Cooperative learning-embedded assessment: Implications for students' assessment literacy and self-directedness in learning

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DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

Signature

November 2019

Date

DEDICATION

This thesis is dedicated to all the important people in my life.

My husband, Henning, thank you for all your support and love. I love you and appreciate all that you've sacrificed over the past four years. When I count my blessings, I count you twice! I love you with all my heart!

My brother, Willem, I love you! Your support, all the way from China, helped me more than you'll ever know! Ek lief jou vreeslik baie Ouboet!

My Dad, Pa Willem, I love you and I am grateful for second chances and new beginnings.

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I lastly, would like to dedicate this thesis to the late Prof. Kobus Lombard. I still had so much to learn from you! We all miss you dearly! Rest in peace, Prof. Kobus.

"Beautiful memories silent kept

of one that we loved

and will never forget."

(foreverinmyheart.com)

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ABSTRACT

Studies reporting on the influence of assessment practices, fostering assessment literacy and self-directed learning skills, are limited.

The aim of this investigation was to determine the influence of the implementation of cooperative learning-embedded assessment on the assessment literacy and 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 of the investigation, the Self-Rating Scale of Self-Directed Learning and the Student Assessment Literacy Questionnaire were analysed.

In the qualitative phase of this investigation, the Cooperative Learning-Embedded Assessment Questionnaire was administered to the first-year Life Sciences students in the experimental group. Semi-structured individual interviews were also conducted with randomly selected first-year Life Sciences students in the experimental group. The questions in the questionnaire and in the interviews were compiled to determine the students' perception of the cooperative learning-embedded assessment intervention. Furthermore, the questions of the questionnaire and interviews aimed to establish how the students' perception of cooperative learning-embedded assessment contributed to their assessment literacy and self-directed learning.

The relationship between the students' assessment literacy and their self-directedness in learning was also established.

The results of this investigation contribute to the body of knowledge on assessment that is situated within cooperative learning with the development of cooperative learning-embedded assessment. Furthermore, a contribution is made to the body of knowledge on assessment literacy of students, as it provides insight into how participating students experienced cooperative learning-embedded assessment. The implementation of cooperative learning-embedded assessment contributes to students' assessment literacy in terms of understanding the university's purpose with assessment, their minimum effort orientation towards assessable tasks, understanding local assessment protocols and assessment standards, as well as being able to use assessment to judge their own work and the work of their peers. The implementation of cooperative learning-embedded assessment also contributes towards the development of the following self-directed learning skills, which are crucial for becoming self-directed in one's learning: diagnosing learning needs, identifying strengths and weaknesses,

seeing peers as resources, being motivated to learn, selecting appropriate learning strategies, and monitoring learning progress.

Key words: cooperative learning-embedded assessment, assessment literacy, self-directed learning, cooperative learning, assessment, first-year students.

OPSOMMING

Daar bestaan beperkte navorsing oor die invloed van assesseringspraktyke op die bevordering van assesseringsgeletterdheid en selfgerigte leervaardighede.

Die doel van hierdie ondersoek was om die invloed van die implementering van koöperatiewe leer-ingebedde assessering op die assesseringsgeletterdheid en selfgerigte leergereedheid van eerstejaarstudente in Lewenswetenskappe te bepaal.

Ten einde die navorsingsdoel te bereik, is ’n gemengdemetode-benadering gevolg. Gedurende die kwantitatiewe fase van die ondersoek is die selfbeoordelingsskaal van selfgerigte leer en die vraelys vir leerderassessering vir studente geanaliseer.

In die kwalitatiewe fase van hierdie ondersoek is die koöperatiewe leer-ingebedde assesserings-vraelys op die eksperimentele groep eerstejaarstudente in Lewenswetenskappe toegepas. Semi-gestruktureerde individuele onderhoude is ook gevoer met willekeurig geselekteerde eerstejaarstudente in Lewenswetenskappe uit die eksperimentele groep. Die vrae in die vraelys en in die onderhoude was saamgestel om die studente se persepsie van die koöperatiewe leer-ingebedde assessering intervensie te bepaal. Verder was die vrae in die vraelys en onderhoude gerig op die bepaling van hoe die studente se persepsie van koöperatiewe leer-ingebedde assessering bygedra het tot hulle assesserings-geletterdheid en selfgerigte leer.

Die verband tussen die studente se assesseringsgeletterdheid en hulle selfgerigte leer is ook vasgestel.

Die resultate van hierdie ondersoek dra by tot die kennis van assessering wat binne koöperatiewe leer geleë is, met die ontwikkeling van koöperatiewe leer-ingebedde assessering. Verder word 'n bydrae gelewer tot die kennis oor assesseringsgeletterdheid van studente,aangesien dit insig bied in hoe deelnemende studente koöperatiewe leer-ingebedde assessering ervaar het. Die implementering van koöperatiewe leer-ingebedde assessering dra by tot die assesseringsgeletterdheid van studente ten opsigte van die begrip van die doel van die universiteit met assessering, studente se minimum pogingsgerigtheid ten opsigte van assesseerbare take, die begrip van plaaslike assesseringsprotokolle en assesseringstandaarde, sowel as die vermoë om assessering te gebruik om hulle eie werk en dié van hulle eweknieë te beoordeel. Die implementering van koöperatiewe leer-ingebedde assessering dra ook by tot die ontwikkeling van die volgende selfgerigte leervaardighede, wat van kardinale belang is ten einde selfgerig te raak ten opsigte van eie leer: die diagnosering

van leerbehoeftes, identifisering van sterkpunte en swakhede, die sien van eweknieë as hulpbronne, motivering om te leer, keuse van toepaslike leerstrategieë, en die monitering van leervordering.

Sleutelwoorde: koöperatiewe leer-ingebedde assessering, assesseringsgeletterdheid, selfgerigte leer, koöperatiewe leer, assessering, eerstejaarstudente.

LIST OF ACRONYMS AND ABBREVIATIONS

AaL	assessment as learning
AE	assessment expectation
AfL	assessment for learning
AJ	assessment judgement
AL	assessment for learning
ALit	assessment literacy
AoL	assessment of learning
AU	assessment understanding
CFA	confirmatory factor analysis
CL	cooperative learning
CL-EA	cooperative learning-embedded assessment
CL-EAQ	cooperative learning-embedded questionnaire
CAQDAS	computer and qualitative data analysis software
EduREC	Faculty of Education Research Ethics Committee
eFundi	learning management system of the university where the investigation was conducted
Gr	groundedness or G-count
HE	higher education
ICT	Information and Communication Technologies
KMO	Kaiser–Meyer–Olkin measure of sampling adequacy
LIFE 112	Life Sciences module presented in the first semester of the first year
LIFE 122	Life Sciences module presented in the second semester of the first year
LMS	learning management system
LOA	learning-oriented assessment
MEO	minimum effort orientation
NWU	North-West University

OCLI	Oddi Continuing Learning Inventory
PAF	principle axis factoring
P-A-R	post-assessment reflection activity
P-I-P&S	peer test, individual test, peer processing and self-reflection
PRO-SDLS	Personal Responsibility Orientation to Self-Direction in Learning Scale
qual	qualitative
quan	quantitative
SALQ	Student Assessment Literacy Questionnaire
SCT	social constructivist theory
SD	standard deviation
SDL	self-directed learning
SDLI	Self-Directed Learning Inventory
SDLRS	Self-Directed Learning Readiness Scale
SIT	social interdependence theory
SLOA	self-directed learning-oriented assessment
SRSSDL	Self-Rating Scale of Self-Directed Learning
t-test	tests using the t-statistic that establishes whether two means collected from independent samples differ significantly
UP	university's purpose with assessment
WIL	work-integrated learning
ZPD	zone of proximal development

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CHAPTER 1 INTRODUCTION AND PROBLEM STATEMENT

1.1 Problem statement and motivation

The role of students within the context of higher education is steadily changing from being passive learners to being more autonomous, meaning that students are directing their own learning (Hussey & Smith, 2010). Globalisation, increasing knowledge economy, as well as rapid developments in information communication technology (ICT) (Mok, 2009) are some of the developments driving the need for more autonomous self-directed lifelong learners (Mumm, Karm, & Remmik, 2015). Taking responsibility for one's own learning, i.e. defining learning goals and evaluating the learning progress in achieving these goals, is a key characteristic of a self-directed lifelong learner (Brockett & Hiemstra, 1991; Brookfield, 2009; Kasworm, 1983; Knowles, 1975; Nepal & Stewart, 2010; Nicol, 2009). Dochy, Segers, Gijbels, and Struyven (2007, p. 97) furthermore state that lifelong learning is characterised by "increasing self-directedness and self-assessment and is more discovery-oriented, using authentic problems or cases". Because the development of complex skills needed for taking up the responsibility for one's own learning, such as self-monitoring and self-regulation, is neither a quick nor an instinctive process, these skills need to be fostered and cultivated (Earl & Katz, 2006). According to Sambell, McDowell, and Montgomery (2013), one of the ways in which students can be assisted in becoming self-directed learners, is through assessment.

Although various aspects of educational assessment have been identified to encourage self-directed learning (SDL) (Kvale, 2007, p. 66), "common forms of educational assessment foster other-directed learning". Assessment is generally disliked by educators and students, therefore also largely ineffective in supporting student learning (Gibbs & Simpson, 2004). Smith, Worsfold, Davies, Fisher, and McPhail (2013) state that students' understanding of the purposes of assessment, as well as the process involving assessment, will aid in the development of the necessary skills needed for taking responsibility for one's own learning. According to Price, Rust, O'Donovan, Handley, and Bryant (2012), simply communicating to students what matters in assessment, will likely be ineffective and therefore students need to be "critical consumers of feedback" (Stiggins, 1991, p. 535). Examining the nature of an assessment task, grasping the purpose of the task and various possible ways of responding to it, understanding how the task relates to the rest of their course and learning, as well as engaging with and using feedback, are necessary actions to be taken by students in order to develop assessment literacy (ALit) (Price et al., 2012). ALit is defined as the ability to recognise different purposes of assessment, and using them accordingly (Volante & Fazio, 2007). According to Smith et al. (2013), retaining responsibility for the learning process is a

characteristic of students who are assessment literate. The way in which assessment literacy, specifically in higher education contexts, is developed, is not at all obvious (Price et al., 2012). However, Becket and Brookes (2009) state that a more personalised learning environment is key for the development of assessment literacy among students.

Cooperative learning (CL) is an instructional method utilising the collective efforts of group members (Johnson & Johnson, 2013). Individual accountability, positive interdependence, promotive interaction, small-group skills, as well as group processing are the five basic elements of CL, which sets it apart from other collaborative efforts (Gillies, 2007; Johnson & Johnson, 2013; Lubbe, 2015). According to Kek and Huijser (2011), students' self-directedness towards learning is enhanced when students participate actively in questioning, explaining, justifying and evaluating their own as well as their peers' ideas. According to Johnson and Johnson (2014), cooperative learning environments not only result in an increase in higher-level reasoning, but the generation of new ideas and solutions occur more frequently. Furthermore, students' willingness to listen to and be influenced by peers, through giving and receiving feedback, increases (Gillies & Boyle, 2011; Johnson & Johnson, 2014). The ineffectiveness of current assessment practices to support student learning (Boud, 2007; Boud & Falchikov, 2007; Boud & Molly, 2013; Gibbs & Simpson, 2004; Nicol, 2010) and the positive outcomes of the successful implementation of CL (Johnson & Johnson, 2014), necessitate taking a closer look at possible assessment practices which are not only authentic, participative and focused on effective feedback, but in which the learning process stands central.

Despite the fact that the slowly learnt skill of ALit (Price et al., 2012) is highly recommended to be focused on from the first year at university (Nicol, 2009), research specifically focusing on how to encourage the development of students' ALit required for higher education actively, is scant (Price et al., 2012). Likewise, research focusing on assessment within CL groups (cooperative learning-embedded assessment), incorporating the five basic CL properties, is limited. The impetus of this investigation was therefore to determine the way in which CL-embedded assessment influences first-year Life Sciences students' Alit, and the implications thereof for the students' self-directedness in learning.

1.2 Overview of relevant literature

The following sections provide a brief overview of literature regarding self-directed learning, assessment and assessment literacy, as well as cooperative learning and CL-embedded assessment.

1.2.1 Self-directed learning

The well-known definition of SDL (Knowles, 1975) provides both an in-depth account of what the process of SDL entail, and of the complexity of SDL. The process of becoming more self-directed in one's learning, involves the identification of learning needs, taking initiative for formulating learning objectives, taking responsibility for the learning process, using different learning strategies, and evaluating learning outcomes (Brockett & Hiemstra, 1991; Kasworm, 1983; Knowles (1975); Kramarski & Michalsky, 2009; Lord et al., 2010; Loyens, Magda, & Rikers, 2008; Lunyk-Child et al., 2001; Roberts, 2010). The ability to identify possible and applicable resources are pointed out by Knowles (1975) and Loyens et al. (2008). According to Thornton (2010, p. 159) 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". Contributing towards the complexity of SDL, is that an individual does not only have to master a single skill in order to become more self-directed in their learning, but a wide range of competencies, attitudes and knowledge should be mastered (Lord et al., 2010).

Patterson, Crooks, and Lunyk-Child (2002, p. 224) identified "assessment of learning gaps, evaluation of self and others, reflection, information management, critical thinking, and critical appraisal" as the six key competencies of a self-directed learner. Warburton and Volet (2012) add to the identified competencies of Patterson et al. (2002), and state that the ability to ask appropriate questions to guide their inquiry, to interrogate the assumptions behind the ideas one are presented with, to identify and select appropriate resources and strategies, and to strategically modify the strategies to achieve their unique learning objectives, are important skills of individuals who are becoming more self-directed in their learning.

Because self-directed learners are taking responsibility for their own learning process and learning progress, Roberts (2010) suggest that cognitive and metacognitive skills are also required. According to Dynan, Cate, and Rhee (2008) the development of SDL is primarily up to educators and their encouragement, whilst Lunyk-Child et al. (2001) states that educators should be skilful in facilitating strategies that promote self-directed learning.

Tools such as the Self-directed Learning Readiness Scale (Guglielmino, 1978) and the Self-Rating Scale of Self-Directed Learning (SRSSDL) (Williamson, 2007) are used to measure the degree of attitudes, skills and characteristics of an individual's current level of self-directedness towards learning.

1.2.2 Assessment and assessment literacy

Supporting student learning, generating marks in order to judge the quality of students' achievement, and providing evidence which satisfies the demands of accountability, are core purposes of assessment (Gibbs, 1999; Newton, 2007; Yorke & Longden, 2008). Not only does assessment lie at the heart of the student experience, but assessment also has an influence on student learning (Crisp, 2012; Price et al., 2012). Because knowledge is more likely to be contested in higher education contexts than in secondary educational contexts, assessment requiring students merely to reproduce knowledge through memorisation is not good enough (Price et al., 2012). Assessment should focus less on measuring what is known, and more on guiding and judging the manner in which knowledge is applied to ill-structured situations and problems (King & Kitchener, 1994).

According to Boud and Falchikov (2007), assessment focuses little on student learning, and most of lecturers' time is spent on marking assessment tasks that contribute to students' final grades (Boud, 2007). Placing student learning at the heart of all assessment, Carless (2015a) coined 'learning-oriented assessment' (LOA) for assessment which supports student learning. Mok (2013) argues that assessment should support and develop learning, and should be self-directed by the learner. This type of assessment is described as 'self-directed learning-oriented assessment' (SLOA) and integrates assessment of, for and as learning (Mok, 2013). According to Hayward (2015, p. 15) –

> *prepositions that link assessment to learning – as, for and of – can be useful if they focus attention on different purposes for assessment. There is, however, a danger that these prepositions turns into an unreflective mantra drawing attention away from the key construct – assessment is learning.*

The LOA framework contains three elements, namely assessment tasks as learning, student involvement in assessment, and student engagement with feedback (Carless, 2015a), whereas SLOA has its foundation in self-directed learning, feedback and metacognition (Mok, 2013).

In its broadest and most conservative sense, assessment literacy is defined as "an individual's understanding of the fundamental assessment concepts and procedures deemed likely to influence educational decisions" (Popham, 2011, p. 267). Smith et al. (2013) state that students need to comprehend the purpose of assessment and how the purpose links to their learning curve. Students also need to be aware of the processes of assessment and they need opportunities to practice judging their own responses. Furthermore, according to Magnusson,

Krajcik and Borko (1999), ALit within science does not only include what to assess, but also knowledge on how to assess. Having ample opportunity practicing to judge one's own responses, can enable students to learn "what is good about their work and what could be improved" (Smith et al., 2013, p. 48). In order to address the general dissatisfaction with assessment in higher education (Boud, 2007; Boud & Falchikov, 2007; Boud & Molly, 2013; Gibbs & Simpson, 2004; Nicol, 2010), and for assessment to become more effective and efficient, Price et al. (2012) suggest that attention be given to the development of students' ALit. In order for novice students to be successful within higher education contexts, being able to utilize feedback effectively (Denton & McIlroy, 2018), the development of students' ALit must take place as soon as possible in their programmes (Price et al., 2012).

1.2.3 Cooperative learning and cooperative learning-embedded assessment

"Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning" (Johnson, Johnson & Holubec, 2008, p. 1:5) and according to Gillies and Boyle (2016, p. 39), CL is "widely recognised as a pedagogical practice". Johnson et al. (2008) also state that CL is the cooperation of individuals in small groups to achieve mutual goals. These mutual goals include the completion of a task or comprehending study material (Grissom, Beck, Simon, & Chizhik, 2013). According to Johnson et al. (2008), CL maximises the learning process of each group member.

The success of CL is, according to Johnson and Johnson (2009b), due to the presence of positive interdependence, individual accountability, face-to-face promotive interaction, small group and social skills as well as group processing. According to Johnson and Johnson (2009a), the most crucial element of CL is structuring positive interdependence, therefore Grissom et al. (2013) state that CL tasks should be designed in such a way that all group members are dependent on each other for success. Positive interdependence can be established through "mutual goals (maximize own and each other's productivity), joint rewards (if all group members achieve above the criteria, each will receive bonus points), sharing resources (members have different expertise)" and assigning roles to group members (Johnson et al., 2008, p. 1:31). Each group member's contribution towards achieving the group's mutual goal, contribute towards individual accountability (Johnson & Johnson, 2009b; Johnson et al., 2008) and according to Johnson and Johnson (2009b), a lack thereof may lead to a decrease in individuals' contributions complex tasks, as a consequent of individuals' reduced feelings of personal. Promotive interaction occurs when individuals "promote each other's productivity by helping, sharing, and encouraging efforts to produce" (Johnson et al., 2008, p. 1:31). Small group and social skills are much needed skills necessary for the effective functioning of cooperative groups (Johnson et al., 2008), and may be emphasised either

indirectly or directly (Gillies & Boyle, 2011). Small group and social skills include "instructorship, decision-making, trust-building, communication, and conflict-management skills: (Johnson et al., 2008, p. 1:31). Group processing occurs when CL groups evaluate how they are handling their learning (Gillies, 2007; Johnson et al., 2008) and "maintaining effective working relationships among members" (Johnson et al., 2008, p. 1:31). According to Johnson and Johnson (2009a), group processing may very well increase self-esteem.

Three different CL types of can be implemented, namely informal CL, formal CL and cooperative base groups (Johnson et al., 2008). Informal CL takes place when "ad hoc groups meet only for a few minutes" (Johnson et al., 2008, p. 1:8) or for a lecture period and may be implemented at any time during a lecture. According to Johnson et al. (2008, p. 3:10), the purposes of this type of cooperative group arrangement include the following –

> *[it] focuses student attention on the material to be learned, sets a mood conducive to learning, helps cognitively organize 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 personalizes learning experiences.*

When individuals work together for longer periods of time (i.e. one lecture or several weeks) formal CL takes. Several pre-instructional decisions are required when making use of formal CL which include making decisions regarding group size and composition, explaining the task and the CL structure, monitoring and intervening, and assessment, evaluation and processing (Johnson et al., 2008, p. 2:2). The stable membership of cooperative base groups is long-term and is characterised by regular meetings. Such meetings occur inside and/or outside the classroom. Some of the primary responsibilities of this particular type of CL group are "provide each other with support, encouragement, and assistance in completing assignments" (Johnson et al., 2008, p. 4:2), and therefore improving the academic achievement of students (Moust, Robertsen, Savelberg, & De Rijik, 2005).

The absence of any of the five basic elements may lead to disappointment in terms of successful cooperation among group members (Sharan, 2010) as not all group work and group efforts are cooperative in nature. Shimazoe and Aldrich (2010, p. 53) identified the following benefits of cooperative learning, namely that 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".

Although various methods are known and implemented during a cooperative lesson, e.g. drill-review pairs, jigsaw procedure, read-and-explain pairs, reading comprehension triads, turn to your neighbour summaries, note-taking pairs (Johnson et al., 2008), circle the sage, team-pair-solo, pass-n-praise, and think-pair-share (Kagan, 2001), literature regarding the use of assessment, cooperatively structured within groups, is scant. According to Boud and Associates (2010), effective assessment engages students in productive learning, provides feedback which is focused on the improvement of learning, and enable students and lecturers to take joint responsibility for learning and assessment. “Working together to achieve a common goal produces higher achievement and greater productivity than does working competitively or individually” (Johnson & Johnson, 2014, p. 843). Johnson and Johnson (2014, p. 843) further states that cooperation leads to “more higher-level reasoning, more frequent generation of new ideas and solutions (i.e., process gain), and greater transfer of what is learned with one situation to another”. Therefore, assessment within CL environments, targeting the learning process, might prove to be more successful at promoting student learning than current assessment practices.

The researcher used social constructivism as a theoretical framework to understand the implementation of CL-embedded assessment (CLEA), and the implications thereof on students’ SDL and ALit. A social constructivist (Vygotsky, 1978) maintains that cognitive development is a social process rather than an individual process (Barak, 2017) and learning is seen as the active discovery and construction of knowledge (Kivunja, 2014). The importance of creating a learning environment where students actively participate in knowledge construction, as well as learning through experiencing, is emphasised by social constructivism (Schreiber & Valle, 2013). Because social constructivists construct reality in accord with the most appropriate concepts relating to their personal experience (Lodico, Spaulding, & Voegtle, 2010), the researcher attempts to understand the perspectives of the participants. The social constructivist approach therefore required in-depth data collection methods which brought the researcher closer to the participants’ view of reality (Lodico et al., 2010).

1.3 Research aim

The aim of this investigation is to determine the implications of CL-embedded assessment for first-year Life Sciences students’ assessment literacy and self-directedness in learning.

1.3.1 Research question

The question that guided the research was *What is the influence of CL-embedded assessment on first-year Life Sciences students' assessment literacy, and what are the implications thereof on the students' self-directed learning?*

1.3.2 Sub-questions

In order to answer the research question, the following sub-questions were investigated:

- What do CL-embedded assessment and assessment literacy within the context of social constructivism, entail?
- How can CL-embedded assessment be implemented in first-year Life Sciences classes?
- What is the influence of CL-embedded assessment on first-year Life Sciences students' assessment literacy?
- What is the influence of CL-embedded assessment on first-year Life Sciences students' self-directed learning?
- What are first-year Life Sciences students' perceptions of CL-embedded assessment?
- What are first-year Life Sciences students' perceptions of assessment literacy?
- What is the relationship between students' assessment literacy and their self-directedness to learning?

1.4 Research design and method

The research paradigm, design and method that was followed during this investigation are discussed in the following sections 1.4.1 to 1.4.3.

1.4.1 Research paradigm

All research that is conducted is influenced by the paradigm or worldview that the researcher holds (Creswell & Plano Clark, 2007). Whilst quantitative research designs are mainly associated with positivism or post-positivism, constructivism or interpretivism are main paradigms associated with qualitative research designs (Creswell, 2003; Feilzer, 2009). Pragmatism is the paradigm which is, according to Teddlie and Tashakkori (2009), most frequently associated with mixed methods research. Instead of being subject to choose between post-positivism and constructivism, a pragmatic worldview offers an alternative, which is problem-centred (Creswell & Plano Clark, 2007; Feilzer, 2009). Because the present investigation focused on finding possible solutions to issues related to current assessment

practices, it is based on the researcher's personal value system and existing literature and made use of both quantitative and qualitative research methods to find answers to the research questions. Throughout the investigation, the researcher assumed a pragmatic stance.

1.4.2 Research design

According to Creswell and Plano Clark (2011), mixed methods research is defined as a technique for collecting, analysing and mixing quantitative and qualitative data in order to understand a research problem fully. A mixed methods approach to research therefore allows flexibility in selecting suitable strategies to address the research questions (Ivankova, Creswell, & Plano Clark, 2016). The complexity of the research questions for this investigation necessitates the need for a non-purist research approach, collecting both numerical and textual data.

Because qualitative findings were used during this investigation to help clarify and explain the quantitative results, an explanatory sequential mixed methods design was followed during the study. During this type of research design, the data are collected separately in two phases (phase 1 – quantitative research; phase 2 – qualitative research) (see Tables 1-1, 1-2 and Figure 4-1). As the quantitative findings determine the planning and execution of the qualitative research, the quantitative data are collected and analysed first (Ivankova et al., 2016).

The straightforwardness of this two-phase design (phase 1 – quantitative; phase 2 – qualitative), collecting only one data set at a time, as well as using in-depth qualitative data to refine and elaborate on quantitative results, is one of the advantages of the explanatory sequential mixed methods design (Creswell & Plano Clark, 2007). This type of research design is not without its challenges, and according to Ivankova et al. (2016), collecting data in sequential phases may cause a prolonged study requiring participants to be available for an extended period.

In this investigation, the quantitative research followed a quasi-experimental design and the qualitative research followed a basic qualitative design. A basic qualitative design seeks to "discover and understand a phenomenon, a process, or the perspectives and world views of the people involved" (Merriam, 1998, p. 11). According to Creswell (2003), in the quasi-experimental design, the selection of the experimental and control groups are without random assignment. Both the experimental and control group take a pre- and post-test, but only the experimental group receives the intervention.

1.4.3 Research method

The sections that follow comprise a brief overview of how the literature study was conducted, as well as the manner in which both the quantitative and qualitative data were collected and analysed.

1.4.3.1 Literature study

The following keywords were used for finding relevant literature by making use of online databases: cooperative learning (*koöperatiewe leer*), learning-oriented assessment, participative assessment, assessment literacy, feedback, self-assessment, peer assessment, self-directed learning (*selfgerigte leer*), self-directed learning readiness scale, assessment literacy survey, assessment as learning, psychology of learning, feedback loop, and social constructivism. The databases that will be used include the following: ERIC, EBSCOhost, Google Scholar and Nexus.

1.4.3.2 Quantitative method

The Student Assessment Literacy Questionnaire (SALQ) (Smith et al., 2013) and the Self-Rating Scale of Self-Directed Learning (SRSSDL) (Williamson, 2007) are the measuring instruments that were used for this phase of the empirical study.

1.4.3.2.1 Population and sampling

This investigation was carried out over a period of two years on two respective campuses (Campus A and Campus B) of a South African university. Because this investigation involves the first-year Life Sciences module, first-year students enrolled for Life Sciences on both campuses took part in this investigation. Therefore, non-randomised sampling was used as all the first-year students enrolled for the Life Sciences module for year 1 (both campuses formed the control group, years 2 and 3 (campus B only formed the experimental group) was part of this investigation. Characteristics of the sample on the respective campuses, include the following: multi-racial, multi-cultural, mixed gender, and students are Afrikaans and / or English speaking.

1.4.3.2.2 Measuring instruments

The 60-item SRSSDL, used to measure the level of students' self-directedness towards their learning process (Williamson, 2007), was used to collect the quantitative data. The items are categorised under five broad areas of SDL, which are awareness, learning strategies, learning activities, evaluation and interpersonal skills (Williamson, 2007, p. 70 – 71). Responses to

each item are rated by making use of a five-point Likert-type scale, ranging from 1 (never) to 5 (always). The Delphi technique was used for the development of the SRSSDL, and internal reliability coefficient for each of the broad areas of the SRSSDL ranges from 0.71 to 0.79 (Williamson, 2007).

The SALQ is a 28-item questionnaire, designed to measure a range of related constructs:

- students' understanding of local performance standards;
- students' use of assessment tasks for enhancing or monitoring their learning;
- students' orientation to putting the minimum amount of effort necessary into the production of assessable work merely to pass the course requirements; and
- students' ability to judge their own and others' responses to assessment tasks (Smith et al., 2013, p. 48).

The responses are rated on a five-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Research done by Smith et al. (2013) indicates the trustworthiness of the SALQ.

Copies of the measuring instruments are included as Addenda A and B of this document, respectively.

