principles or practices of the project are revealed or suspected,
 - it becomes apparent that any relevant information was withheld from the NWU-EC or that information has been false or misrepresented,
 - the required annual report and reporting of adverse events was not done timely and accurately,
 - new institutional rules, national legislation or international conventions deem it necessary.

The Ethics Committee would like to remain at your service as scientist and researcher, and wishes you well with your project. Please do not hesitate to contact the Ethics Committee for any further enquiries or requests for assistance.

Yours sincerely

Prof Amanda Lourens
(chair NWU Ethics Committee)