1.4.3.2.3 Data collection

The following tables (Table 1-1 and Table 1-2) is a diagrammatic representation of the data collection during years 1, 2 and 3 of the investigation:

Table 1-1: Data collection

		Campus A			Campus B			
Year 1	Semester 1	PRE-test	QUAN	SALQ Williamson's SDL	PRE-test	QUAN	SALQ Williamson's SDL	
		No intervention			No intervention			
		POST-test	QUAN	SALQ Williamson's SDL	POST-test	QUAN	SALQ Williamson's SDL	
						QUAL	Open-ended questionnaire	
	Semester 2	PRE-test	QUAN	SALQ Williamson's SDL	PRE-test	QUAN	SALQ Williamson's SDL	
		No intervention			No intervention			
		POST-test	QUAN	SALQ Williamson's SDL	POST-test	QUAN	SALQ Williamson's SDL	

	Phase 1 – Quantitative research
	Phase 2 – Qualitative research

Table 1-2: Data collection (continued)

Campus A					Campus B			
Year 2	Semester 2	PRE-test	QUAN	SALQ Williamson's SDL	PRE-test	QUAN	SALQ Williamson's SDL
		No intervention			CLEA intervention		
		POST-test	QUAN	SALQ Williamson's SDL	POST-test	QUAN	SALQ Williamson's SDL
						QUAL	Open-ended questionnaire
Year 3	Semester 1	PRE-test	QUAN	SALQ Williamson's SDL	PRE-Test	QUAN	SALQ Williamson's SDL
		No intervention			CLEA intervention		
		POST-test	QUAN	SALQ Williamson's SDL	POST-test	QUAN	SALQ Williamson's SDL
						QUAL	Open-ended questionnaire Face-to-face semi-structured interviews

	Phase 1 – Quantitative research
	Phase 2 – Qualitative research

Partaking in the completion of the questionnaires was voluntary and students were asked to sign informed consent forms. Although the nature of the investigation, concerning the way in which the intervention influences the students' SDL and ALit, caused that the anonymity of the participants could not be ensured, participants only had to supply their student numbers and not their full identity. The data was collected by the researcher, after an independent person had explained the nature of the SRSSDL and SALQ to the first-year Life Sciences students. The data collected were analysed by the researcher and Statistical Consultation Services at the North-West University. The data were shared by the researcher only with her promotor and Statistical Consultation Services. The researcher stored the data in a password-encrypted electronic file and will be stored for a period of seven years. Data were treated confidentially. The researcher, her promotor, as well as a statistician from Statistical Consultation Services were the only individuals who had access to the data collected during the study.

1.4.3.2.4 Intervention

The intervention was implemented on Campus B, during the second and third year of the investigation. The intervention entails the implementation of assessment practices, which are embedded within CL groups, structured to guarantee the presence of the five basic CL elements. The first-year Life Sciences students on Campus B were exposed to the intervention for one hour and fifteen minutes per CL-EA opportunity.

1.4.3.2.5 Data analysis

The minimum possible score for the SRSSDL is 60 and the maximum possible is 300 respectively (Williamson, 2007). The total score indicates the respondents' level of self-direction in learning. The scoring range 60–140 is an indication of a 'low' level of self-directed learning, whilst a score between 141 and 220 indicates that a respondent has a 'moderate' level of self-directed learning. A 'high' level of self-directed learning is indicated by a score ranging from 221–300 (Williamson, 2007). The SALQ, involving a 5-point Likert-type scale, was analysed by making use of descriptive statistics and inferential statistics. The scores of the students' self-directed learning readiness, and the data from the SALQ were analysed by Statistical Consultation Services of the North-West University (Potchefstroom campus). Dependent and independent t-tests were performed to determine differences between pre-tests, pre- and post-tests, as well as between post-tests.

1.4.3.3 Qualitative method

The next sections contain a discussion of the population and sampling, qualitative data gathering and analysis.

1.4.3.3.1 Population and sampling

First-year Life Sciences students at the end of the semester of years 2 and 3 of the investigation on both campuses (Campus A and Campus B) took part in this qualitative phase of the empirical investigation. Students who provided informed consent completed the cooperative learning-embedded questionnaire (CL-EAQ), whilst students who provided informed consent and responded to an interview invitation on the Learning Management System, took part in the interviews.

1.4.3.3.2 Data gathering

The qualitative data was gathered by using textual data obtained from a questionnaire containing open questions, as well as from semi-structured individual interviews.

According to Maree and Pietersen (2016), open-ended questionnaires entail that questions are asked and space is provided for words, phrases or comments, this allows for more individualised responses (Mertler & Charles, 2011). Although the analysis of these questions is difficult, open questions enable respondents to give honest answers in detail. The thinking processes of the respondents are revealed, and thematic analysis of the responses yield particularly interesting information (Maree & Pietersen, 2016). The open-ended questionnaire was administered on Campus B (experimental group) at the end (last scheduled class) of the first and second semesters of years 2 and 3. The open-ended questionnaire was completed anonymously by the participants and consisted of questions concerning the students' perception of the CL-EA intervention.

According to DeMarrais (2004, p. 55), an interview is a "process in which a researcher and participant engage in a conversation focused on questions related to a research study". Interviews enable the researcher to obtain rich, narrative data, as an interview is defined as a purposeful conversation (Lodico et al., 2010). The face-to-face, semi-structured interviews took place on Campus B (experimental group) at the end of years 2 and 3 of the investigation. Eleven students voluntarily took part in the interviews. The duration of the interviews was influenced by the students' responses to questions asked but never exceeded fifteen minutes. A separate time was scheduled with each of the students taking part in the interviews. The researcher conducted the interviews in a comfortable setting and data collected from the semi-

structured interviews was treated confidentially as the identity of the interviewees was not linked to their interviews.

1.4.3.3.3 Data analysis

Data was coded, labels were assigned to the codes and codes were grouped into code groups. The researcher made use of member checking and peer-review strategies, as suggested by Creswell and Plano Clark (2007), to validate the qualitative data. The following steps were followed during the qualitative analysis (Creswell, 2013):

- *Organising and preparing the data for analysis* were done through transcribing the interviews. The researcher read through the transcribed interviews to obtain a general understanding of the participants' responses to the posed questions.
- *Inductive coding of the transcribed data* was done by making use of *in vivo* coding. Code groups are broad categories of information, and in this investigation, the code groups were formed by combining similar codes together.
- *Formulating a qualitative narrative* took place by identifying and discussing several code groups. This discussion included multiple perspectives, appropriate quotes, and useful dialogue. The researcher attempted to write the narrative as realistic as possible through noting tensions and contradictions of participants' responses, ensuring that different perspectives are represented.

Trustworthiness of the qualitative phase of this investigation can be guaranteed through credibility, transferability, dependability and confirmability (Babbie & Mouton, 2002), and was adhered to in the following ways:

- Credibility and controlling for researcher bias: member checking – soliciting feedback from the participants on the truthfulness of the formulated code groups (Lodico et al., 2010; Merriam, 2009);
- Dependability: detailed description of data collection and analysis procedures was given, an audio recorder was used for capturing interviews, and data was made available for peer-review (Lodico et al., 2010); and
- Confirmability: reducing researcher bias (Niewenhuis, 2016).

1.4.4 Variables

As an independent variable is defined as a variable which causes or influences a specific outcome (Creswell, 2003), the independent variable in this investigation is the CL-embedded assessment. A dependent variable is the result of the influence of the independent variable

(Creswell, 2003), and therefore the dependent variables in this investigation were assessment literacy and self-directed learning readiness of the first-year Life Sciences students.

1.4.5 Ethical aspects

Participation of the first-year Life Sciences students was voluntary, and students were asked to sign informed consent forms. Permission, covering all ethical aspects for the investigation, was obtained from the ethical committee (EduREC) of the North-West University. As participants of this investigation were first-year students who enrolled for the Life Sciences module, no student was at a disadvantage for not participating in the investigation. No group or classes of students were deprived of the opportunity of partaking in the investigation.

The participants had a choice to participate in the completion of the SRSSDL and SALQ, after signing the informed consent forms. The informed consent forms were administered by an independent person, and not by the researcher. The informed consent form provided a detailed description of the following:

- first-year Life Sciences students are being asked to participate in the investigation;
- the purpose and nature of the proposed investigation;
- who the researcher is and the nature of her expertise;
- the first-year Life Sciences students have a choice whether to participate voluntarily in the completion of the SRSSDL and SALQ, as well as the open-ended questionnaire and interviews or not;
- participants who refuse to participate will not be penalised;
- choosing to participate can be revised at any time during the proposed investigation, and participants may withdraw without any consequences;
- the nature of the responsibilities of the participants and of the researcher;
- that the participants have the right to be informed of relevant findings of the proposed investigation;
- the potential benefits during and after the proposed investigation;
- the extent to which confidentiality is possible;
- that the investigation has been approved by the Research Ethics Committee (EduREC);
- that the Research Ethics Committee (EduREC) may inspect the research records; as well as
- participants may decide not to take part in the data collection process, but they will have to take part in the intervention, as the intervention is linked to their Life Sciences module.

Once the data collected from the interviews had been stored, the audio data were deleted from the audio recorders. All data was password protected and managed only by the researcher. All data was stored by the researcher in a password-encrypted electronic file. Data will be treated confidentially and only the researcher and her promotor had access to the qualitative data.

The collected and analysed data are communicated to academia while addressing the research questions in this thesis.

1.4.6 Role of the researcher

Because of the following, the researcher assumed a participatory role in both the quantitative and qualitative phases of this investigation:

- The researcher lectured the Life Sciences modules (first and second semester module) to the experimental group (Campus B) of first-year students at the tertiary institution where the investigation was conducted.
- The researcher was responsible for administering the SRSSDL and SALQ questionnaires.
- The researcher was responsible for preparing and structuring the interviews with the participants during the qualitative phase of the proposed study.
- The researcher analysed the data.

Because of the participatory role, the researcher may have developed friendly and supportive relationships with some participants. These cordial and supportive relationships could have created a possibility for bias. For this reason, extensive authentication measures, such as meticulous record keeping, engaging with promotors, and including a transparent and clear description of the research process, were used to establish and ensure the accuracy of the findings. Furthermore, all research procedures and data analysis were meticulously audited by the researcher's promotor.

1.5 Contribution of the study

This investigation was conducted within the Research Focus Area SDL and contributes in the development of CL-EA, the body of knowledge on CL-EA and assessment, as well as identifying the importance of changing assessment practices in the 21st century in order to promote SDL. Not only does this contribution influence the way in which assessment is dealt with at the university where this investigation was conducted, but the assessment practices in South African schools will also be infiltrated by the students who graduate from this university. The influence of CL-EA on first-year Life Sciences students' ALit and readiness towards SDL

were explored. The relationship between first-year Life Sciences students' ALit and their self-directedness towards learning was determined. A contribution was therefore made towards the body of knowledge on first-year Life Sciences students' assessment literacy and self-directed learning.

1.6 Structure of dissertation

Chapter 1: Introduction
Provides a preview and outline of the investigation

Chapter 2: Self-directed learning (SDL) and assessment literacy (ALit): the need thereof and readiness therefor
Provides a theoretical and conceptual framework for SDL and ALit

Chapter 3: Cooperative learning (CL) and cooperative learning-embedded assessment (CL-EA)
Provides a theoretical and conceptual framework for CL and CL-EA

Chapter 4: Research methodology
Describes the research design and method followed

Chapter 5: Results and analysis
Presents the quantitative and qualitative results of the investigation

Chapter 6: Conclusions and recommendations
Gives a detailed summary of the main conclusions of this investigation, the contribution made, as well as recommendations to be considered for further investigation

CHAPTER 2

ASSESSMENT LITERACY AND SELF-DIRECTED LEARNING: THE NEED OF AND READINESS FOR IT

"If we want to improve students' engagement with learning, a key locus of enhancement can be refreshing our approaches to assessment" (Brown, 2015, p. 106).

2.1 Introduction

In this chapter, the necessity for assessment literacy (ALit) within a self-directed learning (SDL) environment will be explained. In order to do this sufficiently, various aspects of assessment will be discussed against the backdrop of the influencing learning theories, which will be positioned within the social constructivist theory (SCT).

2.2 Major theories underpinning learning and their consequential influence on assessment

According to Reddy, Le Grange, Beets and Lundie (2015) and Ertmer and Newby (2013a), the nature of assessment practices as well as the way in which these practices are applied, are influenced by the way teaching and learning processes are defined and understood.

Although the process of learning is explained by several theories, the behaviourist, cognitive and constructivist views are the main schools of thought on how learning takes place (Bates, 2016; Ertmer & Newby, 2013b; Kay & Kibble, 2016; Pritchard, 2014; Race, 2015; Slavin, 2012; Yilmaz, 2011). In order to argue the position of assessment and SDL within the SCT, a brief overview of the main learning theories and their influence on assessment practices, is vital, and this overview is given in the following sections.

2.2.1 Behaviourist theories and cognitive science

Simply put, behaviourist theories are focused on the principle of stimulus and response (Bates, 2016; Kay & Kibble, 2016; Race, 2015; Skinner, 1968; Slavin, 2012). The various theorists, whose work influenced this school of thought, are illustrated in Figure 2-1.

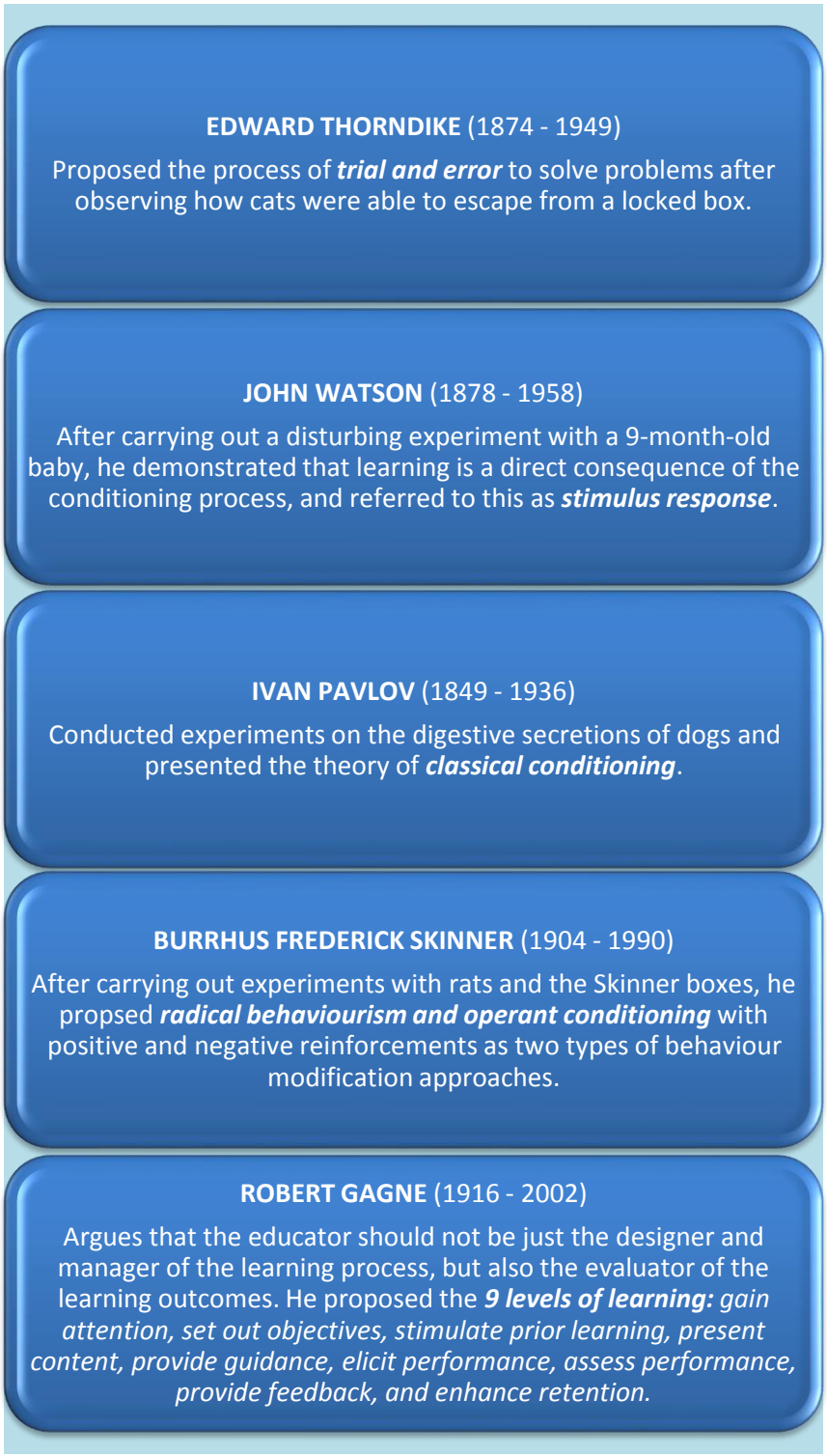


Figure 2-1: Influential theorists and the contributing learning theories to the behaviourist school of thought

Source: Adapted from Bates (2016)

From Figure 2-1, it is evident that the behaviourist school of thought highlights the educator as the author of the learning process. The educator-led activities within the behaviourist school of thought presents the educator as the individual in control of not only what needs to be done, but also the way in which it will be done, as well as determining which evidence of behavioural modification needs to be produced (Bates, 2016; Kay & Kibble, 2016; Race, 2015).

Lao-Tzu, a 6th-century Chinese philosopher, stated, "rewards and punishments are the lowest form of education" (Pritchard, 2014, p. 17), whilst Slavin (2012) states that the limiting factor of behavioural learning theories is that it focuses almost entirely on observable behaviour. According to Race (2015), the articulation of the curriculum in terms of outcomes to be obtained, originates from behaviourist theories. Furthermore, the clear stipulation of assessment criteria to be reached is an attempt to define the learned behaviours (Race, 2015). Little regard is given for the mental processes or understanding involved in learning, as behaviourists see learning as an observable change in an individual's behaviour due to experience, which is affected through consequence (Pritchard, 2014; Slavin, 2012).

Assessment within a behaviourist-driven learning environment requires the educator to explain the learning objectives, which will be tested, and emphasises the production of observable and measurable outcomes (Ertmer & Newby, 2013a; Baird et al., 2014, Bates, 2016; Race, 2015). Learning and assessment are directed, managed and reinforced by the educator (Ozuah, 2005). Highlighting the rewards for achievement and using reinforcement to influence students' performance, as well as drawing attention to the penalties for failing to achieve the learning outcomes are typically relevant to assessment within a behaviourist-driven learning environment (Bates, 2016; Ertmer & Newby, 2013a; Race, 2015). Assessment practices include regular testing, where tests are used for formative purposes and hence seen as a product and not a process (Baird et al., 2014). Feedback is corrective (Baird et al., 2014), is given in the form of reinforcements, and is primarily aimed at modifying behaviour (Ertmer & Newby, 2013a). Assessment is therefore managed under controlled conditions and aims to establish whether students have mastered a certain body of knowledge.

During the late 1950s, however, focus was shifted to more complex cognitive process and the emphasis was on mental processing, which included thinking and problem solving (Ertmer & Newby, 2013a). This paradigm shift was due to the failure of the behaviourist theory in explaining how conceptual change occurs (Yilmaz, 2011). Acquisition of knowledge, as well as making sense of and processing information was deemed more crucial than the considerable emphasis on observable behaviour (Yilmaz, 2011). The acquisition of knowledge is described as "a mental activity that entails internal coding and structuring by the learner" (Ertmer & Newby, 2013a, p. 51); hence, the active role of the learner in his or her learning

process. Figure 2-2 presents the various learning theorists whose work is said to have influenced the cognitive school of thought, and which will be elaborated upon briefly.

According to the theorists (Figure 2-2), a change in behaviour should be learner-centred (Bates, 2016). Perception, learning, thinking and understanding should not be considered separate entities (Köhler, 1947). Furthermore, insight is not something that can be taught; students should rather be encouraged to try out new ideas, learn from their mistakes, as well as reflect on what they have learned by making notes of their thoughts (Köhler, 1947). Although Lev Vygotsky (1978) is said to have contributed towards the cognitive school of thought (Bates, 2016), Vygotsky's notion that knowledge is constructed through interaction with most knowledgeable others within the zone of proximal development (ZPD) will be elaborated upon when discussing the SCT (see 2.3.2). Piaget (1957) states that people construct knowledge, instead of receiving it, and suggests that one's experiences influence the construction of knowledge. Piaget (1957) further argues that amongst others, one's mental state of development influences one's experiences, and identifies the following stages of mental development (Bates, 2016; Pritchard, 2014):

- *Sensorimotor* – this stage takes place from birth to the age of two. A child's learning within this stage takes place through touching and feeling.
- *Pre-operational* – children between the ages of two and seven find themselves within this stage. Children's ability to organise objects in a logistical manner starts to develop during this stage.
- *Concrete operational* – children between the ages of seven and eleven are in this stage during which their ability to use logical thought becomes more structured.
- *Formal operational* – children older than eleven years start to develop verbal and abstract reasoning.

Figure 2-2: Influential theorists and the contributing learning theories to the cognitive school of thought

Source: Adapted from Bates (2016)

According to Pritchard (2014), another aspect of Piaget's work deals with the increase of knowledge and understanding, as well as the ways in which students deal with new

information. Because Piaget defined learning as “a process of adjustment to environmental influences” (Pritchard, 2014, p. 21), he proposed the assimilation and accommodation processes. The process, through which new knowledge is integrated into existing mental structures, is known as assimilation. During assimilation, the knowledge bank is increased. As soon as existing mental structures must be altered to accommodate new knowledge, which contradicts current knowledge, the process is known as accommodation. When someone no longer experiences a state of conflict between existing and new knowledge, a stable state of equilibration is reached (Pritchard, 2014). Observing others and mentally rehearsing whether the observed actions are appropriate before initiating own behaviour and are ways in which behaviour modification is achieved (Bandura, 1977). Bandura identified observation, assessing appropriateness, and initiation of behaviour as role modelling (Malone, 1990).

Bruner’s (1966, 1971) idea of discovery learning states that an individual’s behaviour is modified when he or she is actively participating in the process of discovering knowledge. As opposed to Ausubel’s (1978) notion of reception learning, Bruner’s discovery learning places the learner at the centre of the learning process as it is the learner’s responsibility to organise the understanding and meaning making of new knowledge (Bruner, 1966, 1971).

Within the cognitive theory, the aim of learning is the “acquisition of usable knowledge and problem-solving skills” (Ozuah, 2005, p. 85). Assessment within the cognitive school of thought makes provision for students’ need to make sense of new and existing information (Baird et al., 2014). The connections made between new and existing information is the responsibility of the educator (Ozuah, 2005). Emphasis is placed on learning objectives and assessment criteria, and feedback is a dynamic process through which students can close the learning gap (Baird et al., 2014).

The emphasis in the cognitivist school of thought, therefore, is mostly placed on acquiring, processing and assimilating knowledge (Arghode et al., 2017), and social interactions are not considered. Constructivism, like cognitivism, emphasises learner understanding but highlights the role of social interactions (Jackson, 2009).

2.2.2 Constructivism and social constructivism

According to Slavin (2012), the constructivist school of thought was influenced by both Jean Piaget and Lev Vygotsky. Piaget (1957) is associated with cognitive constructivism, which emphasises the attempt to construct knowledge as a distinct process within each learner, and social interaction with peers is an opportunity to gain needed information to revise one's thinking (Ormrod, 2012). Vygotsky (1978) emphasises the importance of interaction with friends, family, teachers and peers in knowledge and thought construction. Vygotsky (1978) refers to people from whom we learn as 'most knowledgeable others', and argues that the process of learning through social interaction occurs within an individual's ZPD. According to Vygotsky (1978, p. 86), the ZPD is defined as "the distance between the actual developmental 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".

According to Pritchard (2014) and Slavin (2012), constructivist theorists argue that people learn best when they actively construct their own understanding. To this, social constructivism adds a vital aspect to the constructivist domain, namely social interaction. Social constructivists, according to Ben-Zvi Assaraf (2011), believe that meaningful learning takes place when knowledge is shared within large or small groups. Although Lev Vygotsky is said to be the main proponent of the SCT, some scholars are of opinion that Dewey and Bruner also blueprinted the SCT (Kalbfleisch, 2015), whilst Pritchard (2014) states that it is rooted in the work of Jean Piaget. Because the emphasis within the social constructivist learning approach is placed on the interaction of students with others, dialogue enables the students to consider, share and develop ideas (Pritchard, 2014). Ormrod (2012), James (2006), Jensen and Frederick (2016), Schreiber and Valle (2013), Merriam et al. (2007), Pritchard (2014), Bates (2016), Race (2015) as well as Barak (2017), amongst others, define and discuss the SCT.

According to the SCT, all learning is socially enabled within the students' ZPD with the aid of scaffolds (Kay & Kibble, 2016). According to Alt (2014, p. 100), social constructivists view knowledge as "a process that is structured by dialogue and interaction with other learners achieved by experiencing the world together". Upon studying Alt's (2014) definition (see Figure 2-3), it becomes evident that social constructivists not only view learning as a process through which meaning is constructed (Merriam et al., 2007), but they also acknowledge that the active engagement of students is required for learning to take place (James, 2006).

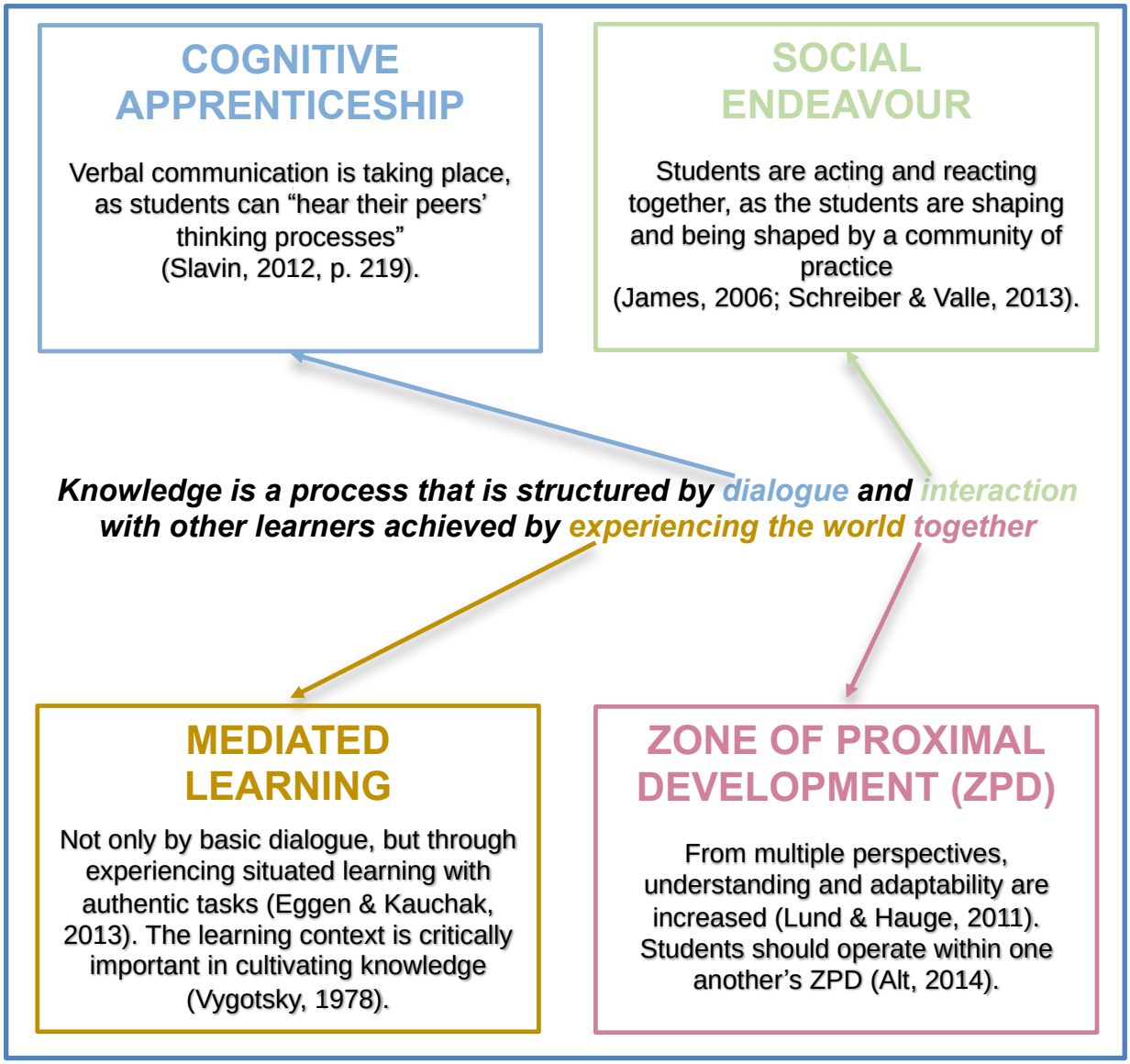


Figure 2-3: Brief analysis of Alt's (2014:100) definition of SCT – indicating Slavin's (2012) four principles of SCT

Robert E. Slavin is not only a well-published author on educational psychology (Slavin, 2012), but has also done extensive research on the implementation of cooperative learning, rooted in social constructivism (Slavin, 2014). According to Slavin (2012), the four principles of SCT are (see Figure 2-3):

Cognitive apprenticeship – this refers to the process through which students gradually acquire expertise and cognitive skills by interacting with an expert. The use of mixed-ability groups promotes conceptual change (Slavin, 2012). It is therefore not surprising that the heterogeneous nature of cooperative learning groups is widely used within a social constructivist environment. The knowledge production, as well as the application thereof, is possible through guidance by a lecturer or a more knowledgeable peer (Schreiber & Valle,

2013). According to Eggen and Kauchak (2012), modelling skills and thinking aloud; providing support through scaffolding; enabling students to verbalise their thoughts; as well as increasing task complexity are four components of cognitive apprenticeship.

Social endeavour – within the social constructivist setting, students' thinking processes are available to all students working together. Successful problem solvers talk themselves through difficult problems; therefore, through active learning, students benefit from the way in which problem solvers are thinking through their different approaches. When students interact with each other, it happens that meanings are socially negotiated, and the students' own understanding of concepts and behaviours are being developed (James, 2006; Schreiber & Valle, 2013). Because active learning is the focus, student-centred instruction is most often used (Jensen & Frederick, 2016).

Mediated learning – educators should give students complex, difficult and authentic tasks along with enough scaffolding for students to achieve the given tasks. Higher cognitive functioning is promoted through the internalisation of mastered skills because of the scaffolding provided by the educator. Authentic tasks, as highlighted by Eggen and Kauchak (2012), are crucial for the transfer of knowledge to take place from one context to another, and the application of acquired knowledge in a variety of contexts is important. Scaffolding refers to all the support, guidance, prompts, direction or resources that are provided to students, which will enable them to do a task otherwise out of their reach (Davis & Miyake, 2004). According to Wass and Golding (2014), providing textbooks or readers containing the necessary background information, guiding heuristics, such as graphic organisers (a Venn diagram for example), feedback, as well as peer support are all examples of scaffolds. Wass and Golding (2014) warn, however, that providing students with assistance and support might not necessarily lead to learning. For scaffolding structures to contribute to autonomous learning, such scaffolding should allow students to identify and solve problems themselves, instead of identifying the problems for them. Sufficient support should be given in order for students to complete the tasks independently, and rather than directing them through a pre-determined set of actions, some choice should be left to the students, instead of telling them exactly what to do (Wass & Golding, 2014).

Zone of proximal development – a student's ZDP "marks the range of tasks the student might not be able to do alone but can do with the assistance of peers or adults" (Slavin, 2012, p. 219). Working with peers is, according to Alt (2014, p. 102), academically beneficial because, "when students are closer to one another in their levels of proximal development, they are able to describe things to one another in a simpler way that is easier to be comprehend than explanations by a person with a very different mental age". The ZPD refers to the specific zone

where optimal learning takes place and represents the difference between what a student can do with guidance and what the student can do without guidance (Vygotsky, 1978). The ZPD can also be described as the gap where a task provides an appropriate challenge level given the student's existing skills, knowledge and ability (Kay & Kibble, 2016). According to Wass and Golding (2014), the ZPD can be used as a tool to guide teaching, and these authors' conceptual analysis of the ZPD indicates that:

- educators have to allocate tasks that the students will only be able to do with assistance;
- educators also have to provide just enough assistance in the form of scaffolding, so that students will eventually learn to complete the tasks independently; and lastly
- learning gains can be increased when educators provide a learning environment that enables students to do tasks that are more difficult.

According to Scrimsher and Tudge (2003), interpretations of the ZPD suggest that it is a two-way learning process and all participants learn through their interactions with each other.

The social interaction between students within a social constructivist learning environment is a result of students bringing their own paradigms to the learning context; therefore, their interaction allows for multiple perspectives and representations of content and reality (Schreiber & Valle, 2013). Within the SCT of learning, students' different starting points as well as the fact that each student has a different level of prior knowledge and lived experience are acknowledged (Hodges, Eames, & Coll, 2014). The top-down approach to instruction, typically utilised within the SCT of learning, enables students to break down complex problems (with scaffolding and guidance from the educator) and to discover the applicable principles (Slavin, 2012).

According to Hassan (2011), assessment plays an integral role in social constructivist learning, since the two-way communication and interaction between the educator and the student enable the educator not only to assess what is achieved, but also what the student can achieve. Assessment, therefore, needs to acknowledge that each student learns different things of potential value and merit (Hodges et al., 2014) from his or her peers. Race (2015) states that students' learning can be deepened when they verbalise their learning and when they regularly assess their own work and that of their peers. Within a social constructivist-driven environment, "the construction of knowledge and not the reproduction of knowledge is paramount" (Pritchard, 2014, p. 35). Because the emphasis is placed on how information is interpreted and elaborated upon (Ertmer & Newby, 2013a), assessment design and implementation within a social constructivist-driven learning environment will be approached differently. Assessment tasks, which require a higher level of heuristic problem solving, as well

as personal selection and monitoring of suitable cognitive strategies (Ertmer & Newby, 2013a) will assess how well content was mastered. Furthermore, assessment tasks will not only be authentic, prompting the development and implementation of problem-solving skills, but will also involve social negotiation to utilise multiple perspectives during problem solving. According to Baird et al. (2014), student engagement is encouraged through active learning practices (i.e. group work) and, therefore, peer- and self-assessment methods are used.

A limitation of behaviourist and cognitive theories is that the contribution of social interactions to what the students can know, do and become, is not acknowledged (Shepard, Penuel & Pellegrino, 2018). Furthermore, behaviourist and cognitive theories are inadequate to clarify how students become more skilled at thinking and doing (Shepard, Penuel & Pellegrino, 2018). SCT entails more than mere knowledge acquisition; SCT "offers a powerful, integrative account of how motivational aspects of learning are completely entwined with cognitive development (Shepard, Penuel & Pellegrino, 2018, p. 23). Closely coordinated co-design of courses and teaching as well as assessment, which enables deep learning over time, is permitted by means of SCT (Shepard, Penuel & Pellegrino, 2018). Consequently, more attention will be given to the centrality of assessment within the socially constructed learning process.

2.3 Assessment and its centrality to learning

The term 'assess' originates from the Latin verb *ad sedere* or *assidere*, which means to sit down besides, and is primarily concerned with the provision of feedback to students about their learning processes (Bachman & Palmer, 2010, cited in Council of Europe, 2010; Hodges et al., 2014). The active role that students must play in the process of assessment is highlighted by the fact that assessment is rooted in a verb ('sit'), which implies students' active involvement during the assessment process. It is therefore of no surprise that the lives of students and of educators are influenced by assessment (Boud & Falchicov, 2007), and that assessment should be developed and designed to support students' learning processes (Gibbs & Simpson, 2004). "Acts of assessment must be designed to leave learners better equipped to learn further" (Boud, 2015, p. 6).

However, students often perceive the relationship between learning and assessment as coming down to one thing: a grade (McMorran, Ragupathi, & Luo, 2017). According to Quesada-Serra, Rodríguez-Gómez, and Ibarra-Sáiz (2016), assessment requires a predominant focus on both students and learning for assessment to influence the learning process. To describe the centrality of assessment to learning within a social constructivist environment, attention will be given to assessment vocabulary, including the key features of

assessment, as well as the importance of assessment within the 21st-century higher education (HE) context.

2.3.1 Assessment nomenclature

With the theoretical perspectives on learning as backdrop, and with 21st-century HE assessment ahead, it is vital to have conceptual knowledge of assessment (i.e. forms and types of assessment). Figure 2-4 aims to clarify possible confusion caused by using assessment terminology and will be discussed in the sections that follow (2.3.1.1 to 2.3.1.5).

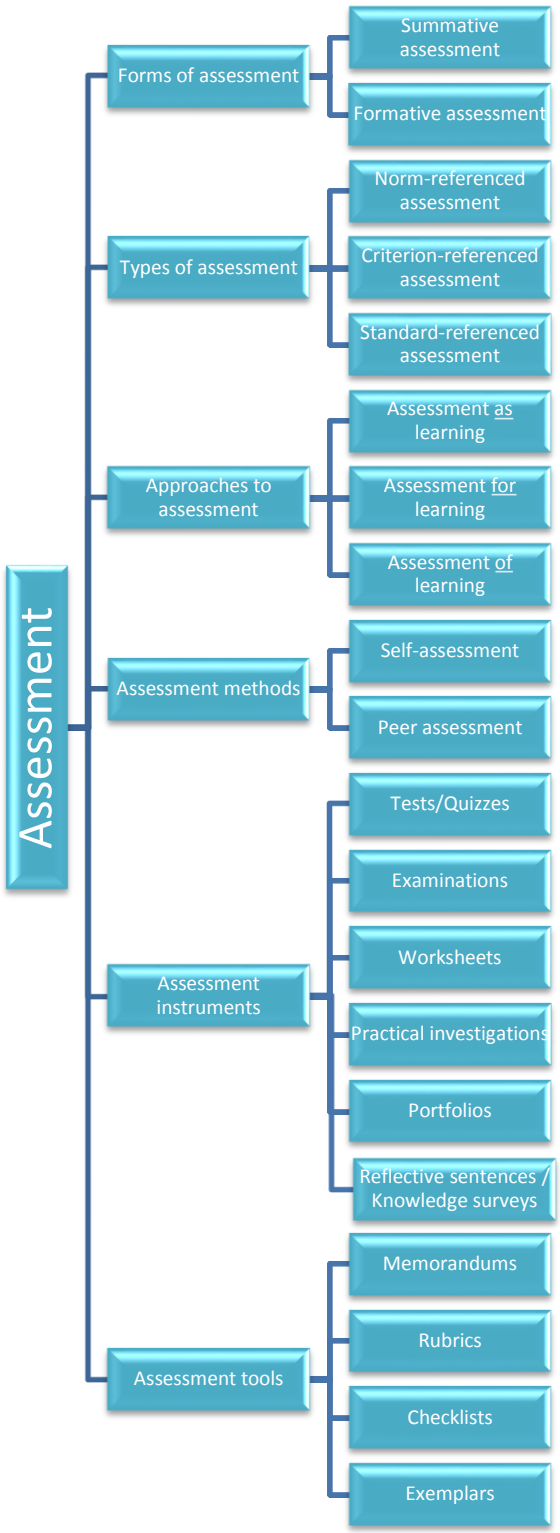


Figure 2-4: Assessment nomenclature mind map

Source: Based on Chapman and King (2013); Carless (2015a); Earl (2013); Falchikov (2005); Mok (2009); Reddy et al. (2015); Wiliam (2011)

2.3.1.1 Forms of assessment

Forms of assessment is used to describe the function that evidence from the assessment serves, rather than the assessment itself (Wiliam, 2011), and can be carried out by educators and students. Formative assessment and summative assessment are forms of assessment, and much has been documented with regard to the purpose of assessment (Barak, 2014, 2017; Boud & Falchikov, 2007; Carless, 2015; Earl, 2013; Falchikov, 2005; Gibbs & Simpson, 2004; Hodges et al., 2014; Quesada-Serra et al., 2016; Slavin, 2012; Tang & Logonnathan, 2015).

Although assessment has existed for centuries, it was not until the turn of the 20th century that the education sector became important social institutions, and assessment of student achievement, as we know it, became an element of education (Earl, 2013). By the mid-20th century, there was considerable pressure to prevent decisions about access to advanced education being based on social status instead of on merit. Tests and examinations were therefore used to rank students in a way that was accepted as fair and satisfying by society (Earl, 2013). Since assessment informs students about what is valued and needed for achieving success in their studies, assessment indubitably captures students' attention and study time (Carless, 2015; Kvale, 2007). Carless (2015a) furthermore states that supporting student learning, judging the quality of student achievement, as well as satisfying accountability demands, are three key functions of assessment. Assessment is commonly used to improve student learning and to establish how much information a student has retained after a learning sequence (Dixon & Worrell, 2016). Therefore, it is evident that the way in which students' results – obtained from assessment tasks – can be used for either formative or summative purposes.

According to Falchikov (2005), the use of formative and summative assessment tasks is influenced by the way in which educators plan on using the results obtained (Bennett, 2011; Dixon & Worrell, 2016; Hassan, 2011; Wiliam, 2011). Table 2.1 explains the characteristics of both formative and summative assessment and will be briefly elaborated upon.

Table 2-1: Characteristics of formative and summative assessments

Characteristic	Formative assessment	Summative assessment
Purpose	To improve teaching and learning To diagnose student difficulties	Evaluation of learning outcomes Placement, promotion decisions
Formality	Usually informal	Usually formal
Timing of administration	Ongoing, before and during instruction	Cumulative, after instruction
Level of stakes	Low stakes	High stakes
Psychometric rigour	Low to high	Moderate to high
Types of questions asked	What is working? What needs to be improved? How can it be improved?	Does student understand the material? Is the student prepared for next level of activity?
Examples	Observations Homework Question and answer sessions Self-evaluations Reflections on performance Curriculum-based measures	Projects Performance assessments Portfolios Papers In-class examinations National tests

Source: Adapted from Dixon and Worrell (2016, p. 154)

"Activities undertaken by teachers – and by their students in assessing themselves – that provide feedback to modify teaching and learning activities" is the definition given by Black and Wiliam (2010, p. 82) for formative assessment. Furthermore, formative assessment is a process (Box, Skoog, & Dabbs, 2015), which not only provides ongoing information for educators to adjust instruction but which is also used to develop appropriate interventions to improve student learning (Dixon & Worrell, 2016; Falchikov, 2005). Therefore, formative assessment is said to focus not only on assessing students' understanding, but also on teaching effectiveness (Dixon & Worrell, 2016). Formative assessment is usually low stakes, can be implemented before and during instruction with the purpose of providing feedback (Van der Kleij, Vermeulen, Schildkamp, & Eggen, 2015), and involves both the educator and the student (Box et al., 2016). Furthermore, formative assessment practices, which focus on the enhancement of students' learning, have been identified to improve academic performance (Quesada-Serra et al., 2016). According to Wiliam (2011:43), formative assessment can be defined as follows:

> *An assessment functions formatively to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers to make decisions about the*

> *next steps in instruction that are likely to be better, or better founded, than the decisions they would have made in the absence of that evidence.*

Wiliam (2011), building on the earlier work of Leahy, Lyon, Thompson, and Wiliam (2005), identifies five key strategies of formative assessment. According to Wiliam (2011), finding out where students are in their learning, where students are going, and how students should get there, are the three key processes to which teaching boils down. Furthermore, Wiliam (2011) states that the three individuals involved in the teaching process are the educator, the peer and the student. Crossing the three identified assessment processes with the different agents involved in formative assessment, gives rise to five key strategies of formative assessment (Wiliam, 2011).

Clarifying, sharing, and understanding learning intentions and success criteria is the first identified key strategy, and involves the educator, the peer and the student. This can be accomplished through, for example, the following techniques (Wiliam, 2011):

- Have students look at samples of other students' work – after students had identified the strengths and weaknesses of the samples, they can engage in a discussion.
- Providing students with rubrics – this could help the students to develop a knack for quality.
- Co-construction of learning intentions – educators can develop learning intentions or success criteria with the students – this will enable students to discuss and develop their own learning intentions and success criteria.
- Samples of quality student work can also be used to exemplify outstanding work in a concrete way through engaging feedback.
- Have students design test items with a memorandum about the work they have been learning – this will enable students to clarify, share and understand learning intentions, as well as to be informed regarding their own level of understanding (Wiliam, 2011).

Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding refers to the necessity for determining where the students are in their own learning. It is important that educators acknowledge that their students do not necessarily learn what the educators intend, and therefore exploring the students' thinking before assuming that they understood something, is vital. Aspects such as student engagement through questioning, waiting time after posing questions, and practicing evaluative and interpretive listening are, amongst others, techniques that can be implemented by educators. Careful planning and thoughtful application of innovative techniques will enable the educator

to have a more engaging classroom, which will assist the educator to make quick and effective instructional adjustments in order to adhere to the learning needs of all students in the class.

Providing feedback that moves learners forward highlights the fact that feedback has a formative function only when the information which is fed back to the students is used by the students to improve their performance. Feedback can be regarded as a recipe for future action and should cause cognitive reactions as opposed to emotional reactions. Feedback should be focused, relate to the learning intentions, and be more work-heavy for the receiver than the giver (Wiliam, 2011).

Activating students as instructional resources for one another links to cooperative learning. When activating students as learning resources for their peers, student learning is increased. Peer assessment is not only beneficial to the student receiving the feedback, but also to the student who provides help. Techniques that can be implemented in the activation of students as resources include peer evaluation of homework, end-of-topic questions, error classification, and group-based test preparation (Wiliam, 2011).

Activating students as the owners of their own learning could lead to astonishing improvements in student achievement, because students learn better when they manage their learning better. Learning logs and learning portfolios, amongst others, are techniques that can be used by educators to develop the skill of critical reflection of one's own learning (Wiliam, 2011).

Summative assessment, as opposed to formative assessment, is defined as "cumulative assessments … that intent to capture what a student has learned, or the quality of the learning, and judge performance against some standards" (National Research Council, 2001, p. 25). Summative assessment is usually high stakes and is used as a final assessment to assess how much learning took place (Gardner, 2010). Because summative assessment tasks occur at the end of instruction, these types of tasks are almost always graded (Dixon & Worrell, 2016).

According to Lau (2016), a dichotomy has unintentionally developed in assessment literature. This dichotomy portrays formative assessment as 'good' assessment and summative assessment as 'bad' assessment (Taras, 2005). 'Teaching to the test', according to Lau (2016), is a direct result of a one-sided focus on summatively assessing students by means of examinations. Lau (2016, p. 523) states that, for assessment to contribute towards students' learning, summative and formative assessment needs to relate to each other, and "assessment as a whole needs to be connected with the overall learning and teaching

environment". Furthermore, Lau (2016, p. 518) is of the opinion that students will "actively seek feedback and engage with the learning process", even if the students are engrossed by summative assessment or when the summative assessment is in line with other learning events (i.e. formative assessments).

2.3.1.2 Types of assessment

Norm-referenced, criterion-referenced and standard-referenced assessment are types of assessment (Reddy et al., 2015) and according to Killen (2017), are all ways to benchmark student performance. Norm-referenced assessment is defined as making judgements about students by comparing them to each other, and is associated with the following: the grading of students, comparing students, and averaging grades of students. According to Killen (2017), the use of *norm-referenced assessment* may lead to various assessment misconceptions, including marks matter, higher marks is better, and it is better for a student to be above the calculated average mark of the group. Attention is thus drawn to the rank-ordering of students instead of focusing on what has or has not been learned (Killen, 2017). *Criterion-referenced assessment* is viewed as making judgements about students by measuring students' work against set criteria that are independent of the work of the other students. Even if grades are awarded, students are graded in terms of whether they have satisfied the criteria set for assessment (Reddy et al., 2015). Designing criterion-referenced assessment tasks is aligned with set criteria, which are linked to grades (Lok, McNaught, & Young, 2016). *Standard-referenced assessment* is defined as the type of assessment where the assessment process is guided and directed by assessment standards (Killen, 2017) and, according to Boud and Falchikov (2007, p. 117), this type of assessment is 'teacher-driven'. Furthermore, Reddy et al. (2015) states that standard-referenced assessment fails to assess student learning.

2.3.1.3 Approaches to assessment

Assessment <u>of</u> learning, assessment <u>for</u> learning and assessment <u>as</u> learning are *approaches to assessment*.

As soon as students have to familiarise themselves with a certain body of knowledge within a specific subject area, their capacity to memorise is mostly developed (Reddy et al., 2015). Therefore, assessing the skill of recalling memorised facts, typically done at the end of a study unit, a module or a grade, is described as *assessment of learning* (AoL) (Earl, 2013; Reddy et al., 2015). According to Dixon and Worrell (2016), any assessments used to obtain an evaluation of the students' knowledge at a certain point in time, is AoL. The allocation of

grades or marks, done by the educator, is the way in which feedback is given to the students, and little guidance is given for improvement (Earl, 2013). Because tests and examinations, therefore AoL practices, control what and how students learn, many students still experience assessment as a threat (Kvale, 2007). According to Marzano (2000), there is increasing scepticism regarding the fairness and accuracy of allocating grades as an indication of how well students are learning. The reason is that several other factors are considered by educators when assigning grades – assessments are weighted differently by different educators, and educators "misinterpret single scores on assessments to represent performance on a wide range of skills and abilities" (Earl, 2013, p. 30).

Although examinations tend not to assess higher-order outcomes (Carless, 2015a), Earl (2013) and Kvale (2007) state that AoL practices still dominate higher education. Several researchers are of the opinion, however, that AoL is necessary for making important decisions that will affect students' lives and futures (Earl, 2013; Mok, 2009). Mok (2009) proposes that AoL should not only be used to establish the students' current level of achievement, but also to provide an external frame of reference on that achievement. According to Mok (2013, p. 6), "it is understandable that attention can easily focus on grades instead of learning", because in education systems where summative "assessment is mainly used for selection purposes, there are many losers and only a few winners". This type of competitive assessment leads to, among others, narrowed learning, induced stress, deteriorating quality of sleep, as well as decreased motivation for future learning (Mok, 2013).

As soon as assessment involves the gathering of data for improving the learning process of students, *assessment for learning* (AfL) takes place (Dixon & Worrell, 2016). According to Earl (2013, p. 27), AfL "shifts the emphasis from summative assessment to formative assessment, from making judgements to creating descriptions that can be used in the service of the next stage of learning". Informing educators whether additional instruction is needed, and informing students whether additional studying is needed, are at the core of AfL (Slavin, 2012).

Although AfL and formative assessment is mostly used synonymously (Earl, 2013; Dixon & Worrell, 2016), Dylan Wiliam (2011) and Rick Stiggins (2005) differentiate between AfL and formative assessment. Stiggins (2005, p. 1–2) explain:

> *If formative assessment is about more frequent, assessment FOR learning is about continuous. If formative assessment is about providing teachers with evidence, assessment FOR learning is about informing the students themselves. If formative assessment tells users who is and who is not meeting state standards, assessment FOR learning tells them what progress each student is making toward meeting each standard while the learning is happening – when there's still time to be helpful.*

Bennett (2011) is of opinion that the definitional issue of formative assessment and AfL is clouded even further when one term is simply replaced by the other. Wiliam (2011) reminds us that the literal meaning of the word 'formative' implies that instruction is shaped trough formative assessment, describing the function the assessment serves.

For the purpose of this study, however, and because of the context of this study, assessment for learning serves the same function as described by Pat-El, Tillema, Segers, and Vedder (2015), namely providing students with the scaffolding needed for learning how to progress from their current level of achievement to the next level; and supporting educators in adapting their teaching, based on the assessment information gathered from the students. Assessment for learning within the context of the current study, therefore, refers to assessment practices that monitor the progress of the student toward a set goal, and seeks to close the gap between a student's current status and the desired outcome (Clark, 2012).

Because learning-oriented assessment (LOA) refers to the idea that all assessment ought to support the advancement of student learning (Carless, 2015a), LOA can easily be justified as being a practice within the AfL approach. Sambell, McDowell and Montgomery (2013) state that LOA is an alternative name for AfL, and the key elements of LOA will be elaborated upon in the subsection directly following.

Learning-oriented assessment (LOA)

The development of LOA was due to the observation that summative assessment was heavily weighted and that there is a need for the development and implementation of assessment practices that focused on learning (Carless, Joughin & Mok, 2006; Carless, 2014, 2015a). The LOA framework stipulates the integration between the three key drivers of LOA: LOA tasks, developing evaluative expertise, and student engagement with feedback (Carless, 2015b, p. 965).

LOA tasks are placed at the top of the LOA framework pyramid because assessment tasks direct the effort of the students (Carless, 2015a). Carless (2015a, p. 27) suggests several principles for design and implementation of LOA tasks (see Table 2.2). Vanderlelie and Alexander (2016) report on research done after redesigning the assessment they used. Greater emphasis was placed on formative assessment and the use of the online learning environment, while drawing from assessment for learning and LOA. The authors concluded that the performance of students was significantly improved by the redevelopment of the assessment strategy (Vanderlelie & Alexander, 2016). In a study by Van Staden (2016), the LOA framework was used to develop an electronic portfolio. Van Staden (2016) also highlights the importance of the development of LOA tasks.

Evaluative expertise is the second key element of LOA and refers to the ability of students to not only evaluate their own work, but also their peers' work (Carless, 2015a). Carless (2015a) highlights the fact that students will not be able to improve their performance unless they know what quality performance encompasses. When students have the opportunity to generate, analyse and apply criteria, they are engaged with quality, and will therefore be able to develop evaluative expertise. Analysing and discussing exemplars of quality work, being involved in peer dialogue, and being encouraged to take responsibility for self-assessing work in progress, could all lead to the development of students' evaluative expertise (Carless, 2015; Wiliam, 2011). Because task design influences the development of students' evaluative expertise, the quality of the assessment task will directly influence the ability to develop evaluative expertise.

Table 2-2: Principles for design and implementation of LOA tasks

Principle	Implications
Promoting deep student approaches to learning and facilitating the development of appropriate learning outcomes.	Tasks that are well designed are likely to capture students' study time and effort, as well as encourage students to spend time studying outside of class meetings and hence take a deep approach to learning. Task design should be approached from a programme-wide perspective.
Balancing the formative and summative aspects to enable all assessment to be learning-oriented.	Encouraging a variety of assessment tasks may encourage student motivation. The use of portfolios provides the possibility for the useful merging of formative and summative assessment.
Spreading student effort and intellectual engagement evenly through a module.	Tasks should be designed to distribute student effort evenly across the topics and weeks of the module. The inclusion of multiple tasks distributes intellectual engagement evenly over a module.
Supporting the development of ways of understanding the nature of quality in the discipline.	Student metacognition is developed by providing students with the opportunity to engage with (and even developing) criteria, standards and exemplars of quality work. Peer dialogues can assist students in engaging with quality.
Involving some personal student investment or choice.	Choice can give students a greater sense of ownership, and summative assessment should give space to individuality.
Facilitating dialogic forms of feedback.	Feedback should be timely, interactive and of good quality. Constructive criticism can open up possibilities for students to advance in their work. At the heart of good feedback practice is the development of students' self-evaluative capacities. Feedback should be embedded within assessment practices.

Source: Adapted from Carless (2015, p. 27)

Student engagement with useful feedback is the third element of LOA and is strongly interlinked with the development of evaluative expertise and influenced by the assessment task (see Figure 2.5). Unless students have some conception of what quality looks like, they will not be able to use the provided feedback (Carless, 2015a). It is important to note that feedback will have a limited influence on learning if students are not engaged with and acting on the provided feedback (Carless, 2015a). As soon as feedback is integrated with classroom activities, feedback is more engaging and interacting as opposed to feedback provided after the completion of an assessment task (Carless, 2015a).

According to Earl (2013), *assessment as learning* (AaL) is an extension of AfL. Self-assessment, self-monitoring, self-regulation and metacognition are at the heart of AaL (Earl, 2013). Furthermore, AaL requires students to be active participants in their own learning and assessment (Reddy et al., 2015). The participative role that students play within AaL practices does not imply the absence or uninvolved role of educators. The roles that educators need to play in promoting the development of independent students through AaL, according to Earl and Katz (2006, p. 41), are:

- "modelling and teaching the skills of self-assessment;
- guiding students in setting goals and monitoring their progress toward them;
- providing exemplars and models of good practice and quality work that reflect curriculum outcomes;
- working with students in developing clear criteria of good practice;
- guiding students in developing internal feedback or self-monitoring mechanisms;
- providing regular and challenging opportunities to practice so that students can become confident, competent self-assessors;
- monitoring students' metacognitive processes as well as their learning;
- providing descriptive feedback; and
- creating an environment where it is safe for students to take chances and were support is readily available".

Participative assessment (e.g. peer and self-assessment) not only promotes active learning (Quesada-Serra, Rodriguez-Gomez & Ibarra-Saiz, 2016), but also empowers students to develop into lifelong learners and assessors (Boud & Falchikov, 2007). Enabling students to learn how to give and receive criticism (Topping, 1998), improving negotiation and diplomacy skills (Lopez-Pastor & Sicilia-Camacho, 2017), developing critical thinking (Hanrahan & Isaacs, 2001), as well as taking responsibility for their own learning (Ljungman & Silén, 2008) are recorded benefits of participative assessment practices. According to Ferris and Hedgcock (2014, as cited in Lam, 2015, p. 1906), students within an AaL context not only "become more

self-directed in the learning process, but they also develop a better understanding of learning goals, assessment criteria, and quantitative and qualitative feedback that assists them to plan for future learning". Feedback contributing to the metacognition of students is typically regarded as AaL (Mok, 2013).

Mok (2013) conceptualises and describes self-directed learning-oriented assessment (SLOA) as assessment practices that are not only learning-oriented (adhering to the criteria of AfL) but is also aimed at cultivating students' SDL (see Figure 2-5). Although SLOA consists of an integration of AoL, AfL and AaL (Mok, 2013), SLOA will be discussed next since core aspects of AaL (i.e. self-assessment, self-monitoring, metacognition and self-regulation) (Earl, 2013) are also seen as characteristics vital for a learner to be self-directed (see section 2.6).

Self-directed learning-oriented assessment (SLOA)

SLOA draws from LOA, feedback, metacognition, motivation, as well as SDL (Mok, 2013).

As previously discussed (see Figure 2-5), LOA has the following three principles at its core, namely assessment should –

- be constructed as learning tasks;
- engage students in peer and self-assessment; and
- include feedback to be used to support current and future learning (Carless, 2015; Mok, 2009).

According to Mok (2009, p. 5), the "extension of LOA to SLOA concerns the self-directed component".

Malcolm Knowles (1975, p. 18) defined SDL as:

> *[A] process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes.*

Because research has indicated that students who are self-directed are also higher achievers, and because new knowledge is created at a rapid pace, SDL is significant within the 21st century (Mok, 2009).

Metacognition not only refers to "thinking about thinking" (Flavell, 1976, p. 232), but is also characterised by the following two distinct components:

- metacognitive knowledge, which includes factual knowledge (knowing what), contextual knowledge (knowing when and why), as well as procedural knowledge (knowing how); and

- self-regulation of cognition.

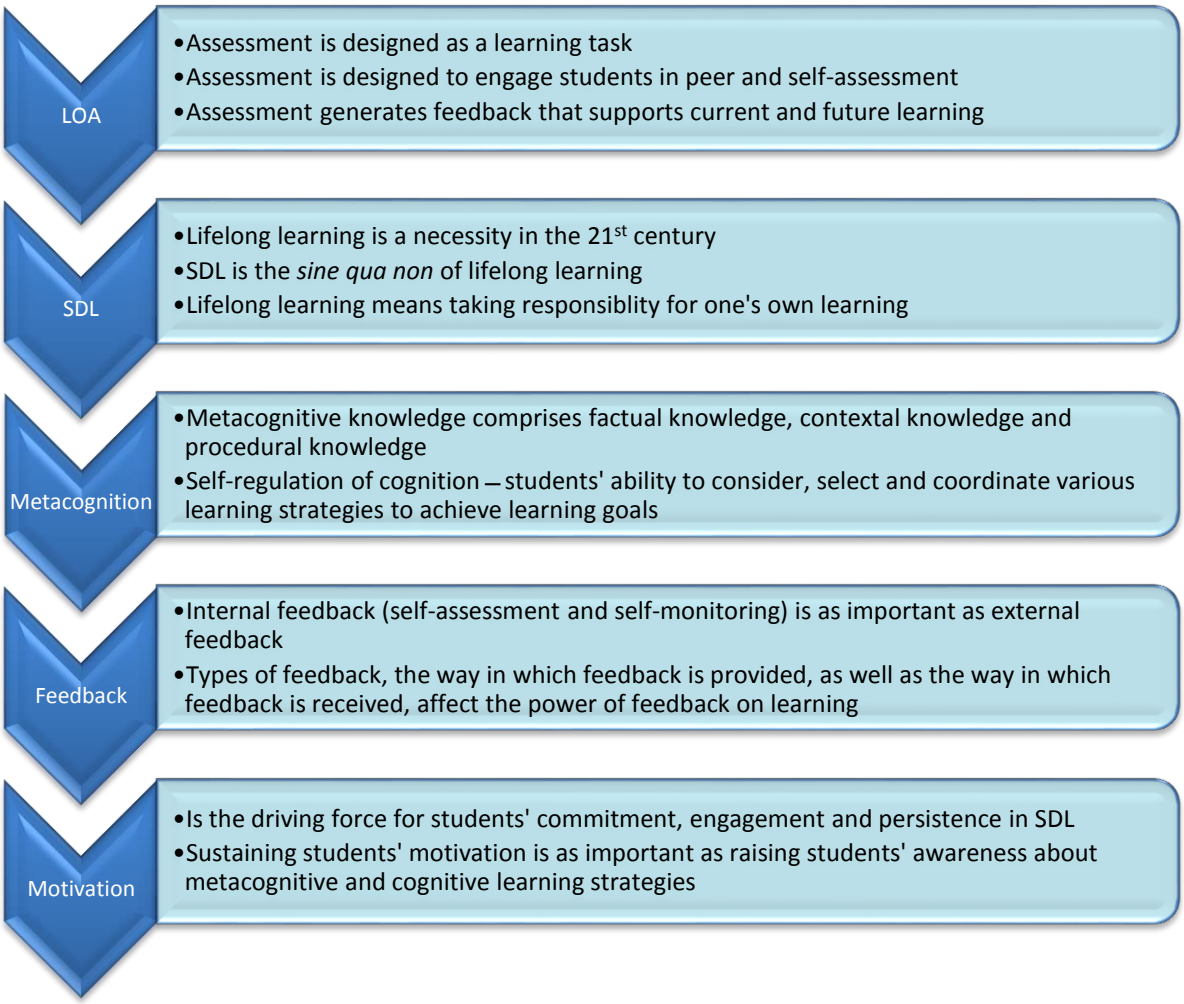


Figure 2-5: Theoretical underpinnings of SLOA

Source Adapted from Mok (2009, p. 7–11)

Self-regulation of cognition entails the monitoring and control of thought processes whilst working on a learning task, which includes the setting of learning goals, planning ahead, monitoring one's progress, assessing and evaluating the effectiveness of the selected learning strategies, which will lead to revising selected strategies (Mok, 2009).

Feedback is an important aspect of efficient learning (Kvale, 2007), and within the SLOA framework, the generation of quality feedback through specifically designed assessment tasks is a prominent feature of SLOA (Mok, 2009). Hattie and Temperley (2007) state that the types of feedback, the way in which feedback is provided, as well as the way in which the feedback is received, affect the power of feedback on the learning process. Therefore, within the SLOA framework, attention is given to external feedback (provided by educators and peers) as well

as internal feedback (self-monitoring and self-assessment procedures) to cultivate SDL capacities by means of quality feedback (Mok, 2009).

Because motivation is identified to be the driving force behind students' commitment, engagement and persistence in SDL (Shraw, Crippen, & Hartley, 2006), sustaining students' motivation is as important as raising students' awareness about metacognitive and cognitive learning strategies (Mok, 2009).

The SLOA framework consists of the following three integrated components: AoL, AfL and AaL (Mok, 2009).

The **AoL** component of SLOA aims to take up an augmentative role for AfL, as the information gathered is used to identify longer-term goals, as well as to determine whether there is a gap between the students' current achievement and their targeted goals. Mok (2009) is also of opinion that AoL will help students to develop metacognitive skills, and therefore AoL will help to support AaL.

The **AfL** component is central to the SLOA framework and engages students in sharing criteria for successful learning. Furthermore, feedback is generated by addressing the following three important questions in learning (Mok, 2009, p. 15–16):

- What is the desired learning goal? What do we want to achieve?
- Where are we in the learning process?
- Is there a gap between the desired learning goal and the current achievement?

Because AfL can be time-consuming, as much time is spent on closing the gap between desired goals and current achievements, AfL is more effective when instruction is within the students' ZPD (Mok, 2009; Vygotsky, 1978). The SLOA makes use of the Rasch analysis, the Student-Problem Chart, as well as Sato's Modified Caution Index to generate information to support instruction (see Mok, 2009). The mentioned strategies were not utilised within the context of the current investigation and are therefore not discussed further.

The **AaL** component of the SLOA framework "conceptualises assessment *as* learning as the engenderment of students into self-directed learners through reflecting on evidence of learning generated from assessment activities" (Mok, 2009, p. 26). Each student is enabled to take responsibility for their own learning. The capacity for setting goals, self-monitoring of learning progress, peer and self-assessment, intrinsic motivation as well as self-regulation and change for the enhancement of further learning, are cultivated by AaL.

2.3.1.4 Assessment methods

'Assessment methods' are defined as "the types of tasks which students are undertaking" (Carless, 2015, p. 47). Assessment methods are also referred to as assessment strategies (Chapman & King, 2013), and are defined as an umbrella term for activities, skills and tools of assessment. Examples of assessment methods include peer, self- and co-assessment. Each of these participative assessment methods will be discussed in terms of their characteristics and value towards successful learning within a social-constructivist environment.

According to Quesada-Serra et al. (2016, p. 49), participative assessment methods have been proved to:

- enable students to become lifelong learners and assessors (Boud & Falchikov, 2007);
- promote active learning (Quesada-Serra, 2016);
- improve negotiation and diplomacy skills (López-Pastor, & Sicilia-Camacho, 2009);
- develop critical thinking (Hanrahan & Isaacs, 2001);
- develop self-regulation skills (Nicol & Macfarlane-Dick, 2006);
- take responsibility for their own learning (Ljungman & Silén, 2008); and
- have a positive effect on students' overall performance and achievement (Sluijsmans, 2002).

Self-assessment, according to Harris and Brown (2013), comprises monitoring and reflecting on one's own learning processes and may include descriptions (e.g. characteristics of one's work) as well as evaluation (i.e. of how good one's work is) (Brown, Andrade, & Chen, 2015), and involves and encourages reflection (although not all reflection leads to self-assessment) (Nicol & Macfarlane-Dick, 2006; Tee & Ahmed, 2014). According to Planas-Lladó et al. (2018), the implementation of peer assessment, self-assessment and co-assessment in HE has been slow and experimental. Benefits include the development of a variety of skills (Lindblom-Ylänne, Pihlajamäki, & Kotkas, 2006), enhancing student participation and autonomy, as well as students taking responsibility for their learning (Planas-Lladó et al., 2018), improved motivation, deeper understanding of content, improved quality of learning, and increased capacity for critical analysis. According to Sadler (2013), for students to develop and become capable and self-confident in self-assessment, they need practice self-assessment independently of peers and educators. The role of the educator is to "teach students how to judge quality and modify their own work during production" (Sadler 2013, p. 55). According to Kvale (2007), peer assessment is difficult to implement when the main selection function of assessment relies on competition between students. According to Nicol and Macfarlane-Dick (2006), peer assessment provides students with the opportunity to make objective judgements

against standards and to engage in the evaluation of others' work. As a result, peer assessment supports the development of self-reflection skills. Furthermore, it is suggested that peer assessment is one way of letting students take charge of their own development and learning, since students may learn from giving and receiving feedback (Nicol et al., 2014).

2.3.1.5 Assessment instruments

An 'assessment instrument' is a formal or informal instrument used to identify the student's knowledge level of the standard, skill or concept (e.g. a reflective sentence) and is also referred to as 'assessment tasks' (Chapman & King, 2013). Tests, quizzes, examinations, practical investigations, worksheets, portfolios and knowledge surveys are some of the assessment instruments used in higher education. A detailed overview of assessment instruments as well as advantages and disadvantages thereof was beyond the scope of the current study. However, it is noteworthy that assessment instruments can be used for both formative and summative purposes, and hence the design of assessment instruments within SCT will depend on the purpose of the instruments.

2.3.1.6 Assessment tools

'Assessment tools' refer to the tools used in conjunction with the assessment instruments, and comprise memorandums, rubrics, checklists and exemplars. Assessment tools are also referred to as 'marking guides' and students should be given access to it before attempting to start with the assessment (Killen, 2017). According to Killen (2017), students should know in advance what the educator would be checking for or what the difference between high- and low-quality work is, and therefore exemplars are included as an assessment tool. The use of exemplars is said to develop student meta-cognition whilst clarifying expectations (Carless, 2015a).

2.4 Role of feedback in assessment

According to Evans (2013, p. 71), feedback can be defined as "all feedback exchanges generated within assessment design, occurring within and beyond the immediate learning context, being overt or covert (actively and/or passively sought and/or received), and importantly, drawing from a range of sources". According to Rowe, Fitness, and Wood (2014), the purposes of feedback (e.g. grading, motivation and communicating praise) fall under two broad functions, namely evaluation and supporting student learning. A phenomenographic investigation, conducted by McLean, Bond, and Nicholson (2015), indicated that undergraduate students conceptualise feedback as telling, guiding, developing understanding, as well as opening different perspectives.

Mulliner and Tucker (2015) highlight the extensive body of research relating to feedback in the HE context, as well as the effect it has on student learning, yet Ajjawi and Boud (2017, p. 252) state, "effective feedback practices are the subject of great concern". According to Merry et al. (2013), feedback is constantly branded by students as the least satisfactory aspect of their HE learning experience. This is alarming since 21st-century HE practices are moving towards student-centred approaches to learning (Ondrashek, 2017) and assessment (Boud, 2007). Therefore, feedback within the social-constructivist environment is not seen as information transmission, which positions the students as passive receivers (Ajjawi & Boud, 2017), but rather as being facilitative (Evans, 2013), descriptive, specific, constructive, challenging, and non-judgemental (Thurlings et al., 2013). Table 2-3 below aims to outline the characteristics which feedback practices must encompass to be deemed effective.

Table 2-3: Characteristics of effective feedback

Effective feedback –
… is appropriate (Mory, 2004);
… is detailed and specific (Poulus & Mahony, 2008);
… accelerates learning; … optimises the quality of what is learned; … raises individual and collective achievement (Hounsell, 2007);
… is perceived to be personal to the student (Ferguson, 2011);
… is encouraging, motivational and constructive (Nicol & Macfarlane-Dick, 2006);
… is legible (Price et al., 2010);
… is prompt and timely; … is of a high quality (Gibbs & Simpson, 2004);
… feeds forward (Glover & Brown, 2006; Carless, 2015);
… involves ongoing dialogue (Carless, 2015; Merry et al., 2013);
… helps clarify goals, criteria and expected standards; … facilitates the development of self-assessment in learning; … delivers high-quality information to students regarding their learning; … encourages educator–peer dialogue regarding learning; … encourages positive motivational beliefs and self-esteem; … provides the opportunity to close the gap between current and desired performance; … provides information to educators that can be used to help shape instruction (Nicol & Macfarlane-Dick, 2006);
… is meaningful, understood and correctly acted upon (Orsmond, Merry, & Reiling, 2005); and
… is used to improve student learning actively (Boud & Associates, 2010).

Source: Author's own compilation based on Mulliner and Tucker (2015)

Despite the clearly outlined characteristics needed for feedback to be effective in supporting student learning, feedback remains primarily a post-submission summative event (Beaumont, O'Doherty, & Shannon, 2011) during which corrective information is provided by experts to passive recipients (Evans, 2013). Furthermore, Boud (2015) states that feedback encompasses much more than simply giving information to students regarding their work, and that the real challenge is engaging students with feedback to bring about noticeable change. Both action without feedback and feedback without action are equally unproductive (Winstone et al., 2017) and therefore student participation and action are necessary for learning gains to occur through feedback (Delva et al., 2013).

The giving and receiving of feedback comprise a two-way communicative process through which the recipient of the feedback deciphers, interprets and responds to the received feedback (Winstone et al., 2017). When the responsibility of the giver (e.g. educator) and receiver (e.g. student) is not shared, and when educators place the responsibility of using assessment feedback primarily on the students (Hernández, 2012), effective implementation of assessment feedback cannot occur (Winstone et al., 2017). Carless (2009) states that, for the receiver of feedback to invest the required time and effort to act upon the feedback received, trust must be built between the giver and the receiver of such feedback. Barker and Pinard (2014) also state that the success of feedback in higher education is often subject to the extent to which both the educator and student are dedicated to the feedback process.

Winstone et al. (2017) made use of activity-oriented focus groups to establish possible barriers that prevent HE students from implementing assessment feedback effectively. The lack of students' ALit and students' passive role in feedback processes are, amongst others, identified as possible barriers to using assessment feedback effectively. Contributing to the fact that feedback is not readily acted upon by students, is the fact that students may not understand the feedback provided (Carless et al., 2011) and according to Mulliner and Tucker (2015), students cannot act on something they do not understand. Therefore, students must be empowered and trained to recognise, understand, interpret (Poulous & Mahony, 2008; Blair & McGinty, 2013) and value feedback (Boud, 2015). Furthermore, students ignore feedback when it is perceived as being too late (Beaumont, O'Doherty, & Shannon, 2011), badly timed or unhelpful (Urquhart, Rees, & Ker, 2014).

Only if there is a difference between the anticipated and actual marks, according to Nesbit and Burton (2006) and Duncan (2007), will students probably take note of feedback. According to research findings from a study done by Beaumont, O'Doherty, and Shannon (2011, p. 674), quality feedback from students' perspective is perceived as "summative judgements of

performance" and as "support through opportunities form a discussion which identifies areas of improvement and scaffolds the student to help achieve higher grades".

A detailed thematic literature review of assessment feedback in higher education leads to the principles for effective feedback being grouped under the following sub-headings:

- "feedback is ongoing and an integral part of assessment;
- assessment feedback guidance is explicit;
- greater emphasis is placed on feed-forward compared to feedback activities;
- students are engaged in and with the feedback process;
- the technicalities of feedback are attended to in order to support learning; and
- training in assessment feedback/forward is an integral part of assessment design" (Evans, 2013, p. 80–83).

Carless (2015a) furthermore suggests embedding in-class dialogic feedback within teaching and learning, especially with first-year students.

Hattie and Timperley (2007, p.98) conceptualised a model of feedback to enhance learning and uses the model to address the following four issues regarding feedback: "the timing of feedback, the effects of positive and negative feedback, the optimal classroom use of feedback, and the role of assessment in feedback". Reducing possible differences between existing understanding or achievement and the desired outcome is, according to Hattie and Timperley (2007), the main purpose of feedback. These differences may be reduced by students and educators and should result in effective feedback.

Effective feedback answers three questions, namely: *Where am I going*? *How am I doing*? and *Where to next*? "The answers to these questions enhance learning when there is a discrepancy between what is understood and what is aimed to be understood" (Hattie & Timperley, 2007, p. 102). According to Hattie and Timperley (2007, p. 87), each of the feedback questions works at the following four levels: "task level, process level, self-regulation level, and self-level".

Task-focused feedback emphasises how well a task has been performed and can occur within individual and group settings. Process-focused feedback is more specific to the underlying processes of tasks and is effective for enhancing students' deeper learning. Asking a student to explain to a peer is process-focused feedback (Boud, 2015). Depending on a student's level of self-directedness, such student will rely either on internally generated feedback while he or she is busy with an academic task or will be more dependent on the educator for feedback.

This level of feedback, through which questions are asked rather than information given, is described by Hattie and Timperley (2007) as feedback at self-regulation level.

Personal feedback or self-focused feedback is directed at personal attributes, and is "unlikely to be effective, because it carries little information that provides answers to any of the three questions and too often deflects attention from the task" (Hattie & Timperley, 2007, p. 96). When making use of their model, Hattie and Timperley (2007) attempt to unravel the following feedback issues:

Promptness of feedback – immediate feedback is likely to be more effective at task level, whilst delayed feedback is more likely to provide an opportunity for students to involve greater degrees of processing about a complex task (Winstone & Boud, 2019).

The effects of positive and negative feedback – whilst negative and positive feedback are said to have beneficial effects on students' learning, the level at which the feedback is focused is more vital than the nature of the feedback. Negative feedback might be more effective at self-level while both positive and negative feedback can be effective at task level.

Feedback and classrooms – after educators have started with effective instruction, feedback happens next. For effective feedback, educators "need to make appropriate judgements about when, how, and at what level to provide appropriate feedback and to which of the three questions it should be addressed" (Hattie & Timperley, p. 100).

Feedback and assessment – assessment can be activities that offer feedback information relating to one or more of the three feedback questions (at the first three feedback levels) to educators and/or students.

From a social-constructivist perspective, feedback should not only be dialogic (Ajjawi & Boud, 2017), but should also assist students in developing their own ability to monitor, evaluate and regulate their learning (Nicol, 2010; Price et al., 2010). Feedback, therefore, is not an input or a product of assessment, but rather a social act with an ongoing relationship between educator and student (Ajjawi & Boud, 2017). The centrality of the student's role within the feedback process is highlighted by Carless and Boud (2018) by defining feedback as a process through which students "make sense of information from various sources and use it to enhance their own work or learning strategies" (p. 1315).

Carless and Boud (2018) further state that the enhancement of feedback processes relies on the development of students' feedback literacy. Feedback literacy, first defined by Sutton (2012), is described by Carless and Boud (2018, p. 1316) as "the understandings, capacities

and dispositions needed to make sense of information and use it to enhance work or learning strategies". The authors identified four features of feedback literacy, namely "appreciating feedback, making judgements, managing affect, and taking action" (Carless & Boud, 2018, p. 1315). For students to comprehend the usefulness of feedback, O'Donovan, Rust, and Price (2016, p. 5–8) suggest various practical methods, which can be implemented, and which include the following:

Draft-plus-rework – students can be required to submit a first draft, which receives feedback, following a resubmission of the assignment in the light of the feedback received (Price et al., 2012). The feedback on the first draft does not necessarily have to be provided by the educator but can also be done through peer assessment practices.

Increasing student engagement and understanding through dialogue and 'relational feedback' – within the social constructivist approach to teaching, learning and assessment, student engagement can be enhanced through discussing exemplars and peer assessment. Sadler (2013) concurs when stating that peer assessment improves the understanding students have regarding feedback.

Ensuring feedback is timely – various examples exist on ways in which prompt feedback can be achieved, including the use of exemplars as well as giving generic feedback to students.

Considering the role of marks – marks may obscure feedback and hinder learning.

Reducing the overemphasis on written feedback – face-to-face oral feedback could potentially be more effective than written feedback. O'Donovan et al. (2016) recommends educators assess laboratory reports in a one-to-one manner with students before the students leave the laboratory.

O'Donovan et al. (2016) state that failing to prepare students to know how to deal with the feedback they receive, will result in students not being able to engage actively in the feedback. Aligning all stakeholders' expectations regarding the purpose of feedback provided, identifying all available feedback (e.g. informal communication between an educator and a student during class), modelling the application of feedback (e.g. making use of previously assessment assignments to indicate the way in which one was used to improve a later assignment), encouraging the application of feedback (e.g. requiring students to indicate how they utilised prior feedback to improve a subsequent assessment task), as well as developing students' self-assessment abilities, are ways in which students can be engaged in effective feedback (O'Donovan et al., 2016).

Resolving the feedback dilemma, according to O'Donovan et al. (2016), might be further enhanced by developing ALit of students (and educators). A closer look at the conceptual clarification of ALit, as well as a detailed discussion on aspects thereof, is dealt with in the sections below.

2.5 Assessment literacy

In the following sections of this chapter, the conceptual clarification (see section 2.5.1), ALit of both educators and students (see sections 2.5.2 and 2.5.3), as well as measuring one's ALit (see sections 2.5.4) are discussed.

2.5.1 Conceptual clarification

According to Stiggins (1991, p. 535), assessment literates are individuals who "have a basic understanding of the meaning of high- and low-quality assessment and are able to apply that knowledge to various measures of assessment". Popham (2011) defines ALit as a person's understanding of the essential assessment concepts and techniques, which will likely influence educational decisions, and Price et al. (2012) believe that ALit involves:

- appreciating the relationship between assessment and learning;
- a conceptual understanding of assessment;
- understanding the essence of assessment criteria and standards;
- being skilful in peer and self-assessment;
- being familiar with the methodological aspects of assessment; and
- being able to choose and apply suitable assessment methods and practises.

According to DeLuca, LaPointe-McEwan, and Luhanga (2016, p. 251), "ALit is a core professional requirement across educational systems". Furthermore, assessment is at the core of the student experience and has a predominant influence on student learning; therefore, simply telling students what matters in assessment is not likely to be effective (Price et al., 2012). Willis, Adie and Klenowski (2013, p. 242) states that ALit "is a dynamic context-dependent social practice that involves teachers articulating and negotiating classroom and cultural knowledge with one another and with learners, in the initiation, development and practice of assessment to achieve the learning goals of students". A more contemporary view of assessment literacy encapsulates the socially negotiated structure thereof (DeLuca et al., 2016; Looney, Cumming, Van der Kleij & Harris, 2017). The need for the development of ALit as soon as possible amongst students in higher education, is highlighted by Price et al. (2012). It is important that the nature of assessment tasks is examined, and that the purpose thereof and various possible ways of responding to it, are grasped.

According to Price et al. (2012), it is important to acknowledge the important role that assessment standards (standards against which students' work will be assessed) play in ALit. When assessment standards are understood, students will be able to make judgements regarding how best to approach and produce a task for assessment and be able to undertake effective peer and self-assessment. Therefore, according to Price et al. (2012), one of the pre-requisites for ALit is a full understanding of the nature of assessment standards. Price et al. (2012) propose two interrelated models of how individuals come to know assessment standards, namely the 'matrix' and the 'cultivated community of practice' models.

The matrix consists of four quadrants, with quadrants one to three being occupied by the three approaches to how assessment standards are shared. The fourth quadrant, however, is occupied by the cultivated community of practice model. The approaches are placed in the matrix based on whether the inputs and activities involved are informal or formal, and by the degree of active student engagement. The traditional model, the explicit model and the social constructivist model are three approaches to the way assessment standards are shared (Price et al., 2012).

The **traditional model** (quadrant 1) depends on small student numbers, as well as prolonged student–staff interaction. Therefore, students come to know assessment standards gradually over time, and assessment standards are not taught explicitly to students. The major disadvantage of the traditional model is the fact that it is inapplicable to the 21st-century HE context. The reason is that larger classes limit student–staff interaction.

The **explicit model** (quadrant 2) emerged in the 1980s when classes gradually became larger and student–staff contact time started to decrease. Assessment standards and criteria are explicitly articulated in response to national concern regarding standards and reliability of marking. The explicit model also provides a systemic approach to assessment. This explicit model, however, seems to ignore tacit knowledge and experience.

The **social constructivist model** (quadrant 3) promotes active learning, enabling individuals to create their own understanding within their own personal and cognitive constructs. Therefore, tacit knowledge is developed due to the increasing use and familiarity of assessment standards. As this is a more heuristic approach, in which students are not static recipients of knowledge anymore, there is a need for more sophisticated ALit. According to Price et al. (2012), the inequality between student and staff (facilitator or educator) and the fact that students lack proactive roles led to the development of the cultivated community of practice model.

The **cultivated community of practice model** (quadrant 4) has two prerequisites (Rust et al., 2005). Firstly, all aspects of the curriculum should be aligned. This means that the learning outcomes, teaching and learning strategies, and assessment methods of the course to be assessed, should be constructively aligned. Secondly, there should be publicly stated assessment criteria, which relate to the learning outcomes of the course. Once these two prerequisites are in place, all stakeholders will be able to engage with the assessment criteria. Another important aspect of the cultivated community of practice model is that students need to engage with the feedback they receive. A clear understanding of the feedback, as well as acting on it will not only affect future learning, but also an understanding of assessment. Price et al. (2012) suggest the following ways in which to engage students in feedback:

- two-stage assignments – involving the students redrafting an assignment in the light of feedback;
- running a workshop activity after an assignment has been summatively assessed – to encourage students to consider what to do differently in the future; and
- giving generic feedback on the class performance as a whole – this will allow feedback to be given quickly, while encouraging students to identify and apply the bits of feedback applicable to their assignment.

The cultivated community of practice model involves two parallel cycles (the student and staff cycle respectively), each of which informs the other. The **student cycle** involves statement of explicit criteria, active engagement with those criteria, followed by completion and submission of the work to be assessed, and lastly active engagement with the feedback given on the submitted work. Assessment design and the development of explicit criteria comprise the first stage in the **staff cycle**. This leads to the educators discussing the criteria, which is followed by assessment guidance provided to staff. The assessment guidance to staff will enable consistent marking, moderation according to the set criteria, and the provision of feedback. Various stages of the student cycle inform stages of the staff cycle, and vice versa. For example, once students have completed an assignment or a task, it is submitted for marking and moderation. Students then actively engage with the feedback provided in terms of the quality of the work. Students' active engagement with marking and quality of the feedback should be fed back to staff for further engagement and possible changes to assessment design which, in turn, will influence the statement of explicit criteria.

Noteworthy is that the **cultivated community of practice model** of assessment not only applies to each stage of assessment processes, but also ensures active engagement from both staff and students (Price et al., 2012). The cultivated community of practice model also retains features of the other three models (traditional, explicit and social constructivist) that

are applicable to the 21st-century HE context. Like the explicit model, the cultivated community of practice model is based upon the publicly stated assessment criteria for all courses. Realising the importance of tacit knowledge, a key feature of the traditional model, is also highlighted by the cultivated community of practice model. For students to engage in tacit knowledge, they must actively use and apply standards and criteria, which is a key feature of the social constructivist model.

The cultivated community of practice model proposes:

> [I]n order to come to a full understanding of assessment standards over time, students must become engaged not only with specific tasks set by expert tutors, but also within a broad and rich community of academic practice and this, in turn, enables them to generate and lead their own activities aimed at enhancing their understanding of assessment standards" (Price et al., 2012, p. 42).

Because of the lack of causal evidence within the specific context of assessment, the cultivated community of practice model is more speculative than the explicit, traditional and social constructivist models. In practice, the cultivated community of practice model entails the planning of assessment, pre-assessment activities for students, assessment tasks and marking, as well as the post-assessment activity (Price et al., 2012), which will be discussed below.

Planning of assessment – content and delivery usually comprise the major focus when planning and implementing programmes within higher education. This may lead to negative consequences, for example fewer opportunities for providing formative feedback. Because of this, Price et al. (2012) suggest that the planning of assessment take place at programme level.

Pre-assessment activities – these include types of tasks and activities that can be used to prepare students for assessment, increase students' ALit, and improve students' learning. These tasks and activities are done prior to students undertaking assessed tasks, in order to increase students' understanding of the nature of assessment, the criteria and standards, as well as the assessment processes that will be used to assess their work. Examples of pre-assessment activities include the use of exemplars (Orsmond, Merry, & Reiling 2002), practicing the application of marking criteria (Rust, Price, & O'Donovan, 2003), making use of peer review, as well as self-assessment exercises (Bloxham & West, 2007). According to Price et al. (2012), students develop their ALit by being actively engaged with the standards and criteria. This happens using exemplars and working within a community of practice.

Assessment tasks and marking – staff and students are both aspects of assessment activity. Staff must choose the assessment tasks by taking the following aspects into consideration: student engagement, feedback loops, knowledge of their students, manageability of assessment tasks, as well as independent learning of students. A second area of staff assessment activity is the marking process. Staff must decide whether to use criterion-referenced or norm-referenced assessment, and might want to consider a community-of-practice-based approach to marking. Student assessment activity includes peer and self-assessment, both of which improve student performance (Taylor, 2011).

Post-assessment activity – during this activity, learning is enhanced via feedback. It is important to grasp the changing role of feedback from being reinforcement (according to the behaviourists) to correction (according to the cognitivists). Both approaches to learning view feedback as a product, whereas the social constructivist approach to learning views feedback as a process. Within the social constructivist approach, generating feedback is only a part of the ongoing process of engagement, reflection and action. The following figure (Figure 2-6) illustrates the process of engagement with feedback, possible reflection upon feedback, as well as possible action because of reflection.

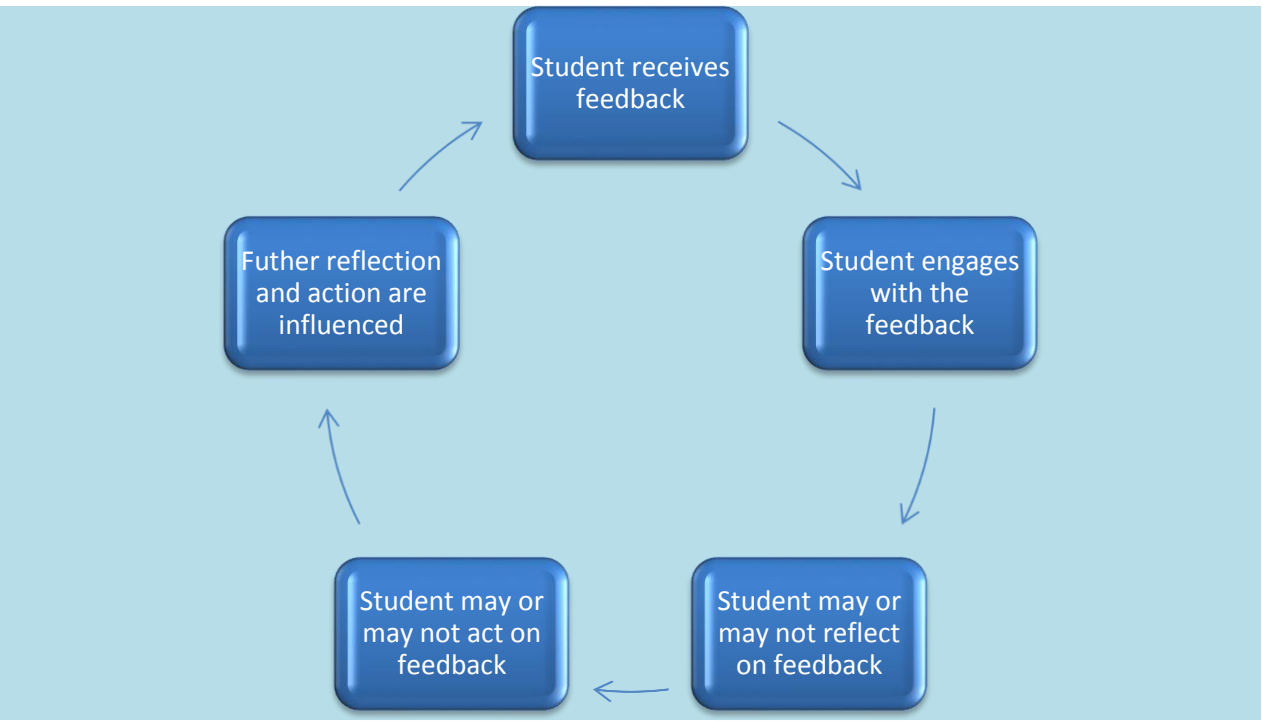


Figure 2-6: Process of engagement with, reflection upon, and action on feedback

Source: Author's own compilation

The engagement, reflection and action processes commence with the student receiving and engaging with the feedback which is received. This may or may not prompt the student to reflect on the feedback, and hence may or may not cause the student to act on the feedback. This in turn has an influence on further reflection and feedback. A student will perform more effectively and become more ALit because of engaging with feedback (Price et al., 2012).

To address the dissatisfaction with assessment, and for assessment to more effective and efficient, both students and staff need to become assessment literate (Price et al., 2012; Smith et al., 2009). Therefore, the educators' and students' ALit will be discussed in the following sections (sections 2.5.2 and 2.5.3) respectively.

2.5.2 Educators' assessment literacy

The ability to identify, select or create assessments for various purposes (e.g. identifying learning gaps and accountability), as well as the ability to analyse, evaluate and use the evidence generated by assessments to improve student learning, comprises a broad definition of educators' ALit (Kahl, Hofman, & Bryant, 2012). According to Edwards (2017), being assessment literate is a necessity for educators if assessment is to be used to extend student learning. Popham (2011) furthermore states that it is necessary for educators to have an adequate level of ALit to evaluate students appropriately; therefore, ALit is an important characteristic of effective educators (Gotch & French, 2014). Because assessment literate educators enable students to become "critical consumers of feedback" (Stiggins, 1991, p. 535), it is of no surprise that Kahl et al. (2012) point out that educators' ALit affect students' motivation and achievement.

Stiggins (1991, p. 535) proposes that assessment literate educators ask themselves the following important questions:

- "What does this assessment tell students about the achievement outcomes we value?"
- "What is likely to be the effect of this assessment on students?"

Later, Stiggins (1995) states that educators who are assessment literate know what to assess, know why they assess, know how to assess, are capable to recognise possible difficulties with assessment and know by what means to prevent such problems from happening, and are also aware that incorrect and poor assessment may have negative consequences. Despite the variety of definitions and descriptions of what ALit is, Volante and Fazio (2007) believe educators must recognise different purposes of assessment and use these accordingly.

Because educators' ALit is the key link between assessment quality and student achievement (Mertler & Campbell, 2005), it is important to establish educators' ALit.

Educators often "believe that the assessment training that they received as undergrads did not prepare them to be comfortable with the decisions they are routinely charged to make" (Mertler, 2009, p. 101). A study done by MacLellan (2004) on teacher candidates' readiness for assessing student learning revealed low levels of ALit due to compartmentalisation of knowledge on assessment. DeLuca and Volante (2016) furthermore highlight that the relative short educational programmes, which are sporadically interrupted by work-integrated learning (WIL), may lead to teacher candidates not being sufficiently exposed to assessment pedagogy. Abell and Siegel (2011) developed a model for science teacher ALit, which attempts to indicate the various types of assessment knowledge and skills teachers need to create an "assessment-centred learning environment" (p. 212).

According to Abell and Siegel (2011, p. 212), the following are valued principles of assessment, based on SCT of learning, and form the core of an educator's ALit:

- educators learn through the process of assessment;
- students learn through the process of assessment;
- for students to regulate their own learning, assessment ought to support students to be metacognitive about their knowledge and skills development; and
- assessment tasks need to be unbiased towards all students.

Four types of knowledge and skills, which educators need to carry out assessment, surround the above-mentioned principles, and are discussed below.

Knowledge of purpose of assessment relates to the educator's purpose of assessment. Abell and Siegel (2011) state that the purposes of assessment can be grouped into four main types of assessment: diagnostic assessment, formative assessment, summative assessment, and metacognitive assessment. According to Abell and Volkmann (2006), the educator's view of learning and assessment values is related to the type of assessment that the educators choose to use.

Knowledge of what to assess is related to the stipulated aims in the curriculum, as well as the belief how learning occurs. The knowledge of what to assess is linked to the purpose of assessment and rooted in the core assessment values and principles.

Knowledge of assessment strategies refers not only to the various ways in which an educator assesses student learning, but also to the knowledge of content-specific assessment tasks.

The relationship of knowledge of assessment strategies to knowledge of assessment purposes is evident.

Knowledge of assessment interpretation and action-taking refers to what educators do with assessment data. It is believed that a crucial aspect of Alit is what educators know about "interpreting and acting upon assessment data" (Abell & Siegel, 2011, p. 215), and what they know about using assessment data to assist students in their learning process.

The model of ALit (Abell & Siegel, 2011, p. 217) has certain implications for science teacher education, namely explicitly addressing the four identified principles of assessment, and providing sufficient opportunities for student teachers to develop and enhance their knowledge of assessment purposes, what to assess, assessment strategies, assessment interpretation and action-taking.

2.5.3 Students' assessment literacy

Despite the fact that the importance of students' ALit is emphasised by several researchers (Carless, 2007; DeLuca, LaPointe-McEwan, & Luhanga, 2016; Edwards, 2017; Smith, Worsfold, Davies, Fisher, & McPhail, 2013), research on students' ALit is scant (Smith et al., 2013). Smith et al. (2013, p. 4 – 5 identify three dimensions of students' ALit. Students need:

- to understand the purpose of assessment and how it links with their learning trajectory;
- to be conscious of the processes of assessment; and
- opportunities to practice judging their own responses to assessment tasks. Price et al. (2012) further state that students' ALit can be enhanced through the following:
  - appreciating the relationship between assessment and learning;
  - conceptual understanding of assessment and assessment processes; and
  - developing skills in peer and self-assessment.

The peer review process will enable students to construct a feedback loop into the assessment process (Price et al., 2012). A study by Taylor (2011) showed how a peer-review task, which was done mid-semester, improved student performance. Students were, therefore, provided with a valuable learning opportunity, which in turn enabled them to act as assessors. The speed and quality of the formative feedback, the opportunity to see different approaches to the task, as well as having to judge the work of their peers, were aspects which students deemed useful (Taylor, 2011). Similar results were obtained from studies by Orsmond, Merry, and Reiling (2002), Orsmond, Merry, and Callaghan (2004), Price et al. (2012), Rust, Price, and O'Donovan (2003), as well as Smith et al. (2009).

2.5.4 Measuring levels of assessment literacy

Instruments developed to measure teachers' ALit include the:

- Assessment Practices Inventory (Zhang & Burry-Stock, 2003);
- Assessment Self-Confidence Survey (Jarr, 2012);
- Assessment in Vocational Classroom Questionnaire, Part II (Kershaw, 1993);
- Measurement Literacy Questionnaire (Daniel & King, 1998);
- Teacher Assessment Literacy Questionnaire (Plake, Impara, & Fager, 1993);
- Approaches to Classroom Assessment Inventory (DeLuca, LaPointe-McEwan, & Luhanga, 2016); and
- Summative Assessment Literacy Rubric (Edwards, 2017).

Instruments used to measure the ALit of pre-service teachers include the following:

- the Assessment Literacy Inventory (Campbell, Murphy, & Holt, 2002);
- the Revised Assessment Literacy Inventory (Mertler & Campbell, 2005), and
- the Student Assessment Literacy Questionnaire (SALQ) (Smith et al., 2013).

The 28-item SALQ (see Addendum A), developed by Smith et al. (2013, p. 48) to test a range of interrelated concepts, was the instrument selected for this study. The interrelated concepts were students' –

- "understanding of local protocols and performance standards;
- use of assessment tasks for learning;
- use of assessment tasks for grading;
- orientation towards putting in the minimum amount of effort into producing assessable work necessary to simply pass the module requirements; and
- ability to judge their own assessment tasks and those of their peers".

Being able to use assessment tasks for learning and to make use of self- and peer assessment, is also part of a self-directed learner's profile. Furthermore, the importance of SDL skills, especially in the 21st century, cannot be overemphasised.

2.6 Self-directed learning

Drawing comparisons between various definitions of SDL (Brockett & Hiemstra, 1991; Brookfield, 2009; Guglielmino, 1978; Kasworm, 1983; Knowles, 1975; Nepal & Stewart, 2010; Savin-Baden & Major, 2004), Lubbe (2015) highlighted shared properties amongst the various definitions: SDL comprise a continuous process during which students (not necessarily on

their own) take initiative in and responsibility for their own learning, formulate their learning goals, select appropriate learning strategies, and evaluate their learning experiences.

SDL is, according to Guglielmino and Long (2011, p. 2), “our most basic, natural response to newness, problems, or challenges in our environment”. Because the world is changing at an increasing pace, where change is the only constant, Nepal and Stewart (2010) state that SDL skills are vital. Skills and competencies needed by a self-directed learner are well documented (Dynan, Cate, & Rhee, 2008; Knowles, 1975; Guglielmino, 1978; Lord, Chen, Stolk, Nottis, Stefanou, & Price, 2010; Robertson, 2010; Warburton & Volet, 2012). Table 2-4 aims to outline such skills.

Table 2-4: SDL skills

A self-directed learner can:
… apply basic ideas to authentic problems or scenarios; … recognise and explain major fundamental assumptions; … compare the pros and cons of models (Dynan et al., 2008);
… relate collaboratively to peers; … identify peers as resources for diagnosing learning needs and for planning learning; … give assistance to peers; … receive assistance from peers; … realistically identify his or her own learning gaps, with or without the help of others; … translate his or her identified learning needs into learning goals; … identify various resources; … select appropriate strategies for learning; … gather and corroborate evidence of the achievement of learning goals (Knowles, 1975);
… take initiative in his or her learning process, and is curious; … be independent and persistent in his or her learning; … accept responsibility for his or her own learning; … exercise self-discipline; … take joy in learning; … be goal-oriented; … view problems as challenges (Guglielmino, 1978);
… reflect and analyse; … be flexible, independent and motivated (Lord et al., 2010);
… utilise a wide range of cognitive and metacognitive skills (Robertson, 2010);
… ask suitable questions for guided enquiry; … question the assumptions underpinning newly encountered concepts; … identify effective resources; and … use or adapt selected resources to accomplish learning objectives (Warburton & Volet, 2012).

Source: Author's own compilation adapted from Lubbe (2015)

Educators have a vital role to play in assisting students to develop SDL skills (Thornton, 2010), and Borich (2000) identifies several activities educators require to promote SDL:

- information should be provided to students on when and how various learning strategies should be used;
- modelling of the transferability of such strategies to authentic problems;
- students should be given the opportunity to rearrange content based on prior knowledge; and
- students should gradually move towards heuristic approaches to learning.

It is noteworthy that Kramarski and Michalsky (2009) point out the connection between educators' ability to foster SDL and their own level of SDL.

Some instruments available to measure SDL are:

- Self-Directed Learning Readiness Scale (SDLRS) (Guglielmino, 1978);
- Oddi Continuing Learning Inventory (OCLI) (Oddi, 1986);
- The Chinese version of the SDLRS (Deng, 1995);
- Self-directed learning ability scale (Ho, 1998);
- Fischer et al.'s (2001) self-directed learning readiness scale;
- Personal Responsibility Orientation to Self-Direction in Learning Scale (PRO-SDLS) (Stockdale, 2003);
- Self-Rating Scale of Self-Directed Learning (SRSSDL) (Williamson, 2007); and
- Self-Directed Learning Instrument (SDLI) (Cheng, Kuo, Lin, & Lee-Hsieh, 2010)

According to Merriam, Caffarella, and Baumgartner (2007), the 58-item SDLRS (Guglielmino, 1978) is the most widely used instrument for measuring one's current level of self-directedness in learning. Oddi's (1986) OCLI consists of three overlapping domains with 24 items, and aims to measure personal SDL characteristics (Harvey, Rothman, & Frecker, 2006). Deng (1995) adapted Guglielmino's (1978) SDLRS, and Ho's (1998) SDL ability scale is only available in Chinese (Cheng, Kuo, Lin, & Lee-Hsieh, 2010). Fischer, King, and Tague's (1991) SDL readiness scale has been tested extensively among nursing students specifically (Cheng et al., 2010), whilst Stockdale's (2003) PRO-SDLS was developed to be used among college students, to assess teaching–learning and learner characteristics (Stockdale & Brockett, 2011). Both the SRSSDL (Williamson, 2007) and the SDLI (Cheng et al., 2010) were developed for nursing students. The SDLI was specifically developed to identify SDL abilities across different programmes and grades (Cheng et al., 2010), whilst the SRSSDL was developed to measure the level of self-directedness in one's own learning (Williamson, 2007).

Only the SDLRS (Guglielmino, 1978) and SRSSDL (Williamson, 2007) have been translated into Afrikaans (one of the official languages of South Africa).

The SRSSDL is a 60-item instrument, which was developed by means of the Delphi technique with a panel of 15 experts. The responses for each item are rated by making use of a five-point Likert-type scale: 1 = never, 2 = seldom, 3 = sometimes, 4 = often, 5 = always. The maximum and minimum possible scores for the SRSSDL are 300 and 60 respectively. A total score between 60 and 140 indicate a low level of SDL, a total score between 141 and 220 is an indication of a moderate level of SDL, whilst a score above 220 is an indication of a high level of SDL. All SRSSDL items are categorised under five broad areas of SDL, each consisting of twelve items, namely (Williamson, 2007:70-71):

- "Awareness – items which relate to students' understanding of the factors contributing to becoming self-directed learners.
- Learning strategies – items which explain the various strategies self-directed learners should implement to become self-directed in their learning processes.
- Learning activities – items which specify the requisite learning activities which learners should actively engage to become self-directed in their learning processes.
- Evaluation – items which reveal students' specific attributes to assist in monitoring their learning activities.
- Interpersonal skills – items which relate to students' skills in interpersonal relationships".

According to Mentz and Van Zyl (2016) and Van der Westhuizen (2015), the SRSSDL is a reliable instrument to use within the South African context.

2.7 Self-directed learning and assessment literacy: essential for successful learning in the 21st century

The Millennials are used to getting an answer instantly and knowing how to communicate comfortably through social media.

Boud (2007, p. 17) states:

> [T]he fundamental problem of the dominant view for assessment is that it constructs students as passive subjects. That is, students are often seen to have no role other than to subject themselves to the assessment acts of others, to be measured and classified.

It is therefore of no surprise that assessment is disliked by both students and educators, and that assessment seems to be largely ineffective in supporting learning (Gibbs & Simpson, 2004). Furthermore, Boud and Falchikov (2007) state that traditional assessment focuses little

on learning and on how learning will take place after the point of assessment. Because educators tend to pay attention only to what is tested and adapt the curricula and teaching strategy accordingly (Binkley et al., 2012), assessment largely determines teaching.

Frequently assessing students for grades leads to students focusing on getting grades instead of gaining a deeper understanding of the content (Harland, McLean, Wass, Miller, & Sim, 2015), and most of educators' time will be spent on marking assessment tasks, which will contribute to the final grade (Boud, 2007). According to Gibbs and Simpson (2004), students are likely to perceive a grade as an indication of their personal ability or worth as a person, and "assessment results have become the vehicle of choice for accountability" (Earl, 2013, p. 14). When students focus more on doing well in an assessment task and less on learning, performance orientation will be promoted. Student engagement, persistence in learning, metacognition, as well as self-regulation should therefore be promoted (Binkley et al., 2012). As soon as assessment is designed to provide feedback instead of for making comparative judgements, assessment will further students' learning (Earl, 2013). Although the implementation of continuous formative assessment may help students build conceptual understandings and problem-solving skills (Binkley et al., 2012), Boud (2007) cautions against over-assessment. The emphasis, according to Earl (2013) is still placed on AoL in relation to AfL and AaL in traditional assessment.

Traditional assessment is furthermore characterised by a limited number of assessment strategies and techniques, which mainly depend on examinations (Falchikov, 2005; Mertler & Campbell, 2005) and may not be good at laying the fundamentals for lifelong learning. Although students are natural-born learners, the following are identified by Kvale (2007) as aspects of educational assessment that may potentially discourage lifelong 21st-century learning:

- *Using grade point average as a learning goal* – research (see Kvale, 2007) indicates that deeper and further learning is counteracted by the presence of competition for high grades amongst students;
- *Dominance of multiple-choice tests* – factual memory tends to be emphasised when making use of multiple-choice tests, rather than promoting more complex cognitive processes. Furthermore, empirical evidence indicates that multiple-choice tests may well lead to a simplification of the acquired knowledge;
- *Test anxiety* – "assessment has traditionally been associated with negative emotions, primarily anxiety" (Kvale, 2007, p. 65) and strong test anxiety could impair the learning process;
- *Lack of feedback* – feedback is known, according to the psychology of learning, as an essential component for essential learning;

- *Use of inauthentic assessment* – traditional assessment leans towards inauthenticity because the content and form of assessment do not align with "content and form of corresponding tasks to be measured outside of educational settings: (Kvale, 2007, p. 66); and
- *Absence of peer and self-assessment* – common forms of assessment foster other-directed learning instead of SDL. Peer assessment is especially difficult to implement when a key selection function of assessment rests solely on competition between students.

Because students have little or no control over these types of traditional assessment processes, they are forced into being passive consumers (Falchikov, 2005). According to Black and Wiliam (1998, p. 8), the overall picture of traditional assessment is one of weak practice with several key weaknesses, namely the following:

- focusing on superficial and rote learning, which emphasises recall of specific content knowledge;
- not much reflection on what is being assessed is done by the educators;
- grading of assessment tasks is over-emphasised, whilst the learning process is under-emphasised;
- competition between students, instead of individual improvement, is emphasised due to focusing on criterion-referenced assessment;
- feedback given on criterion-referenced assessment further de-motivates less successful students and lowers self-esteem;
- traditional assessment fails to inform educators what they need to know about their students' learning, as educators have the tendency to assess quantity of work instead of quality of learning.

Although Earl (2013) believes the status quo of assessment needs to be challenged and advocates the use of assessment for learning, participative assessment is not used adequately (Sinclair & Cleland, 2007). The implementation of participative assessment at university level has been gradual and often experimental in nature (Rodriguez, Ibarra, & Garcia, 2013), which may be because participative assessment requires much effort from educators and students (Quesada-Serra et al., 2016).

According to Boud and Falchikov (2007, p. 4), "studying in higher education is arguably for … providing a foundation for a lifetime of learning and work in which there is little formal assessment or formal instruction". Gibbs and Simpson (2004) and Gibbs (2006) discuss ten conditions under which assessment could support learning in higher education. The first three conditions describe the way in which assessment influences the volume, focus and quality of

studying. The remaining seven conditions elaborate on the influence of feedback on students' learning.

Not surprisingly, Earl (2013) states the need for the status quo of assessment to be challenged. According to Dochy et al. (2007), 21st-century learning is characterised by developing self-directedness and self-assessment. Also, 21st-century learning is discovery-oriented and makes use of real-life tasks (Dochy et al., 2007). Implementing pedagogies that enhance students' SDL, is well-researched and documented (Breed, 2016; Breed & Bailey, 2018; Havenga, 2015; Lubbe, 2015). Despite the move towards more active and student-centred teaching and learning, it seems that assessment practices remain largely traditional and summative (Jankowski, Timmer, Kinzie, & Kuh, 2018), and this is no different for Life Sciences (Clark, 2012). David Boud and Associates (2010, para. 9) state that assessment in HE is most effective when assessment is used to "engage students in learning that is productive, when feedback is used to actively improve student learning, students and [educators] become responsible partners in learning and assessment, students are inducted into the assessment practices and cultures of higher education, assessment for learning is placed at the centre of subject and programme design, assessment for learning is a focus for staff and institutional development, and assessment provides inclusive and trustworthy representation of students achievements". Therefore, assessment forms an integral part of the teaching and learning process and cannot be used only as an add-on for grading purposes.

2.8 Summary

This chapter set out to advocate the necessity for ALit within an SDL environment. This was accomplished by giving a detailed overview of literature regarding influential learning theories, namely behaviourism, cognitivism and constructivism. As this investigation was positioned within the SCT, special attention was given to the principles of SCT. From the social constructivist stance, various aspects of assessment were outlined to argue the centrality of assessment to the learning process. Conceptual clarification of ALit, student and educator assessment, and measuring levels of it were also outlined. The chapter concluded with linking SDL and ALit in the 21st century.

CHAPTER 3 COOPERTIVE LEARNING AND COOPERATIVE LEARNING-EMBEDDED ASSESSMENT

3.1 Introduction

Chapter 2 aimed to provide a theoretical and conceptual framework of SDL and ALit, from a social constructivist stance. The purpose of this chapter is to provide a theoretical and conceptual framework for cooperative learning (CL) and cooperative learning-embedded assessment (CL-EA). In section 3.2, the theoretical perspectives on CL, as well as the principles at the core of CL, are discussed. In section 3.3, a conceptual model of assessment embedded within CL is discussed, highlighting the characteristics, the role of the facilitator, as well as the role of the student. Guidelines are also provided for successful development and implementation of CL-EA (see section 3.4). Lastly, this chapter concludes with a summary (see section 3.5).

3.2 Cooperative learning

Cooperative learning (CL) is a pedagogical practice making use of small-group instruction during which all group members' learning is maximised (Gillies & Boyle, 2010; Johnson, Johnson, & Holubec, 2008). There is overwhelming evidence that the successful implementation of CL influences student learning (Slavin, 2014). These well-researched and documented effects of CL on student learning are, amongst others, increased motivation and confidence, improved learning, deeper understanding, improved critical thinking skills, increased academic achievement, as well as development of social skills (Cavanagh, 2011; Gillies & Boyle, 2010; Hsiung, 2012; Johnson & Johnson, 2014; Johnson, Johnson, & Holubec, 2008; Shimazoe & Aldrich, 2010; Tsay & Brady, 2010).

According to Johnson and Johnson (2014), empowering individuals to meet 21st-century challenges can be successfully done when making use of CL as a pedagogical practice. The success of CL as a pedagogical practice is, according to Johnson and Johnson (2015, p. 18), a result of CL being rooted in "theory validated by research".

3.2.1 Theoretical perspectives

Johnson and Johnson (2015, p. 2) state, "theory is to practice what the soil is to plants". The term 'theorise' comes from the Greek word *theorin*, which is a combination of two separate words, namely *thea* and *horin*. The word *thea* means to observe or study, whilst *horin* means to contemplate or explain. To theorise is therefore to observe or study a phenomenon and

then to contemplate what you have observed in order to provide an explanation for it (Johnson & Johnson, 2015).

Social interdependence theory (SIT) is the most influential theory underpinning the success of CL (Johnson & Johnson, 2015). Although the formulation of SIT was published by Morton Deutsch in 1949, SIT is rooted in the work of Kurt Koffka (Johnson & Johnson, 2015). During the 1920s, Koffka's notion that groups are dynamic wholes with varying interdependence amongst group members, was extended by Kurt Lewin. Lewin stated that the dynamic whole is due to the goal interdependence among group members. Deutsch, one of Lewin's graduate students, extended on Lewin's work by developing a theory of positive interdependence (cooperation) and negative interdependence (competition) (Deutsch, 1949). In 1962, Deutsch extended the theory by adding individualistic efforts. In 1972, Watson and Johnson extended the SIT by proposing the 'structure-process-outcome theory' for cooperation. Table 3-1 presents a summary of the interaction patterns of Watson and Johnson's (1972) theory.

Table 3-1: Interaction patterns of interdependence

Way in which social interdependence is structured	Way in which individual group members react	Type of group interaction
Positive interdependence	Cooperation	Promotive interaction
No interdependence	As individuals	No interaction
Negative interdependence	Competition	Oppositional interaction

Source: Author's own compilation

According to Watson and Johnson (1972), the way in which interdependence is structured influences the way in which individual group members react, which in turn influences the outcomes of the interaction. From Table 3-1, it is evident that positive interdependence leads to cooperation, which in turn results in promotive interaction among group members. Increased efforts to achieve, positive interpersonal relationships as well as psychological health are some of the outcomes of promotive interaction within a group. Group members help and assist each other by exchanging resources, giving and receiving feedback, encouraging each other's increased efforts, engaging in social skills necessary for the group's success, reflecting on current and desired teamwork, and challenging cognitive skills. Promotive interaction results in group members not only focusing on maximising their own learning, but rather the learning of all group members (Johnson & Johnson, 2015).

No interdependence leads to members perceiving that they can reach their goal on their own. Group members will therefore act in their own interest and there will be no interaction amongst group members.

Negative interaction leads to competitive behaviour amongst group members and will result in oppositional interaction. Oppositional interaction not only results in individual group members focusing on increasing their own success, but also in obstructing the efforts by group members to achieve their goals. According to Johnson and Johnson (2015), individualistic and competitive efforts lead to decreased efforts to achieve, negative interpersonal relationships, and psychological maladjustment.

Noteworthy also is the fact that social interdependence differs from social dependence and social independence in the following way (Johnson & Johnson, 2015:23):

- *Social interdependence* – individual group members share a common goal and each individual group member's outcomes are affected by the actions of the other group members.
- *Social dependence* – outcomes of an individual group member are affected by the actions of another group member, but not vice versa.
- *Social independence* – the outcomes of individual group members are not affected by the other group members' actions.

The internal and external validity, the well-defined concepts, the testability as well as the cumulative and dynamic nature of SIT are some of the characteristics highlighted by Johnson and Johnson (2015).

CL-EA is fundamentally rooted in the principles of the SCT. Due to the social nature of the SCT, participative assessment practices can occur through collaborative learning. Collaborative learning, however, does not necessarily lead to cooperation but may lead to competition or individualism. For cooperative interaction to take place, social interdependence should be positively structured. CL-EA is therefore not only rooted in the principles of the SCT, but also draws from the SIT by structuring social interdependence instead of social dependence or social independence. According to Liang (2002), CL group members are active constructors of knowledge during the learning process. The cooperative environment is also distinguishable by the presence of the five basic CL principles (Johnson, Johnson, & Holubec, 2008; Johnson & Johnson, 2015; Tsay & Brady, 2010; Tran, 2013). These principles, as well their presence within CL-EA, are elaborated upon in the subsequent sections.

3.2.2 Heartbeat of cooperative learning

Crucial to the success of CL, is the presence of five basic principles – as an extension to the work of Deutsch (Johnson & Johnson, 2015). These principles set CL apart from simply instructing students to work collaboratively in groups or teams (Gillies, 2016), and must be structured carefully and purposefully (Johnson & Johnson, 2014). Section 3.2.2.1 provides a discussion of the basic CL principles – the heartbeat of CL – in order to set a backdrop for the subsequent discussion of the conceptual model of CL-EA, as well as the ways in which the basic CL principles were embedded within the assessment activities for the current research.

3.2.2.1 Positive interdependence

According to Deutsch (1949), positive interdependence is the core of all cooperative efforts, and Johnson and Johnson (2008) use the 'sink or swim together' principle to describe this vital element. Positive interdependence is "the perception that one is linked with others in a way so that one cannot succeed unless they do (and vice versa) and that groupmates' work benefits you and your work benefits them" (Johnson and Johnson, 2014, p. 845). Each group member will comprehend that his or her contribution is crucial for the success of the whole group (Johnson & Johnson, 2013; Slavin, 2012), which will ensure that there are no 'free-riders' (Millis, 2010). Positive interdependence needs to be constructed purposefully in CL groups (Tran, 2013) to ensure that the success of the whole CL group depends on the effort of each group member (Köse, Sahin, Ergü, & Gezer, 2010).

According to Johnson, Johnson, and Holubec (2008), three major categories of positive interdependence exist, namely outcomes (goal and reward interdependence), means (resource, role and task interdependence), as well as boundary (outside enemy, identity and environmental interdependence). Table 3-2 provides a summary of the identified categories and the ways in which they can be structured.

Table 3-2: Major categories of positive interdependence

Category of positive interdependence	Outcomes	Means	Boundary
What it entails	Orientation of a group toward a desired outcome, goal or reward	The means through which the shared goals or rewards are to be accomplished	Unexpected disjointedness that separates groups from each other, as well as uniting the members of a group
Types of interdependence	• Goal interdependence • Reward interdependence	• Resource interdependence • Role interdependence • Task interdependence	• Outside enemy interdependence • Identity interdependence • Environmental interdependence
Ways in which it can be structured	• Group setting mutual goals • Mutual rewards for successful groups	• Each group member has a part of the information • Each group member is assigned a role • Work is organised sequentially	• Groups are put in competition with each other • Group name and motto • Groups are bound together by the environment

Source: Author's own compilation based on Johnson and Johnson (2002)

Positive goal interdependence exists when students comprehend that they can only achieve their own learning goals when all the members of the group achieve their goals. Providing groups with the opportunity to set mutual goals is one way in which positive goal interdependence can be structured. *Positive reward interdependence* is present when a mutual reward is given for effective group work. *Positive resource interdependence* can be structured by making sure that the group members are interdependent for resources, information or materials necessary for completing their task. This way, group members' resources should be combined so that the group achieves its goal. *Positive role interdependence* can be structured by assigning complementary and interconnected roles to each group member. In this way, the responsibilities linked to the roles will enable the group to fulfil a mutual task. *Positive task interdependence* is present when the work is organised in sequence. Positive resource, role, and task interdependence result in individuals grasping that the performance of group members depends on the whole group and not on individual group members. As a result, group members are willing and susceptible to being influenced by each other. *Positive outside enemy interdependence* exists when groups are positioned in competition with each other. Doing this will result in group members working together to win the competition. *Positive identity interdependence* can be structured when groups agree upon

a common identity. This can be a group name, a motto or slogan. *Positive environmental interdependence* exists when students are bound together by the physical environment within which they work, and could include seating arrangements that unite students.

Although positive interdependence is crucial for successful cooperation within CL groups, each group member is still held accountable for doing his or her part of the work. Therefore, structuring individual accountability is equally important.

3.2.2.2 Individual accountability

Individual accountability ensures that students, although learning together as a CL group, could perform better or achieve higher as individuals (Johnson & Johnson, 2014). Each group member is strengthened by holding individuals accountable for completing their part of the work (e.g. completing an assignment or a specific task). According to Johnson and Johnson (2009b), individual accountability means that students ask for support and learn as much as possible. “Individual accountability is considered as the degree to which the achievement of the group is dependent on the individual learning of all group members” (Tran, 2013, p. 103).

Ways in which individual accountability can be structured are individual tests, explaining work to peers, keeping the CL groups small, and documenting contributions on an observation sheet (Johnson & Johnson, 2014). The absence of individual accountability may lead to some group members ‘free-riding’ (Tran, 2013). According to Yamarik (2007) and Onwuegbuzie, Collins, and Jiao (2009), the success of CL activities relies on the presence of individual accountability.

3.2.2.3 Face-to-face promotive interaction

Promotive interaction within CL groups exists because of the verbal interaction required amongst group members (Johnson & Johnson, 2008). “Students promote each other’s success by helping, assisting, supporting, encouraging, and praising each other’s efforts to learn” (Johnson & Johnson, 2014, p. 845). This will result in several cognitive and interpersonal processes, e.g.

- explaining the way in which problems can be solved;
- conversing about concepts that are being learned;
- peer teaching;
- stimulating each other’s reasoning;
- linking existing and new knowledge;
- exhibiting effective use of social skills;

- supporting and encouraging learning efforts; and
- sharing in the celebrations of success (Johnson & Johnson, 2014).

3.2.2.4 Small groups and social skills

Social skills for effective CL, according to Gillies (2016), are the ability to listen actively, to comment constructively on peers' ideas, to accept responsibility for one's behaviour, the ability to share ideas and resources, and the ability to make democratic decisions. According to Johnson and Johnson (2013), effective CL will not occur when group members are socially unskilled. Social skills such as "[l]eadership, decision-making, trust-building, communication, and conflict-management skills have to be taught just as purposefully and precisely as academic skills" (Johnson & Johnson, 2014, p. 845). Getting to know and trust one's group members, communicating accurately and unambiguously, accepting and supporting one another, and constructively resolving conflict within the group are crucial social skills required to coordinate efforts to achieve common goals (Johnson & Johnson, 2009a). Tran (2013, p. 104) furthermore states that "not only do social skills promote higher achievement, they contribute to building more positive relationships among group members".

3.2.2.5 Group processing

According to Sutherland, Stuhr, Ressler, Smith, and Wiggin (2019, p. 22), "group processing is arguably the pivotal element when implementing CL with students". The purpose of group processing, according to Tran (2013), is to clarify and improve the efficiency of group members' contribution to achieving the goals of the group. Johnson et al. (2008) identify two levels of group processing, namely small-group and whole-class processing. *Small-group processing* is structured at the end of each class, and provides opportunity for students to process how effectively the group members were working together. This can be done by asking group members to describe helpful actions, as well as by asking students to make decisions regarding behaviours to be changed or continued. Small-group processing is said to:

- enable group members within CL groups to uphold good relationships;
- facilitate cooperative skills;
- examine group tasks to provide feedback on members' participation;
- examine members' knowledge on their own learning sections; and
- celebrate the success of the CL group and reinforces positive behaviours amongst members (Johnson, Johnson, & Holubec, 2008).

Whole-class processing also takes place at the end of a class, and is done by the lecturer through sharing observations he or she had made of each group's functioning (Johnson et al., 2008). When structuring group processing successfully, Johnson and Johnson (2014, p. 846) are of the opinion that it may result in "(a) streamlining the learning process to make it simpler, (b) eliminating unskilled and inappropriate actions, (c) improving continuously students' skills in working as part of a team, and (d) celebrating hard work and success".

In summary, once these five basic elements of CL have been structured purposefully within cooperative group settings, students' achievement, deeper learning, and positive interpersonal relationships (amongst others) will be positively influenced (Johnson et al., 2008). Noteworthy also, is the role reversal of lecturers and students, with students taking up an active and participative role in learning whilst the lecturer facilitates the learning process (Tran, 2013).

The proposed conceptual model of CL-EA, which draws from previously discussed sections on the characteristics of SCT (see section 2.2.2), as well as the above-mentioned aspects of SIT (see section 3.2.1) will be discussed in section 3.3.

3.3 Conceptual model of cooperative learning-embedded assessment

Based on the literature review in Chapters 2 and 3 with regards to SCT, SIT, CL, assessment, ALit and SDL, the researcher proposes a conceptual model for CL-EA. The researcher's point of departure in terms of what matters most for assessment can be summarised by starting with these premises:

- Assessment is rooted in SCT (see section 2.2.2).
- Assessment is a social activity (see section 2.2.2).
- Learning takes place through formative and summative assessment (see section 2.3.1.1).
- Learning and assessment take place due to promotive cooperative interaction (see section 3.2.1).
- Assessment activities are embedded within CL with the presence of social interdependence, individual accountability, promotive face-to-face interaction, small-group and interpersonal skills, as well as group processing (see section 3.2).
- Assessment provides immediate feedback (see section 2.4).
- Assessment provides opportunity for metacognitive reflection (see section 2.3.1.3).
- Teaching, learning and assessment comprise an inseparable collection of pedagogical practices (see section 2.7).

As an echo of these premises, the focus of CL-EA is on assessment as a social learning activity; therefore, learning through assessment. CL-embedded assessment is not seen as an add-on to the teaching and learning process, but rather as a learning activity taking place within a social constructivist, CL context. According to Webb, Franke, Ing, Turrou, and Johnson (2015, p. 49), "explaining one's thinking and engaging with others' ideas are at the heart of many researchers' perspectives on productive student participation". The characteristics of and a proposed model for CL-EA, as well as a detailed discussion of these, follow.

One of the characteristics of CL-EA is the fact that all assessment activities are embedded within a CL environment (see Figure 3-1). Positive interdependence, individual accountability, promotive face-to-face interaction, small-group social skills, and group processing are built into each assessment activity. Teaching, learning and assessment comprise an inseparable collection of processes due to the social constructivist approach (see section 2.2.2). This implies that assessment activities are also participative in nature, as opposed to normal competitive or individualistic assessments. Even though there has been a shift from assessment of learning to more AfL and AaL approaches, assessment still seems to take centre stage. CL-EA promotes learning through assessment, which highlights the learning process rather than the assessment practices. Assessment is seen as a teaching and learning strategy from the social constructivist theory in the 21st-century HE context (see section 2.2.2).

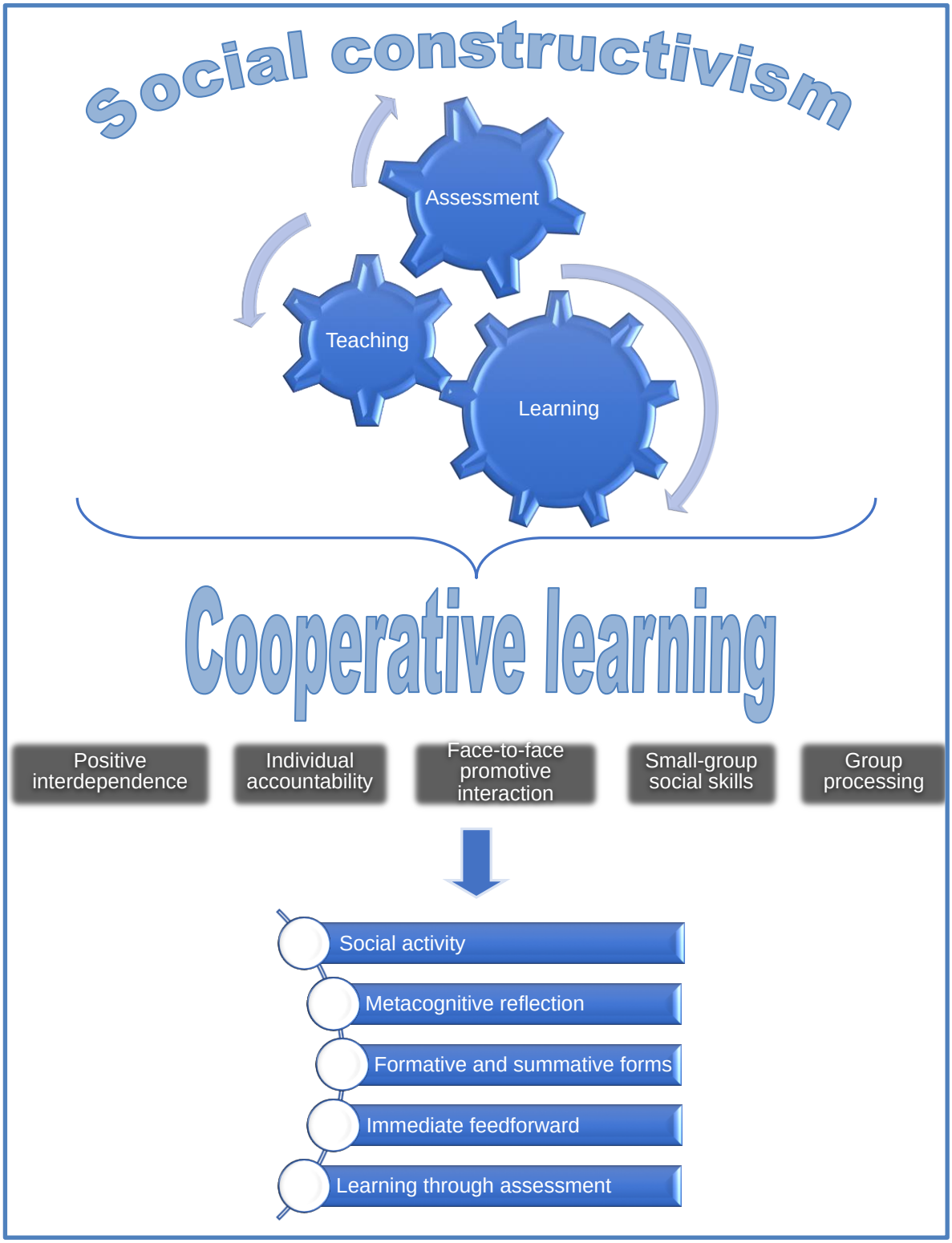


Figure 3-1: CL-EA characteristics

Source: Author's own compilation

Next, general guidelines to be followed when developing and implementing CL-EA are discussed.

3.4 General guidelines for developing and implementing CL-EA intervention

In the current study, the implementation of the CL-EA intervention required extensive planning, and the selection of assessment activities, embedded within CL, was done timeously and purposefully. The researcher suggested that the following aspects had to be adhered to when developing CL-EA:

- Assessment should be a social activity (see section 2.2.2).
- Assessment should provide an opportunity for metacognitive reflection (see section 2.3.1.3).
- Assessment can be formative and summative (see section 2.3.1.1).
- Assessment should include an opportunity for immediate feedforward (see section 2.4).
- Learning and assessment should take place within a CL environment (see section 3.2).
- Learning takes place through the assessment.

3.4.1 Social activity

Due to the theoretical underpinning of CL-EA (see section 3.2.1), it is imperative that, when selecting assessment instruments, the participative possibilities thereof were examined. If the nature of the selected assessment instrument was not participative (e.g. standard individual tests), it had to be reconstructed to allow for participation. This implied that the assessment instrument had to be conducted in groups, more specifically, CL groups. In the case of individual tests, a participative component could be added to ensure that the assessment practice was rooted in SCT. This could be done, for example, by having students write the test together. In such an instance, one copy of the same test could be provided within the CL group. Not only would this ensure that the test was a social activity, but individual accountability would also be structured. Another option was to have students write the test in CL groups first, and individually afterwards. In such a case, the test would not only be a social activity through which positive interdependence was ensured, but the individual test component would also ensure individual accountability. It was also possible to have students write the individual test first, and then rewrite the same test within their CL groups. Regardless of the sequence of test writing, social skills would be developed.

3.4.2 Metacognitive reflection

The ability to evaluate one's own learning is not only one of the characteristics of a self-directed learner (Knowles, 1978), but also part of the repertoire of an assessment literate student (Price et al., 2012). When planning for CL-EA, provision should be made for metacognitive reflection. This can be done, for example, by making use of reflection prompts (Ifenthaler, 2012). These reflection prompts can either be done online or be structured as part of the assessment instrument. When having students write an individual test, followed by a CL group test, this will enable students to reflect on and self-assess their individual answers when writing the test within the CL group. After such an assessment, students can be asked to complete an online reflection prompt or to complete a reflection sheet in class (Ifenthaler, 2012). Such a reflective activity would consist of questions prompting students to reflect on the way in which they prepared for the test, the time spent in preparing for the test, the possibility of adapting their learning strategies, as well as indicating what they would do differently when preparing for the next test.

3.4.3 Formative and summative

The participative nature of CL-EA, rooted within SCT and embedded within CL, enables CL-EA to be used for both forms of assessment – formative and summative – simultaneously (Brookhart, 2003; Taylor, 2008). This implies that CL-EA activities are used for evaluation of learning outcomes, as well as to diagnose learning gaps and improve teaching and learning. A CL group test is therefore not only classified as a high-stakes summative form of assessment, which is done at the end of instruction. Should students write an individual test followed by a CL group test, the result of such a test could be used to evaluate the learning outcomes whilst diagnosing learning gaps (Stiggins & Chappuis, 2005).

3.4.4 Immediate feedforward

The necessity of effective feedback strategies in assessment is well documented (see section 2.4). When developing and implementing CL-EA instruments, opportunity for effective feedback (see Table 2-3) should be purposefully structured, and the feedback provider should be identified (i.e. peers or the lecturer or both). In the case of students writing an individual test followed by a CL group test, immediate feedback is provided by peers when discussing individual answers to reach consensus on the correct answer. Should the CL group test be written first, followed by an individual test, the immediate feedback provided by peers' feeds forward to close the gap between current and desired achievement (Koen, Bitzer, & Beets, 2012). Students will therefore be able to act immediately on the feedback received from their

peers. Another option would be to have students write an individual test, after which students collaborate within their CL groups to compile a memorandum for the written test. When compiling the memorandum, students may be allowed to make use of relevant resources, as learning is encouraged. The compiled memorandum can then be used by the students to peer assess the individual tests. To ensure immediate feedback, peers can discuss their individual tests in relation to the memorandum. This ongoing dialogue will also provide students with the opportunity to develop self-assessment and social skills. After such a CL-EA intervention, a whole-class discussion can be prompted by the lecturer to encourage ongoing lecturer–peer dialogue regarding learning. Whole-class discussion will also ensure the group processing element of CL.

3.4.5 Within a cooperative learning environment

Developing and implementing CL-EA implies that the five basic CL elements (see section 3.2.2) be structured within the assessment instrument. Noteworthy is the fact that all five CL elements should be present in order to ensure positive interdependence, which will lead to cooperation amongst students. Building on the test example mentioned above, *positive interdependence* could be structured by ensuring that the CL groups receive only one copy of the test. The students therefore need to work together on completing the single test copy. Ensuring that the groups are small – two or four students per CL group – will contribute to the presence of positive interdependence. *Individual accountability* can be structured by combining the CL group test with an individual test. Furthermore, should the lecturer choose to use the test as a summative form of assessment, the individual test could have a higher weighting than the CL group test. *Promotive face-to-face interaction* can be ensured through keeping the groups small (two or four students per CL group) as well as by having students face each other when writing the CL group test. *Small-group social skills* can be ensured through the CL group test, either before or after the individual test. Discussing the test, explaining the work, reaching consensus on the correct answer, as well as providing feedback, are all ways in which the small-group social skills of students can be enhanced through CL-EA. When students write the CL group test, *group processing* takes place through the provision of feedback. This is done since feedback is not only content-related but may include advice on how to study differently. After the tests – individual and group – have been written and submitted, whole-class processing can take place in the form of ongoing lecturer–peer dialogue (Johnson et al., 2008).

3.4.6 Learning through assessment approach

A paradigm shift is needed when developing and implementing CL-EA. No longer should the focus be on assessment (ASSESSMENT of learning, ASSESSMENT for learning, ASSESSMENT as learning), but the emphasis should be on the learning process. CL-EA suggests a new approach to assessment, one that places learning at its core: LEARNING through assessment. This approach to assessment views teaching, learning and assessment as an inseparable collection of activities within a social constructivist context. Placing the emphasis on the learning process, rather than the form of assessment or the purpose of assessment, ensures that students can learn from CL-EA. CL-EA is suggested, developed and implemented by the researcher as a learning activity.

It is imperative to the successful implementation of CL-EA that all the above-mentioned aspects are adhered to when developing such assessment. Table 3-3 summarises guidelines for CL-EA design and implementation by means of a checklist.

Table 3-3: Checklist for CL-EA design and implementation guidelines

	CL-EA aspect	Guideline
✓	Social activity	• Conducted within CL groups (Johnson et al., 2008) • Peer assessment (Nulty, 2011; Mostert & Snowball, 2013) • Participative in nature (Brew & Riley, 2011)
✓	Metacognitive reflection	• Reflection prompts (Ifenthaler, 2012) • Self-assessment (Nulty, 2011; Yan & Brown, 2017) • Group processing (Johnson et al., 2008)
✓	Formative and summative purposes	• Evaluates learning outcomes and improves learning by diagnosing learning gaps (Stiggins & Chappuis, 2005; Taylor, 2008) • Marks not necessary (McMorran & Ragupathi, 2019)
✓	Immediate feedforward	• Group component (Johnson et al., 2008) • Peer assessment with dialogue (Nulty, 2011; Mostert & Snowball, 2013)
✓	Within CL environment	• Positive interdependence • Individual accountability • Promotive face-to-face interaction • Small-group social skills • Group processing (Johnson et al., 2008)
✓	Learning through assessment approach	• Emphasis on learning • Assessment used as a learning activity

Source: Author's own compilation

It should be noted that the list in Table 3-3 is not exhaustive, and that the type of assessment instrument chosen has an influence on the way in which these aspects can be structured. Furthermore, it needs to be mentioned that the successful implementation of CL-EA depends on thorough planning. Part of the planning process, is making decisions regarding what form(s) of assessment will be utilized. Will the CL-EA be used for formative, summative or both forms of assessment? Deciding on the assessment method, whether CL-EA will include self- and/or peer assessment, as well as the type of assessment instruments and assessment tools that will be used, are also part of the planning process. The size and composition of the CL groups should also be established by deciding how many students will be in a CL group, and whether or not the students will be able to choose their own groups. Planning and structuring the presence of all five the CL basic elements are also crucial to the successful implementation of CL-EA. Making sure that there are enough opportunity for feedback, which is immediate and feeds forward, is another part of the planning process for successful implementation of CL-EA. The number of reflection prompts, when it will be completed, as well as how it will have to be completed, forms part of the planning of the inclusion of metacognitive reflection. Making sure that the CL-EA is structured as a learning opportunity, will enable students to learning through the CL-EA. Another important aspect of the planning of CL-EA, is time management. Enough time should be available for effective participative assessments, group processing, as well as feedback dialogue within the CL groups.

These decisions will have an influence on the development and implementation of CL-EA; therefore, it is suggested that the planning of CL-EA be done timeously and in as much detail as possible. This will ensure that successful learning through CL-EA will take place.

3.5 Summary

Chapter 3 aimed to provide a theoretical and conceptual framework for CL and CL-EA. SIT was discussed and linked to the overall social constructivist theoretical lens of this study. The five basic elements, at the core of CL (positive interdependence, individual accountability, promotive face-to-face interaction, small-group social skills, and group processing) were discussed in the light of CL-EA. Furthermore, a conceptual model for CL-EA, based on the literature review in Chapters 2 and 3, was proposed and its characteristics discussed. General guidelines for the development and implementation of CL-EA were finally discussed. The development and implementation of the CL-EA intervention in this investigation as well as the research design and methodology will be discussed comprehensively in Chapter 4.

CHAPTER 4 RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

Chapters 2 and 3 aimed at providing the backdrop necessary to answer the research question of this investigation. Assessment, ALit, SDL, SDL readiness, CL, as well as CL-EA were the concepts dealt with and elaborated upon within these two chapters.

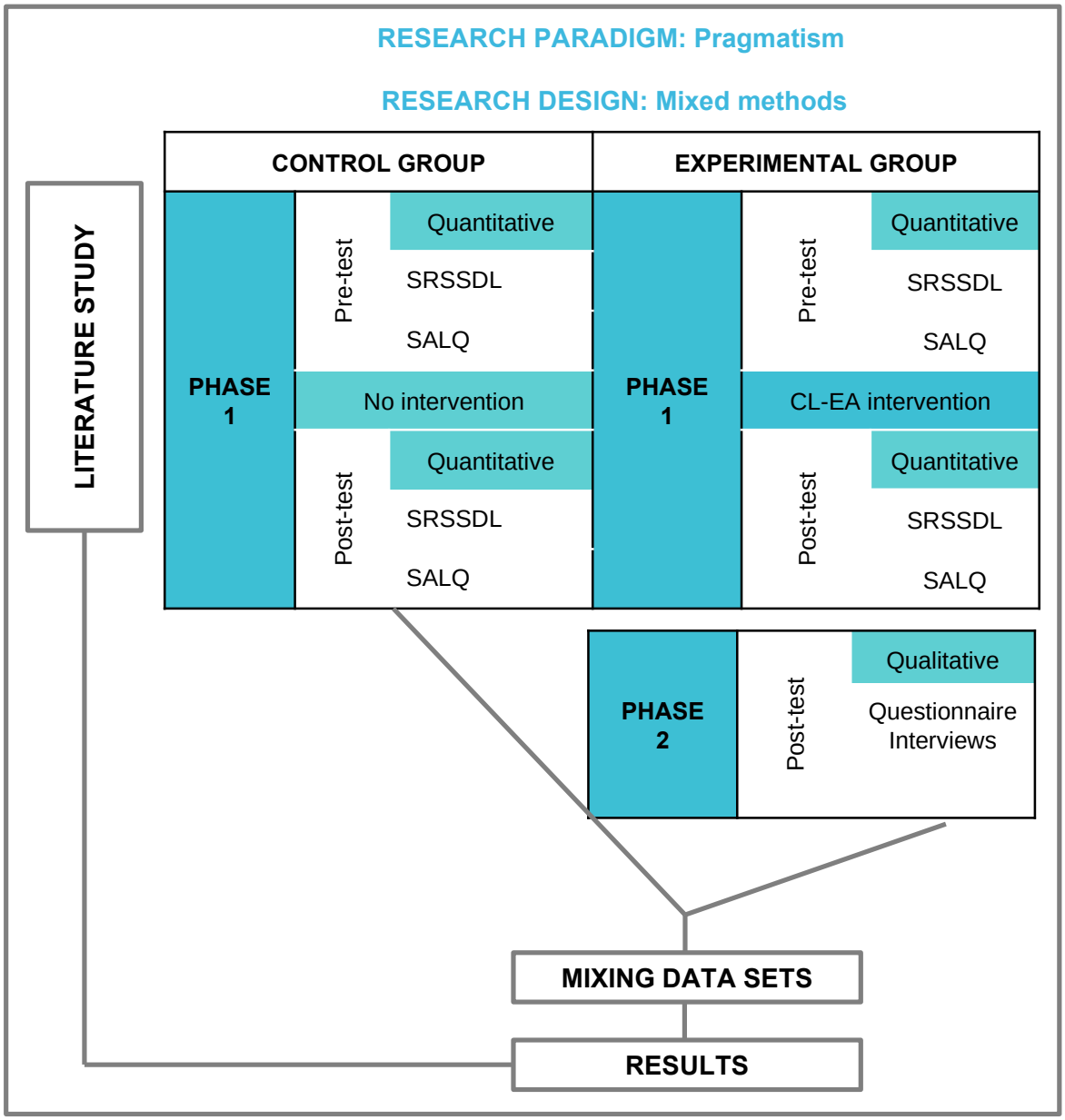
The main research question that guided the investigation was: What is the influence of CL-EA on first-year Life Sciences students' ALit and SDL readiness? In order to answer this research question, the researcher identified the following sub-questions:

- What do CL-EA and ALit within the context of social constructivism, entail?
- How can CL-EA be implemented in first-year Life Sciences classes?
- What is the influence of CL-EA on first-year Life Sciences students' ALit?
- What is the influence of CL-EA on first-year Life Sciences students' SDL?
- What are first-year Life Sciences students' perceptions of CL-EA?
- What are first-year Life Sciences students' perceptions of ALit?
- What is the relationship between students' ALit and their self-directedness to learning?

Chapter 4 discusses the empirical research process of this investigation, and is based on the theoretical and conceptual frameworks discussed in Chapters 2 and 3. The sections below present a description of the research paradigm from which the investigation was planned and conducted, as well as the research design used to answer the research question. This chapter also contains a description of the study population, as well as the quantitative and qualitative procedures that were followed during this investigation. An elaborate discussion of the CL-EA intervention concludes this chapter.

4.2 Research paradigm and design

The research paradigm, design and method used for this investigation are illustrated in Figure 4-1 and are discussed next.



Note: SRSSDL – Self-rating scale of self-directed learning; SALQ – Student Assessment Literacy Questionnaire; CL-EA – cooperative learning-embedded assessment

Figure 4-1: Research paradigm and design

The nature of ethics and values (axiology), reality (ontology), knowledge (epistemology) as well as the nature of systematic inquiry (methodology) are the four philosophical assumptions, which exemplify a researcher's paradigm (Mertens, 2018). This paradigm, in turn, has an influence on the way in which the research is conceptualised (Creswell & Plano Clark, 2011; Mertens, 2018). Because of the researcher's view that the research question is of primary concern, and that mixing the quantitative and qualitative design would best answer the

complex research question, neither paradigms associated with pure quantitative research nor pure qualitative research were considered. Rather, the researcher selected pragmatism as the paradigm from which the research would be conducted and interpreted. According to Teddlie and Tashakkori (2009, p. 7), pragmatism is defined as:

> *[A] deconstructive paradigm that debunks concepts such as "truth" and "reality" and focuses instead on "what works" as the truth regarding the research questions under investigation. Pragmatism rejects the either/or choices associated with the paradigm wars, advocates for the use of mixed methods in research, and acknowledges that the values of the researcher play a large role in interpretation of results*.

The term 'mixed methods' refers to a research design in which both numeric and text information are collected and analysed to answer the research question(s) (Delport & Fouché, 2011). The numeric (quantitative) and text (qualitative) information are integrated or connected (mixed) within a single study (Delport & Fouché, 2011). According to Johnson, Onwuegbuzie and Turner (2007, p. 123), mixed-methods research is defined as:

> *[T]he type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understandings and corroboration*.

Creswell and Plano Clark (2007) state that the collection and analysis of both quantitative and qualitative data, the mixing of these data sets, as well as the possibility to collect the quantitative and qualitative data sets within a single study or within multiple studies, are important elements of mixed methods research design. Using mixed methods not only has the potential to provide stronger inferences but allows the researcher to use all possible research methods to address the research question(s), as well as to combine inductive and deductive reasoning processes (Delport & Fouché, 2011).

The four types of mixed methods designs are: exploratory mixed methods design; explanatory mixed methods design; triangulation mixed methods design; and embedded mixed methods design (Creswell & Plano Clark, 2011; Delport & Fouché, 2011). According to Delport and Fouché (2011, p. 444), choosing the type of mixed methods design depends on the following three dimensions (Table 4-1):

- the *timing* or 'sequence' of the collected data is used;
- the relative *weight* of both quantitative and qualitative approaches; and
- the approach to mixing the two datasets (i.e. the way the quantitative and qualitative datasets will be merged, embedded or connected).

Table 4-1: Dimensions and of mixed methods research design

Dimension		
Approach to mixing	**Sequence**	**Weight**
Exploratory – phenomenon is first explored by using qualitative data, then tested quantitatively (two-phased design)	Concurrent – both quantitative and qualitative methods are used at the same time within a study (indicated by the plus symbol [**+**])	Equal weight of quantitative data and qualitative data
Explanatory – quantitative data is collected and analysed first, followed by qualitative data collection and analysis (two-phased design)		Greater emphasis on quantitative (**QUAN**) data
Triangulation – quantitative and qualitative data is collected and analysed concurrently but separately, with equal weighting (one-phased design).	Sequential – quantitative and qualitative methods are used in two phases and collection and analysis of one type are done before the other (indicated by arrows [→])	Greater emphasis on qualitative (**QUAL**) data
Embedded – views a single dataset as insufficient; thus, one dataset provides a supportive role in a study based on the other dataset, and can be collected concurrently (indicated with brackets, i.e. Quan (qual))		

Source: Adapted from Delport and Fouché (2011) and Ivankova et al. (2016).

In 1991, Janice Morse developed the mixed methods notational system, which includes the use of the plus (+) symbol, arrows (→), as well as capital and lower-case letters (Table 4-1). The plus symbol is used to indicate the concurrent collection of datasets (i.e. QUAN + qual), whilst the arrows indicate sequential data collection (i.e. QUAL → quan). The use of capital and lower-case letters indicate which design is dominant, and which design is less dominant (i.e. QUAN and quan). Delport and Fouché (2011, p. 440) provide the following examples of the use of Morse's (1991) notation system:

- "QUAN → qual. This notation indicates a quantitatively driven sequential study, where quantitative data collection is followed by qualitative data collection with unequal priority.
- QUAL + QUAN. This notation indicates a qualitatively and quantitatively driven concurrent study, where qualitative and quantitative data collection occurs at the same time and are given equal priority.
- QUAN (qual). This notation indicates that the qualitative methods are embedded within a quantitative design".

During the current investigation, the researcher conducted interviews and administered an open-ended questionnaire. The data collected this way was used to add meaning to the quantitative data collected. Therefore, the explanatory sequential (QUAN → qual) mixed methods design was utilised during this investigation. This two-phased design (see Figure 4-1) started with the collection and analysis of quantitative data, followed by the collection and analysis of qualitative data. According to Creswell and Plano Clark (2011), the general aim of the explanatory sequential mixed methods design is that the narrative data is used to clarify the numeric results from the first phase of the design. A major advantage and disadvantage of the explanatory sequential mixed methods design are rooted, according to Delport and Fouché (2011), in their two-phased nature. This implies that, even though implementation of this design and reporting its results are straightforward (as quantitative and qualitative data collection are conducted separately), this design is time-consuming.

In the sections below, attention is given to the literature study, study population and sample, quantitative and qualitative data collection techniques, quantitative and qualitative data analysis, as well the ethical aspects involved.

4.3 Research method

A brief overview of the way the literature study was conducted, and the way in which quantitative and qualitative was were collected and analysed is discussed in sections 4.3.1 to 4.3.3.

4.3.1 Literature study

Finding relevant literature was done by making us of the following keywords: cooperative learning, self-directed learning, ALit, assessment feedback, self-assessment, peer assessment, participative assessment, assessment as learning, psychology of learning, social interdependence theory, and social constructivism. The following databases were used: ERIC, EBSCOhost, Google Scholar, as well as Nexus.

4.3.2 Quantitative research design

Because all the first-year students who enrolled for the LIFE 112 and LIFE 122 modules formed part of this investigation, the researcher was unable to assign participants randomly to the control and experimental groups; therefore, a quasi-experimental design was followed (Mertens, 2018). Both the experimental and control groups took a pre- and post-test, whilst only the experimental groups were exposed to the intervention.

4.3.2.1 Population and sample

Figure 4-2 outlines the population and sample (who provided informed consent) of quantitative phase of this investigation.

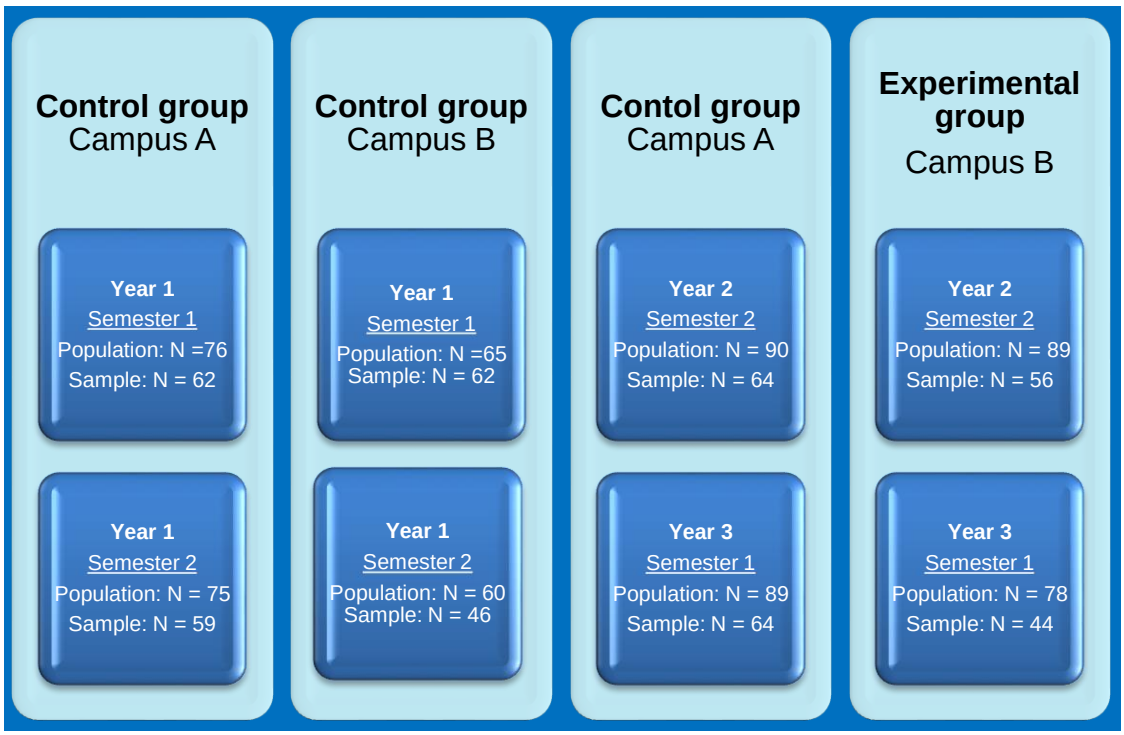


Figure 4-2: Population and sample of the control and experimental groups that provide written informed consent

Source: Author's own compilation

This investigation was carried out over a three-year period on two respective campuses (Campus A and Campus B) of a South African university. Because this investigation involved the first-year Life Sciences students, all students who enrolled for the LIFE 112 and LIFE 122 modules on both campuses who gave written informed consent, were involved in this investigation. The population of the respective years were not the same students. Non-

randomised sampling was used. Because the completion of the questionnaires was voluntary, based on who gave written informed consent, the researcher did not have control over the number of students who completed the questionnaires. This contributed to the differences in the number of students who completed the pre- and post-tests.

4.3.2.2 Data collection procedure and measuring instruments

Both the Student Assessment Literacy Questionnaire (SALQ) and the Self-Rating Scale of Self-Directed Learning (SRSSDL) were administered to the study population on both campuses at the beginning of a semester (see Figure 4-3) and at the end of a semester. During Year 1 of the investigation, the SRSSDL and SALQ were administered on both campuses at the beginning and at the end of the first semester, whilst only the SRSSDL was administered at the beginning of the second semester (see Figure 4-3). Because the SALQ is aimed at establishing students' levels of ALit, and the study population were not exposed to assessment practices during the three-week recess (between semester 1 and semester 2 of Year 1), the SALQ was not administered at the beginning of the second semester. Partaking in the completion of this phase of the investigation was voluntary, and the students were asked to complete written informed consent forms (see section 4.5). The data collected was analysed by the researcher, as well as a statistician from the Statistical Consultation Services at the South African university where the investigation took place.

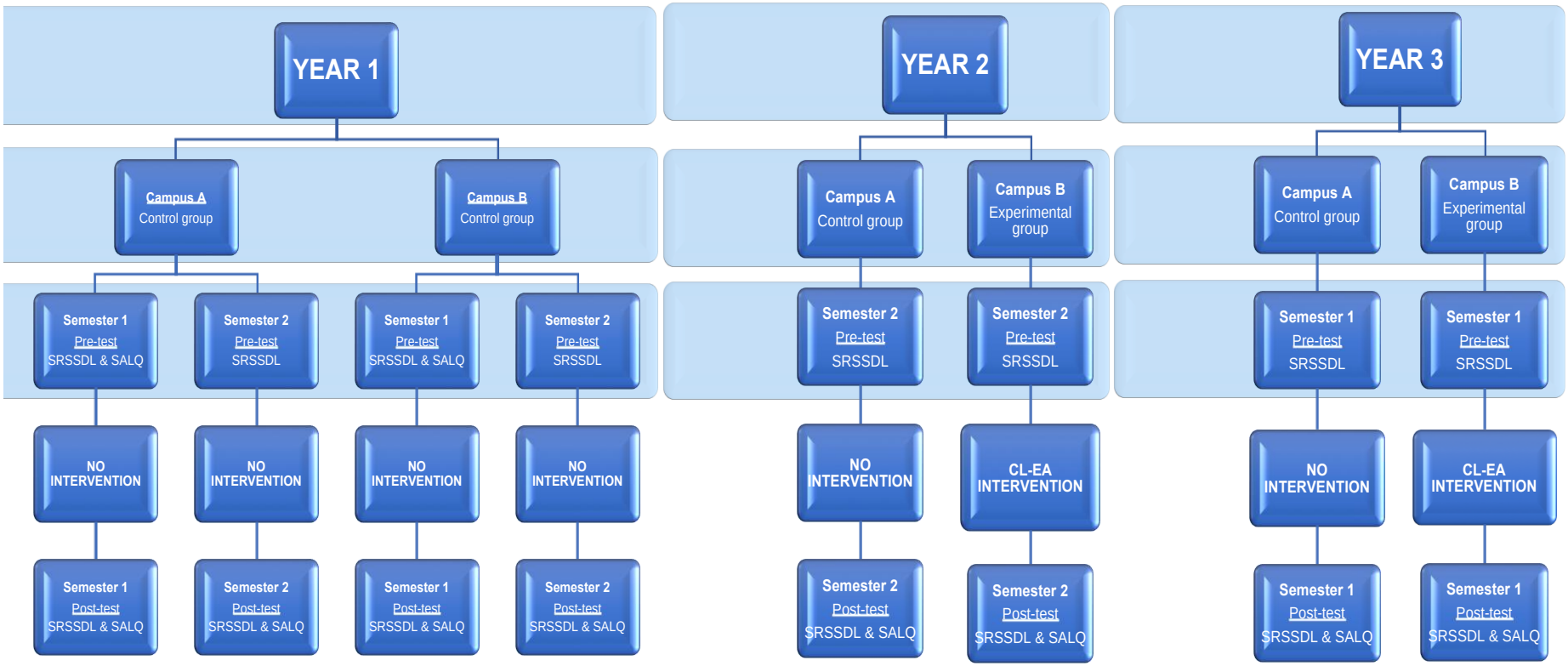


Figure 4-3: Quantitative research design followed during this investigation

Source: Author's own compilation

The SALQ (Smith et al., 2013) and the SRSSDL (Williamson, 2007) were the measuring instruments that were used for the quantitative phase of this investigation.

The SALQ is a 28-item questionnaire (Addendum A), designed to measure a range of related constructs, such as:

- "students' understanding of local performance standards;
- students' use of assessment tasks for enhancing or monitoring their learning;
- students' orientation to putting the minimum amount of effort necessary into the production of assessable work merely to comply with the course requirements; and
- students' ability to judge their own responses and those of others to assessment tasks" (Smith et al., 2013, p. 48).

Students' responses to the above-mentioned items were rated on a five-point Likert-type scale (1 = 'strongly disagree' to 5 = 'strongly agree'). Smith et al. (2013, p. 51) identify the following factors:

- "Assessment Literacy (Understanding) (AU);
- Assessment for Learning (AL);
- Minimum Effort Orientation (MEO); and
- Assessment Literacy (Judgement) (AJ)".

The factors identified for this investigation within the South African context, were:

- University's Purpose (UP);
- Assessment Understanding (AU);
- Assessment for Learning (AL);
- Minimum Effort Orientation (MEO);
- Assessment Judgement (AJ); and
- Assessment Expectations (AE).

All factors had eigenvalues greater than 1 (see section 5.2.1.1).

The 60-item SRSSDL (Addendum B) was used to measure the level of students' self-directedness towards their learning process (Williamson, 2007). The items were categorised under the following five broad areas of SDL:

- "awareness;
- learning strategies;
- learning activities;

- evaluation; and
- interpersonal skills" (Williamson, 2007, p. 70 – 71).

Responses to each item are rated by making use of a five-point Likert-type scale, ranging from 1 (never) to 5 (always). The Delphi technique (see Williamson, 2007) was used for the development of the SRSSDL, and internal reliability coefficient for each of the broad areas of the SRSSDL ranged from 0.71 to 0.79 (Williamson, 2007).

4.3.2.3 Validity

According to Pietersen and Maree (2016b), the extent to which an instrument measures what it is supposed to measure, is referred to the instrument's validity. Validity of the SALQ and SRSSDL was established by "data screening, corrected item-total correlation analysis, exploratory factor analysis (EFA) using principle axis factoring (PAF)" (Smith et al., 2013, p. 51) and Williamson's (2007) Delphi technique.

The results of the factor analysis and the correlations between the factors are discussed in detail in Chapter 5 (see section 5.2).

4.3.2.4 Reliability

Pietersen and Maree (2016b) state that the reliability of a measuring instrument refers to consistency and repeatability (i.e. using the instrument at different times or with different respondents, should yield the same findings). The Cronbach's alpha coefficient is used to determine the internal reliability of a measuring instrument and is based on the inter-item correlations (Pietersen & Maree, 2016b). Should the items strongly correlate with each other the alpha coefficient will be closer to one. An alpha coefficient closer to zero will indicate poorly formulated items that do not correlate strongly (Pietersen & Maree, 2016b). The interpretation of Cronbach's alpha coefficient, is guided by the following:

- "0.90 = high reliability;
- 0.80 = moderate reliability; and
- 0.70 = low reliability" (Pietersen & Maree, 2016b, p. 239).

Even though Pietersen and Maree (2016b) suggest the above-mentioned interpretation, an acceptable value for Cronbach's alpha coefficient has been debated by statisticians (DeVellis, 2003), and an alpha coefficient of between 0.65 and 0.80 is often deemed acceptable (Vaske, 2008). An acceptable internal reliability for the SALQ ($\alpha > 0.65$) is reported by Smith et al. (2013). Within the South African context of this investigation, acceptable Cronbach alpha coefficients for the identified SALQ factors ranged from 0.68 to 0.86 (see Table 5-1). Studies

done in South Africa, using the SRSSDL to determine the level of self-directedness in learning, report Cronbach alpha coefficients for the five categories ranging from 0.76 to 0.88 (Mentz & Van Zyl, 2016; Van der Westhuizen, 2015). These values are an indication of the reliability of the use of the SRSSDL within the South African context (Mentz & Van Zyl, 2016; Van der Westhuizen, 2015), and hence for this investigation. Further discussion follows in Chapter 5 (see section 5.2).

The following section contains a detailed discussion of the statistical techniques and methods used for the quantitative data analysis of the investigation.

4.3.2.5 Statistical techniques and methods used for data analysis

After data collection and capturing, descriptive statistics were used to "organise and summarise data in a meaningful way" (Pietersen & Maree, 2016a, p. 204). The organisation of data can be in either a graphical or a numerical way.

The analysis of the SALQ and SRSSDL data was done by making use of descriptive and inferential statistics. Independent and dependent t-tests were used, and p-values and effect sizes were calculated, but only effect sizes were interpreted.

Effect sizes, indicating practical significance, are calculated for the difference between two means, by making use of Cohen's d-value (Pietersen & Maree, 2016a). The guideline for interpreting calculated d-values are:

- "d = 0.2: small effect;
- d = 0.5: medium effect; and
- d = 0.8: large effect" (Cohen, 1992, p. 157)

Pre-test scores were analysed with independent t-tests to determine any practical significant differences in the means of the SRSSDL pre-tests on both campuses during Years 2 and 3 respectively. Independent t-tests were also used to determine any practical significant differences between the means of the SALQ pre-tests on both campuses during Year 2 and 3 respectively. Dependent t-tests were done to match and compare the pre- and post-tests of Years 2 and 3 on both campuses. To establish any practical significant differences between the mean values of the SRSSDL post-tests (for both Years 2 and 3 on Campus A and B respectively), a dependent t-test was done. Similarly, a dependent t-test was used to determine possible differences in the post-test mean values for the SALQ.

Spearman's rank-order correlation coefficients were calculated to investigate the interrelationship between the SALQ questionnaire factors and the SRSSDL post-test of the

experimental groups, and the following guidelines proposed by Pietersen and Maree (2016c) to interpret the correlation coefficients: r = 0.1: small correlation; r = 0.3: medium correlation; and r = 0.5: large correlation. Lund Research Ltd (2018) proposes the following values as guidelines. These guidelines were used in this study, for the interpretation of correlation coefficients:

	Coefficient, r	
Strength of association	**Positive**	**Negative**
Small	0.1 to 0.3	-0.1 to -0.3
Medium	0.3 to 0.5	-0.3 to -0.5
Large	0.5 to 1.0	-0.5 to -1.0

The minimum possible score for the SRSSDL is 30, and the maximum possible score is 300 (Williamson, 2007). An individual's SRSSDL score is a measure of his or her current level of readiness for SDL, and is converted to the following categories, namely 'low' (60–140), 'moderate' (141–220) and 'high' (221–300) (Williamson, 2007). The scores of the students' level of self-directed readiness for learning, was calculated by a statistician from the Statistical Consultation Services at the South African university where the investigation was conducted.

The qualitative research design (as phase 2 of this investigation) as well as the way in which the results of this phase of the mixed methods design contribute to answering the research sub-questions, are discussed in section 4.3.3.

4.3.3 Qualitative research design

As previously discussed in section 4.3, qualitative data gathering and analysis were done to add meaning to the quantitative data. According to Teddlie and Tashakkori (2009, p. 343), qualitative research is the "gathering, analysis, interpretation, and presentation of narrative information". The aim of the qualitative data was therefore to answer the sub-questions of this investigation relating to the first-year Life Sciences students' perception of CL-EA and ALit, as well as the contribution thereof to SDL competencies.

The qualitative research phase followed a basic qualitative design which, according to Merriam (2009, p. 23), is the design used by researchers who are interested in "(1) how people interpret their experiences, (2) how they construct their worlds, and (3) what meaning they attribute to their experiences. The overall purpose is to understand how people make sense of their lives and their experiences."

Figure 4-4: Qualitative research design followed during this investigation

Source: Author's own compilation

Figure 4-4 illustrates the qualitative research design followed during this investigation. The qualitative data in this investigation was gathered through an open-ended questionnaire and open-ended, semi-structured, face-to-face individual interviews. The qualitative data was gathered to add meaning to the quantitative results, and hence the open-ended questionnaire was administered at the end of each semester during Year 2 and Year 3 of the investigation (after the CL-EA intervention). The open-ended, semi-structured face-to-face interviews were also conducted at the end of semester 2 of Year 2, and at the end of semester 1 of Year 3 (after the CL-EA intervention). This was done because the researcher wanted to understand what the implementation of the CL-EA intervention meant to the first-year Life Sciences students.

4.3.3.1 Participants

All Life Sciences students in the experimental group (Campus B) during Year 2 and Year 3 of the investigation, who provided informed consent by signing the informed consent forms, completed the open-ended questionnaire. An invitation to participate in the interviews were posted on the Learning Management System (LMS) (eFundi) for the LIFE modules. Students who provided informed consent and were interested to take part in the interviews, contacted the independent researcher via email.

4.3.3.2 Data gathering procedure

The qualitative data was gathered by using textual data obtained from the open-ended questionnaire, as well as from the open-ended, semi-structured, face-to-face interviews. Maree and Pietersen (2016) state that open-ended questionnaire require that space should be provided for participants to answer the questions. These answers can be in the form of a single word, or phrases or comments, and allow for more individualised responses (Mertler & Charles, 2011). According to Maree and Pietersen (2016), the analysis of open-ended questionnaire is more difficult; however, the respondents will be able to provide honest and detailed answers. The open-ended questionnaire was administered to the experimental group of first-year Life Sciences students on Campus B (see Figure 4-4). The open-ended questionnaire comprised the following questions:

- What is, according to you, the purpose of assessment in LIFE 122/LIFE 112?
- Please explain the role that assessment played in your learning process throughout the LIFE 122/LIFE 112 module.
- In which way did the assessment practices used in LIFE 122/LIFE 112 influence your learning throughout the semester?

- In which way did the assessment practices used in LIFE 122/LIFE 112 influence your preparation for the exam?
- What is your general feeling regarding the assessment practices which were implemented in LIFE 122/LIFE 112?

DeMarrais (2004, p. 55) states that an interview is a "process in which a researcher and participant engage in a conversation focused on questions related to a research study", and Greef (2011) adds that interviews comprise the main method for qualitative data gathering. As the researcher's aim with the interviews was to gain a detailed picture of the first-year Life Sciences students' perceptions of the CL-EA intervention, the interviews were semi-structured. Although the researcher had a set of pre-structured questions, this type of interviewing allows the researcher to ask follow-up questions (Greef, 2011). The interviews, with randomly selected students, took place in a relaxed environment and did not exceed 15 minutes. Interviews are based on mutual respect, trust and rapport, therefore the interviews were conducted by the researcher herself. Once the data from the interviews were stored, the audio data were deleted from the voice recorder. All data were password encrypted and managed only by the researcher. All data will be stored in a password-encrypted electronic file for a period of seven years, after which final disposal of the data will take place. The data was treated confidentially. Member-checking by the supervisor was done in order to control for potential bias. During the interviews, the following questions were asked to the students:

- Please tell me what the assessment activities within LIFE 122/LIFE 112 mean to you.
- Please tell me of the degree to which you had the confidence to contribute and participate within the assessment activities (i.e. the 'turn-around test').
- What is your experience with the online assessments? (i.e. the post-assessment reflection).
- What was the value of the assessment activities in LIFE 122/LIFE 112 for you personally?

The analysis of the qualitative data is discussed in the next section.

4.3.3.3 Data analysis

Patton (2002) states that possible ideas for qualitative data analysis will start occurring as soon as the data is being collected; therefore, patterns and themes will start to come to mind. Nieuwenhuis (2016) concurs by stating that qualitative data analysis is a non-linear process rather than steps to be followed. Similarly, Seidel (1998) describes qualitative data analysis as an ongoing, iterative process of noticing things, collecting things, as well as thinking about things.

Nieuwenhuis (2016) says the preparation of data and the coding of the data are general steps to be followed during qualitative data analysis. During the first step of preparing the qualitative data, a detailed description of the population sample and participants is vital. This is followed by organising the data (i.e. de-identifying the participants by allocating pseudonyms instead). Transcribing the data verbatim is next, which is followed by the researcher getting to know the data inside out. Coding is a way of organising and managing qualitative data (Merriam, 2009), and is done through reading through the transcribed text, and dividing the text into “meaningful analytical units” which a code or label is assigned to (Nieuwenhuis, 2016, p. 116).

Coding, which is done by means of predetermined analytical units, is known as a priori coding, whilst open coding refers to coding done through emerging analytical units identified after examining the data (Nieuwenhuis, 2016). Axial coding is done when new relationships between categories and their sub-categories have been identified (Schurink, Fouché, & De Vos, 2011). Selective coding refers to the selection of a main category, and linking this category with other categories (Nieuwenhuis, 2016; Schurink et al., 2011). The researcher made use of a priori coding for analysing the qualitative data in this investigation. Coding can be done either by making use of a transcript (Taylor & Gibbs, 2010), or by making use of Computers and Qualitative Data Analysis Software (CAQDAS) (Merriam, 2009).

Figure 4-5 aims to illustrate the procedures that were followed during the qualitative data analysis of this investigation.

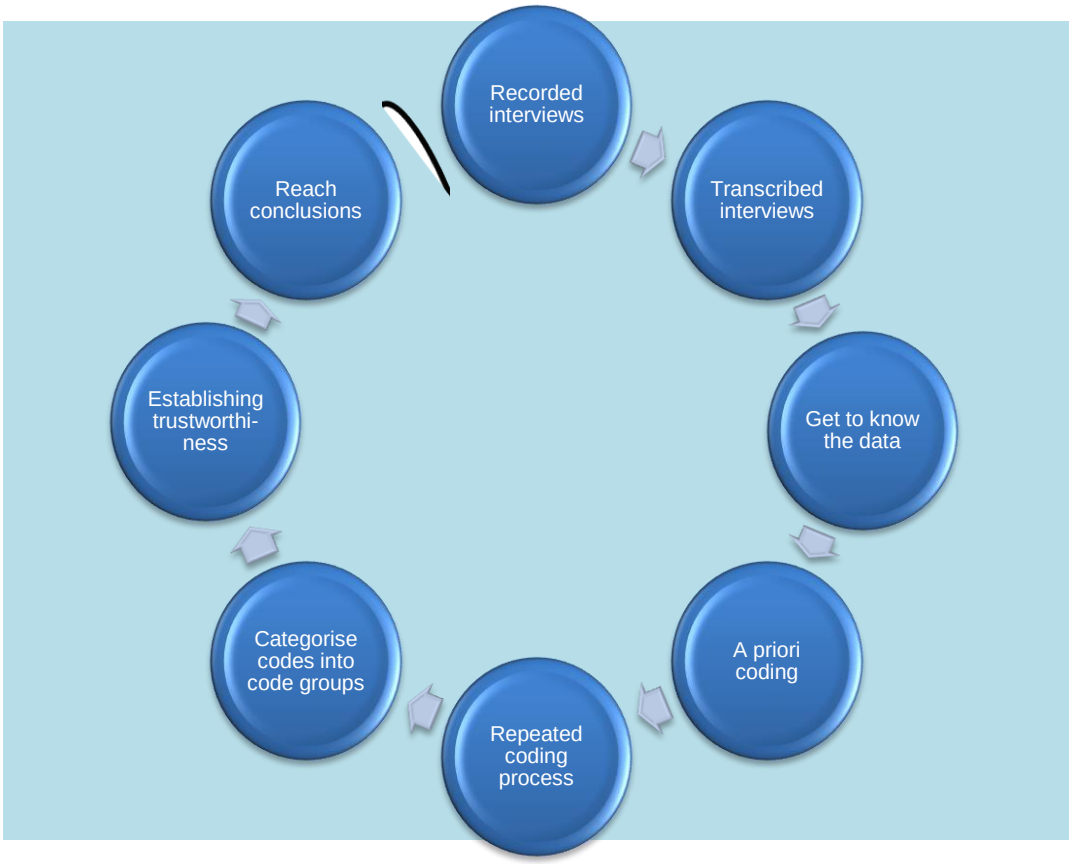


Figure 4-5: Qualitative data analysis procedures

Source: Author's own compilation

During this investigation, the researcher made use of ATLAS.ti™ (a type of CAQDAS) to construct code lists, retrieve coded text, examine coded text, as well as writing memos linked to codes (Taylor & Gibbs, 2010). The ways in which trustworthiness and credibility were established, are discussed next.

4.3.3.4 Trustworthiness

Assessing the quality of qualitative research is of the utmost importance (Nieuwenhuis, 2016; Schurink et al., 2011). According to Guba (1981), credibility, transferability, dependability and confirmability are the criteria that qualitative researchers need to consider ensuring a trustworthy study.

Credibility refers to the believability and trustworthiness of the research. During this investigation, credibility was established through:

- verbatim transcription of interviews;
- making interpretations in consultation with my promoter;

- seeking expert advice from my promoter, to safeguard against potential bias;
- carefully selecting the participants' quotes to ensure that the argument at hand was fully supported; and
- stating identified limitations within this investigation upfront, which will ensure that the way in which the conclusions were drawn, is clear to the reader.

Transferability relates to the generalisability of the research findings, which was established during this investigation through the following:

- verbatim transcription of interviews; and
- avoiding generalisation across the study population with the aim to gain better understanding regarding the participants' perspectives.

Dependability is described by Merriam (2009) as the extent to which the research findings can be replicated within a similar context, as well as with similar participants. Dependability was established through:

- making interpretations in consultation with the researcher's promoter;
- using qualitative data to make sense of the quantitative data, therefore multiple-data instruments were used (triangulation of data); and
- meticulously analysing negative cases and discrepancies.

Confirmability refers to the extent to which the research findings are confirmable when being researched by others. During this investigation, confirmability was established through:

- verbatim transcription of interviews;
- making interpretations in consultation with the researcher's promoter;
- using audio recorders to record the interviews; and
- seeking expert advice from the researcher's promoter, to safeguard against potential bias.

These four strategies could enhance the trustworthiness of this investigation. Equally important were the ethical guidelines in research. Next, the ethical aspects applicable to this investigation are discussed.

4.4 Ethical aspects

Since this investigation involved acquiring information from human beings, it was important to protect their rights and interests (McMillan & Schumacher, 2001). Permission, covering all ethical aspects of this investigation, were obtained from the EduREC (Faculty of Education Research Ethics Committee) of the university where the investigation took place. Although all

the first-year students who enrolled for the Life Sciences modules (LIFE 112 and LIFE 122) were exposed of the CL-EA intervention in this study, participating in the completion of the SRSSDL, the SALQ, the open-ended questionnaire, as well as taking part in the semi-structured interviews, was voluntary. Only data of students who provided informed consent could be included in this thesis. The participants' privacy was respected throughout the investigation, and all data was treated confidentially. SRSSDL and SALQ scores, as well the text data from the open-ended questionnaire and the interviews, were safeguarded by making use of password encryptions. Only the researcher, the researcher's promoter, as well as the statistician had access to the data. Due to the pre-test post-test nature of the investigation, only partial anonymity could be ensured. The interviews were conducted during the day, in a safe and comfortable setting, and participants were not interviewed for longer than fifteen minutes. All recorded interviews were deleted from the audio-recorder once the transcription process had been finalised. All data will be safeguarded for a period of seven years, as required by the ethics committee of the university, after which final disposal will take place. Since the CL-EA intervention was part of the teaching–learning strategy of the Life Sciences module, students not partaking in the data collection of the investigation were not at a disadvantage as they were also part of the CL-EA intervention.

The researcher made use of an independent researcher to explain the scope of the research, after which the informed consent forms were completed. The informed consent form covered the following:

- the request to first-year Life Sciences students to participate in the study;
- an explanation of the purpose and nature of the investigation;
- the details of the researcher and the nature of her expertise;
- the details of the project leader (promoter), the nature of her expertise, as well as her contact details;
- assurance that first-year Life Sciences students had a choice to participate voluntarily in the completion of the SRSSDL, SALQ, open-ended questionnaire, as well as the interviews, or not;
- the estimated time it would take to complete the questionnaire;
- reassurance that students refusing to partake in the completion of the questionnaire and interviews would not be penalised;
- reassurance that choosing to participate could be revised at any time during the investigation, and withdrawing would not have any consequences;
- an explanation of any potential risks and benefits of the investigation;
- assurance that participants had the right to be informed of relevant findings of the investigation;

- ensuring participants about the extent to which confidentiality is possible;
- assurance of the approval of the investigation by the EduREC; and
- guarantee that participants who decided not to partake in the data collection process, would still be part of the CL-EA intervention, as the intervention was linked to the normal class activities of the Life Sciences modules on Campus B.

All the data collected and analysed during this investigation will be communicated when addressing the research questions in the researcher's thesis.

4.5 Role of the researcher

The researcher assumed a participatory role in both phases of the investigation because:

- the researcher was the lecturer of the LIFE 112 and LIFE 122 modules for the experimental group (Campus B) at the university where the investigation was conducted;
- the researcher was responsible for preparing, structuring and conducting the interviews with the participants of the experimental group who provided informed consent; and
- the researcher collected and analysed the quantitative and qualitative data of this study.

This participatory role of the researcher could have led to the researcher developing friendly and supportive relationships with some participants, which may have created potential biases. Meticulous record-keeping, engaging with her promoter and including a clear and detailed description of the research process, were used to ensure the accuracy of the findings.

The independent researcher was responsible for:

- providing students with the scope of the investigation;
- administering the informed consent forms;
- administering the SRSSDL and SALQ;
- administering the CL-EAQ; and
- communicating with the interviewees.

4.6 Intervention

The implementation of the CL-EA intervention required extensive planning with the selection of assessment activities, embedded within CL, done timeously and purposefully. Three different types of assessment instruments, each of which made use of self- and peer assessment methods, were implemented. An assessment as learning approach was followed,

and results were aimed at both forms of assessment (summative and formative). The three assessments were a turn-around test, a memo–peer test, and a peer-individual-peer and self-reflection (P-I-P&S) test. A brief outline of each of the three assessments is presented in Figure 4-6 below and is discussed subsequently.

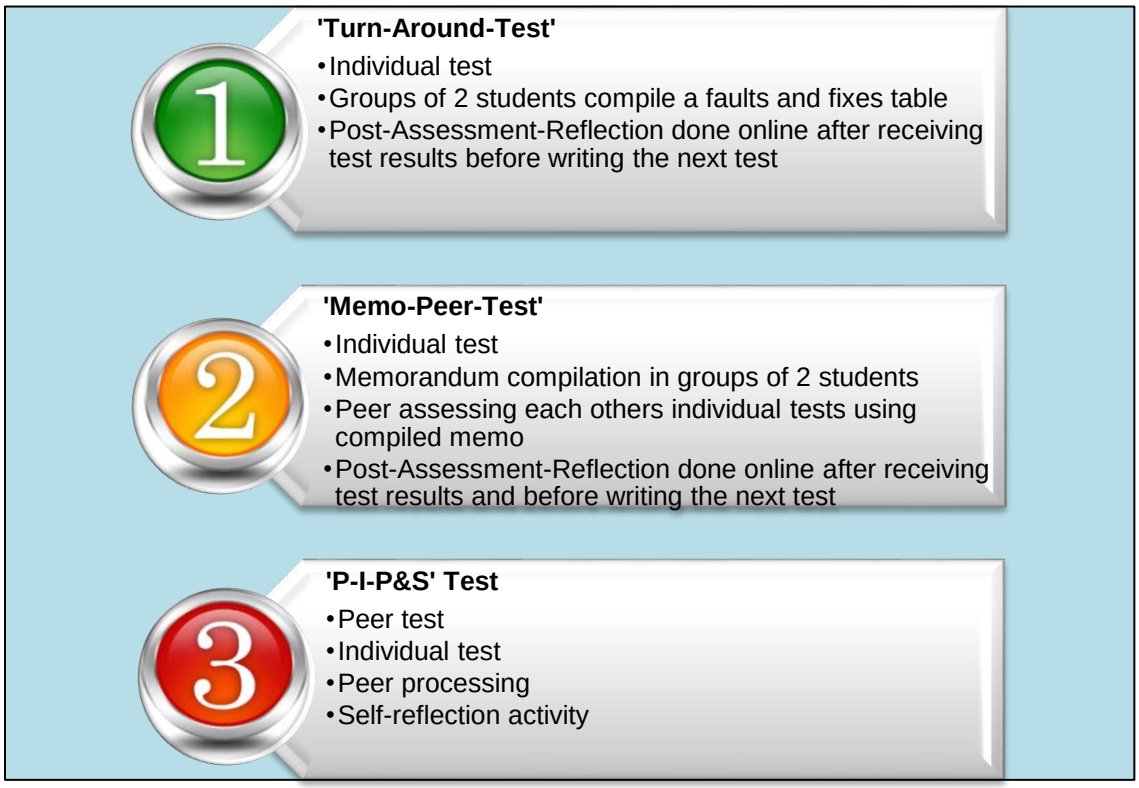


Figure 4-6: Outline of the implemented assessment instruments for CL-EA

Source: Author's own compilation

Turn-around test

During the turn-around test, students first wrote an individual test, and were instructed to stay seated after the elapsed time. Students knew that they were going to write a test but were unaware of the participative nature of the test. After completing the individual test, the lecturer collected the tests and instructed the students to form groups of two. The seating arrangements in the lecturer hall enabled students to sit in groups of six around a round table (see Figure 4-7). Therefore, students primarily paired off with other students sitting beside them (indicated by the colours in Figure 4-7 below).

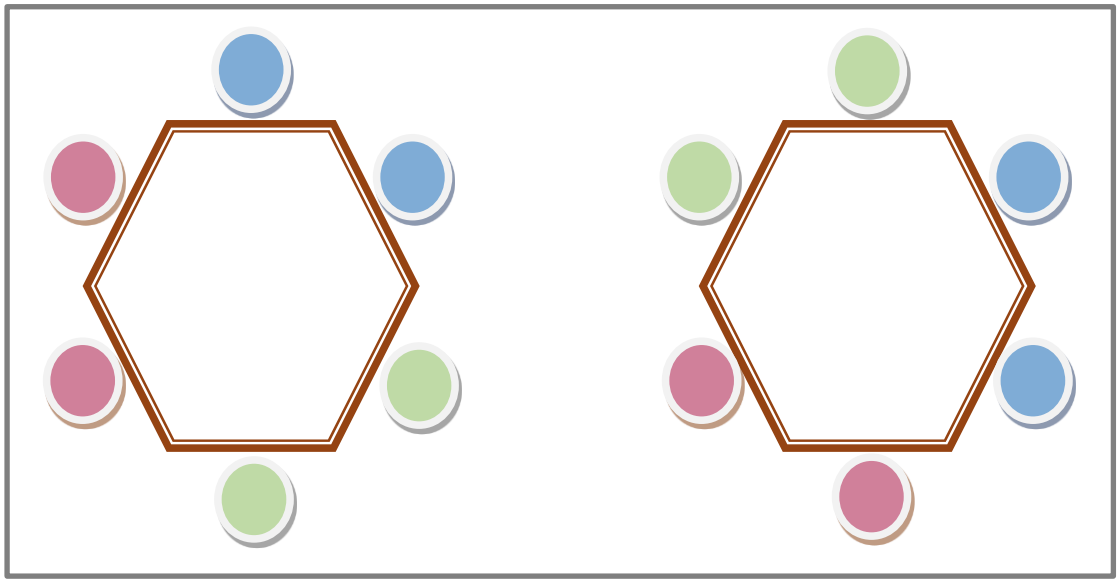


Figure 4-7: Seating arrangements in lecture hall for turn-around test

Source: Author's own compilation

Each pair then received one copy of a completed individual test. This test was identical to the test that the students wrote individually; however, some of the answers within this test copy were correct, others were incorrect, while some answers were incomplete. The pairs had to work through the completed test, discussing and considering each other's answers from the individual tests, to compile a faults and fixes table. The faults and fixes table is a table consisting of columns with all the incorrect and incomplete answers (with the relevant question numbers) in one column, and the correct answers in another column. Within the given time, students had to discuss the answers in order to reach consensus on which questions they were going to include in their faults and fixes table. During this time, the lecturer acted as a facilitator and moved from group to group in order to provide feedback when and where needed. Without exception, all groups were actively involved in discussing and elaborating on their individual answers for the successful completion of their group's faults and fixes table. The lecturer observed several groups discussing their faults and fixes possibilities with other groups for clarity. After the completed faults and fixes tables had been submitted, the lecturer facilitated whole-class group processing. This was done by prompting students to identify concepts and aspects about which, based on their individual tests and faults and fixes tables, they were unclear. From the observations made by the lecturer during the faults and fixes phase of the turn-around test, feedback was provided on specific aspects.

Both the individual test and the faults and fixes table were assessed by the lecturer with the aid of a memorandum. The final mark for each student's turn-around test consisted of the

individual test and the faults and fixes table. Once the lecturer had assessed the tests, and students had received their final test score, each student had to complete an online self-reflection activity called the 'post-assessment reflection'. With the aid of the university's LMS (eFundi), the lecturer was able to embed the reflection document from Google Forms (see Addendum C). Students were prompted to complete the 'post-assessment reflection' (P-A-R) before the next scheduled test. The purpose of the P-A-R was to provide an opportunity for students to reflect on the effectiveness of their current learning strategy, as well as to interpret and reflect on their expected and obtained achievement. Students were furthermore prompted to narrate their strategy for the next assessment opportunity. The P-A-R is an open-ended reflection document, enabling students to elaborate on each of the prompts. No additional marks were allocated for the completion of this reflective activity. The lecturer also read through each of the P-A-Rs in order to determine whether there were major discrepancies between the expected and obtained achievements.

Memo–peer test

During the memo–peer test, students again first wrote an individual scheduled test. Again, they were unaware of the participative test they were also going to write. Once again students had been instructed to stay seated after finishing their individual tests until the set time had run out. One student pair (see Figure 4-7) was then instructed to collect the individual tests and place them face down in the middle of the table. After students had been instructed to work in groups of two, a blank copy of the same test was handed out to each pair. By making use of their textbooks, study notes as well as additional resources, students then had to compile a memorandum. The memorandum had to consist of all possible answers, as well as a mark allocation for each question. Students had to work together, discussing their answers from the individual tests, as well as referencing their study material in order to compile a memorandum. The lecturer observed several groups giving assistance to each other and receiving assistance from one another. The fact that only one copy of the blank test was available amongst student pairs ensured positive interdependence as well as promotive interaction. During this time, the lecturer acted as facilitator and moved between the groups. Once all the groups had finished their memorandums, the individual tests were handed back to them. Within the groups of two, students were instructed to assess their peer's individual test by making use of the memorandum they had compiled. During this time, the lecturer acted as a facilitator by moving between the groups.

After the peer assessment stage, students had to complete a hard copy reflection document for the student whose test they had just assessed. The refection document prompted the student assessor to provide detailed feedback to his or her peer in terms of specific aspects

of the relevant topic that needed further attention. Furthermore, the reflection document prompted the student assessor to praise his or her peer for specific aspects of the relevant topic which he or she had mastered successfully. The aim of this reflection document was not only to provide immediate feedback to peers, but also to enable the student assessors to think critically when linking the way in which questions were answered with learning outcomes of the relevant study unit assessed. Being able to evaluate answers in order to obtain a picture of achieved or unachieved learning outcomes, is an important skill needed by students and educators alike. The individual tests, which were peer-assessed, the student-compiled memorandums as well as the peer-completed reflection documents were submitted to the lecturer. Although the lecturer only assessed the individual tests, all the documents submitted were studied. Once the lecturer had studied the student-compiled memoranda of all the groups, major aspects sprouting from the way in which these memoranda were constructed, were discussed during a class session. Since students had access to their textbooks, their study notes and additional resources, the whole-class group processing did not focus on the content, but rather application of knowledge in different/other contexts and on the functioning of the small-groups (within their pairs). Therefore, students were instructed to give each other a high five, and to elaborate on the aspects where they had perceived their groups did well, as well as aspects which they had perceived could have been done better.

Once students had received their final test score, each student had to complete an online self-reflection activity called the 'post-assessment reflection' (P-A-R). With the aid of the university's LMS (eFundi), the lecturer was able to embed the reflection document from Google Forms (see Addendum C). Students were prompted to complete the P-A-R before the next scheduled test. The purpose of the P-A-R was to provide an opportunity for students to reflect on the effectiveness of their current learning strategy, as well as to interpret and reflect on their expected and obtained achievement. Students were furthermore prompted to narrate their strategy for the next assessment opportunity. The P-A-R is an open-ended reflection document, enabling students to elaborate on each of the prompts. No additional marks were allocated for the completion of this reflective activity. The lecturer also read through each of the P-A-Rs in order to determine whether there were major discrepancies between the expected and obtained achievements.

Peer-individual-peer processing and self-reflection test

Students were not briefed about the participative test they were about to write. They were instructed to sit in groups of two (see Figure 4-7), and each pair received a copy of the test. They were prompted to write the test within their groups, by discussing the possible answers, and reaching consensus about the correct answer. During this phase of the test, the lecturer

acted as a facilitator and moved between the groups. The lecturer observed the interaction within the groups and provided feedback when needed. Once the students had finished the test, they were instructed to stay seated. The lecturer collected the tests after the elapsed time, and then informed students that they were going to write an individual test as well. Several students requested a couple of minutes, after the pair test, to double-check aspects of the content before writing the individual tests. The individual test did not differ in content from the peer test; however, some of the figures and diagrams were changed and the order of some of the questions was changed. This was done to minimise the possibility that under-prepared students had memorised some of the answers whilst writing the pair test. Each student was handed a copy of the individual test and was prompted to write the test in the set time. After the individual tests had been written and submitted to the lecturer, students were prompted to do group processing within their groups of two. The lecturer suggested that they congratulate each other on aspects where they thought they had done well within their group and requested them to discuss possible improvements to be made in case a similar test had to be taken in future. Because the P-I-P&S test was the last test that the first-year Life Sciences students wrote for the module, the lecturer made use of a hard copy self-reflection document instead of the usual online P-A-R. The self-reflection document prompted students to reflect on the effectiveness of their current learning strategy, as well as to interpret and reflect on their expected and obtained achievements. The lecturer assessed the peer and individual tests with the aid of a memorandum and analysed the self-reflection documents. The final test score consisted of all three components of the P-I-P&S test and was calculated in the following manner: 40% of the peer test mark plus 60% of the individual test mark. An additional 10 marks were added to the total mark for the completion the self-reflection activity.

Table 4-2 below summarises the ways in which each of the CL-EA characteristics (see Figure 3-1) were purposefully structured within the intervention.

Table 4-2: Ways in which CL-EA characteristics were structured

This CL-EA characteristic …	was structured through …
Social activity (see 2.2.2)	• writing tests together in CL groups • small CL groups • participative nature of the assessment activities
Metacognitive reflection (see 2.3.1.3)	• completing P-A-R • completing reflection documents • discussing individual answers during the CL group test in order to reach consensus on the correct answer

This CL-EA characteristic …	was structured through …
Formative and summative forms (see 2.3.1.1)	• test results contributed towards students' module mark • test results were used (via reflection and group processing) to inform students and lecturer about teaching and learning practice • emphasis was not placed on the marks, but on informing students that the focus is solely on the learning process and that marks can be deceiving
Immediate feedforward (see 2.4)	• writing an individual test after a CL group test • writing a CL group test after writing an individual test • including peer assessment • completing P-A-R • completing reflection documents • have whole-class and small-group processing
Positive interdependence (see 3.2.2.1)	• the participative nature of the tests – task interdependence and goal interdependence • giving a single copy of the CL group test – resource interdependence • small CL groups (2 or 4 students per group) • face-to-face seating arrangements in class – environmental interdependence not informing students beforehand about the participative structure of the tests
Individual accountability (see 3.2.2.2)	• having an individual test in conjunction with a CL group test • larger weighting of the individual test compared to the CL group test
Promotive face-to-face interaction (see 3.2.2.3)	• small groups (2 or 4 students per group) • face-to-face seating arrangements • exchanging information when writing tests together • giving and receiving feedback on teamwork and taskwork • challenging each other's reasoning
Small-group social skills (see 3.2.2.4)	• discussing individual answers during the CL group test in order to reach consensus on the correct answer • listening to each other's opinions and views • having whole-class and small-group processing • including peer assessment • including writing of peer reflection document after completing peer assessment

This CL-EA characteristic …	was structured through …
Group processing (see 3.2.2.5)	• prompting reflection on how effective the groups worked together • describing helpful actions of group members • discussing behaviours which need to change • prompting the whole class to reflect on the content after an assessment activity – also based on the facilitator's observations
Learning through assessment	• allowing students to make use of resources when compiling the memo for the memo-peer-test • writing an individual test in conjunction with a CL group test which allows immediate feed forward – participative assessment • including self- and peer assessment • discussing individual answers during the CL group test in order to reach consensus on the correct answer

Source: Author's own compilation

The implementation of the CL-EA intervention (turn-around test, memo–peer test, P-I-P&S test, as well the reflective instruments used) were carefully planned to ensure that students retain their individual accountability and that all the CL-EA characteristics were structured (see Table 4-2).

Noteworthy is the teaching–learning philosophy of the researcher, who was also the lecturer implementing the CL-EA intervention. Since she followed a social constructivist approach to teaching and learning, she made use of active teaching and learning strategies during the LIFE 112 and LIFE 122 modules on Campus B (Years 1, 2 and 3). Therefore, students were not exposed to lecturing. The LMS (eFundi) of the university where the investigation was conducted, was utilised to provide students with the semester planning, and included the work that students had to prepare for each of the scheduled classes. The researcher made use of a variety of active teaching and learning activities, during which she acted as the facilitator. Jigsaw (Johnson et al., 2007), cooperative SNAP! and cooperative silent-card shuffle (Rahmawati & Fitriati, 2017) are examples of the activities that were done in both LIFE modules on Campus B during the study. The teaching–learning strategy followed on Campus A was a more traditional approach with no CL-EA activities.

4.7 Summary

The first section of this chapter gave a detailed discussion of the implementation of the CL-EA intervention, which was followed by an outline of the pragmatic research paradigm from which this mixed methods investigation was done. Components of the mixed methods research design were discussed, and the choice for the explanatory sequential design was justified. Both the quantitative and qualitative research designs were discussed. The SRSSDL, the SALQ, the open-ended questionnaires and the semi-structured, face-to-face interviews were used to collect and gather qualitative data from the first-year Life Sciences students (experimental group) during this investigation. Procedures that were followed to ensure the validity and reliability of the quantitative data collection, as well as the trustworthiness of the qualitative data gathering, were also elaborated. A detailed description of the statistical techniques and methods that were used to analyse the quantitative data and of the process followed to analyse the qualitative text data, was provided. Finally, the ethical aspects for both phases of this mixed methods investigation were discussed. This was followed by a description of the researcher's role. The next chapter will present a discussion of the analysis and interpretation of the quantitative and qualitative data.

CHAPTER 5 RESULTS AND ANALYSIS

5.1 Introduction

The analysis of the quantitative and qualitative results, obtained according to the research design and methodology described in Chapter 4 is presented in this chapter. Quantitative data was collected by means of the SALQ and the SRSSDL questionnaires in order to determine the influence of CL-EA on first-year Life Sciences students' ALit and SDL, as well as to establish the relationship between students' ALit and their self-directedness to learning. Qualitative data was gathered by means of an open-ended cooperative learning-embedded assessment questionnaire and semi-structured interviews in order to determine the first-year Life Sciences students' perception of CL-EA.

The reliability and validity of the applicable measuring instruments (SALQ and SRSSDL) were determined and are discussed first. Thereafter the results of this investigation are discussed based on the following research sub-questions (see section 4.1):

- What is the influence of CL-EA on first-year Life Sciences students' ALit?
- What is the influence of CL-EA on first-year Life Sciences students' SDL?
- What are first-year Life Sciences students' perceptions of CL-EA?
- What is the relationship between students' ALit and their self-directedness to learning?

Some of the results will be interpreted in this chapter in order to answer the research sub-questions in Chapter 6. The remaining two research sub-questions, pertaining to what CL-EA and ALit within the context of social constructivism entail, as well as the way in which CL-EA can be implemented in Life Sciences classes, are rooted in the literature review (Chapters 2 and 3) of this investigation, and will be answered in Chapter 6.

5.2 Reliability and validity of the measuring instruments

In order to report on the data collected from the SALQ and the SRSSDL, the reliability and validity thereof were calculated, and the findings are briefly outlined in the sections that follow.

5.2.1 Student assessment literacy questionnaire

The calculated Cronbach's alpha values for the six factors of the SALQ were greater than 0.65 (see Table 5-1), which confirms the reliability of the constructs for the population for which it was used. This implies that the SALQ is reliable to create reproducible results.

Factor analysis was used to determine the construct validity of the SALQ. To establish whether a factor analysis will produce well-defined factors for the population it was used to obtain values for the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy, and Bartlett's test of sphericity was performed. While Hutcheson and Sofroniou (1999) state that values between 0.8 and 0.9 are great, Kaiser (1974) states that values greater than 0.5 are acceptable. For the SALQ in this study, the KMO value of 0.851 implies that there was a great possibility that factor analysis would yield well-defined factors. Regarding the Bartlett's test of sphericity, small values (below 0.05) of the significance level indicated that a factor analysis may well be useful with the data.

A confirmatory factor analysis (CFA) was done in order to determine whether the items were grouped together meaningfully. This was done by means of the Oblimin-rotation method and Kaiser normalization. All factors with a value greater than 1 were, in compliance with Kaiser's criterion, extracted. After extraction for this investigation, communality varied between 0.301 (Item 22) and 0.853 (Item 28). It was not necessary to remove any of the items from the SALQ. The result from the CFA for the SALQ, with the communalities of the different items, the number of items per factor, the factor description, the Cronbach alpha coefficient of the factors, and the percentage variance declared per factor are presented in Table 5-1 below. A discussion of the factors will follow in Table 5-1.

Table 5-1: Items per factor, the factor description, communalities of the different items, Cronbach's alpha coefficients, and percentage of variance for identified factors based on SALQ responses

Items	Factor number	Communalities after extraction	Factor description	Cronbach alpha coefficient	% of Variance
23	1	0.650	AJ – assessment judgement	0.789	25.34
24		0.607			
25		0.633			
26		0.642			
11	2	0.703	MEO – minimum effort orientation	0.695	33.72
12		0.583			
13		0.697			
14		0.626			
1	3	0.745	UP –university's purpose	0.681	40.48
2		0.702			
3		0.545			
4		0.446			
16	4	0.663	AU – assessment understanding	0.868	46.08
17		0.739			
18		0.767			
19		0.723			
20		0.619			
21		0.659			
22		0.541			
6	5	0.419	AL – assessment for learning	0.697	51.18
7		0.678			
8		0.618			
9		0.538			
10		0.466			
15		0.663			
27	6	0.708	AE – assessment expectations	0.766	55.79
28		0.769			
29		0.671			

According to Field (2013), the closer the communalities value is to 1, the better the factors are compiled in order to explain the original data. For all the SALQ factors within this study, the communalities values were above the norm value of 0.3. This implies that all the items in a factor play a role in the interpretation of that factor, although the larger the communalities value, the greater the role.

The pattern matrix and correlation matrix for the items included in the SALQ are outlined in Tables 5-2 and 5-3 respectively. The factor loading of the pattern matrix is an indication of the relative contribution of each item to the factor (Field, 2013). 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.

Based on the pattern matrix (Table 5-2), the following six factors were identified: university's purpose with assessment (UP), use of assessment tasks for enhancing or monitoring learning (AL), minimum effort orientation (MEO), understanding of local protocols and performance standards (AU), ability to judge their own and peers' work (AJ), as well as expectations of assessment grade (AE). Item 5 refers to students' perception of the use of assessment by the university to compare students with each other, and since Item 5 did not load with any of the other factors, this item will be discussed separately. Four (AU, AL, MEO, AJ) of the six identified factors were similar to the factors identified by Smith et al. (2013). For the purpose of this study, the six identified factors were used for further discussions regarding students' ALit (see Table 5.2).

Factor 1 consisted of four items (Items 23, 24, 25 and 26), which addressed students' ability to judge their own and their peers' work. Items 23, 25 and 26 dealt with the ability to make use of self-assessment methods (i.e. "I feel confident I could judge my own work accurately using my knowledge of the criteria and achievement standards provided"), while item 24 deals with students' ability to use peer assessment (i.e. "I feel confident I could judge my peer's work accurately using my knowledge of the criteria and achievement standards provided"). In the literature review (see 2.3.1.4), peer and self-assessment methods were discussed to support the development of self-reflections skills, and furthermore to let students take responsibility for their own learning. As discussed in Chapter 2 (see 2.6), taking responsibility for one's own learning is a characteristic of a self-directed learner. During further discussions regarding the SALQ, Factor 1 will be referred to 'assessment judgement' (AJ).

Factor 2 consisted of Items 11, 12, 13 and 14, which addressed students' minimum effort orientation, i.e. passing the course with as little work as possible (Item 11) and using assessment to work out the minimum work needed to pass (Item 13). Item 12 referred to doing assessment because it is compulsory (i.e. "I do assessment because I have to"), whilst Item 14 referred to the use of assessment to decide which level of work should be done to obtain the desired mark. In the literature review for this investigation (see section 2.2.1), the traditional assessment practices were discussed to be mostly summative in nature and primarily focused on grading. In such cases, 'teaching to the test' (see section 2.3.1.1) usually occurs. This causes assessment practices not to be utilised as learning opportunities, which

might lead to students only wanting to put the minimum amount of effort into assessment activities merely to pass. Having a minimum effort orientation (MEO) is not desirable for ALit or SDL. Further discussions relating to this factor of the SALQ, will be referred to as 'minimum effort orientation' (MEO).

Factor 3 consisted of items regarding students' perception of the university's purpose with assessment, i.e. it advances learning (Item 1), it helps to ascertain the quality of work (Item 2), and it provides a grade which enables obtaining a degree (Item 4). Item 3 indicated students' perception that the work they produce can be judged for marking and grading purposes by the university. As pointed out in section 2.5.3 of the literature review, one of the ways in which students' ALit can be improved is through the conceptual understanding of assessment and assessment processes. Understanding the purpose of assessment within the university context in this investigation, might assist students to develop an in-depth conceptual understanding of assessment and related processes. For the purpose of this investigation, Factor 3 and its items will be referred to as 'university's purpose' (UP).

The items within Factor 4 addressed students' understanding of local protocols and performance standards. Item 16 addressed students' understanding of the rules applying to assessment, Item 17 indicated students' understanding of the assessment procedures in the faculty, and Item 22 indicated students' confidence in fair assessments by the faculty. The factor loading for Item 22 was higher for Factor 4 (factor loading = 0.394) than for Factor 3 (factor loading = -0.366) (see Table 5-2). Items 18 and 19 addressed students' understanding of the criteria and standards against which their work would be assessed. Item 20 referred to students' understanding of what they had to do to advance their learning and to achieve their desired outcome. Item 21 addressed students' understanding of what they needed to do in the assessment task to obtain the desired mark. Item 21 had a higher factor loading (0.513) for Factor 4 than with Factor 1 (factor loading = 0.293) (see Table 5-2); hence, the inclusion of this item in Factor 4. The relationship between the items in Factor 4 indicates that students need to grasp the rules of assessment, assessment criteria, as well as achievement standards in order to enhance their ALit. The relationship between these items and the students' understanding of what they need to do for expected achievement, as well as students having confidence in fair assessment for enhanced ALit is evident. Further discussions regarding Factor 4 and its items, will make use of the term 'assessment understanding' (AU).

The items within Factor 5 addressed students' use of assessment tasks for enhancing or monitoring their learning. Items 6 and 9 addressed the use of assessment to figure out what is important and what the expected achievement standards are (i.e. "I use assessment to figure out what is important"). Item 7 addressed the learning that took place through the

assessment tasks (i.e. “I learn more when I do the assessment tasks”). Item 8 indicated the use of assessment to determine how much of the content is understood (i.e. “I use assessment to show me how much of the course content I understand”). Item 10 addressed the degree to which students used assessment to figure out how well they were doing. Item 15 loaded within this factor (factor loading = -0.493) (Table 5-2) and referred to students being more interested in understanding the course than merely passing the course (i.e. “I am more interested in advancing my understanding in this course than just passing”). The relationship between the items within Factor 5 is an indication that for enhancing students’ ALit, students need to be able to use assessment to enhance and monitor their learning. The ability to monitor one’s learning is furthermore a characteristic of a self-directed learner (see 2.6). Factor 5 and its items will, for the purpose of this study, be referred to as ‘assessment for learning’ (AL).

Factor 6 consisted of Items 27, 28 and 29 and related to students’ ability to obtain the mark they expected. Item 27 referred to students’ confidence that they would get the mark or grade they expected for the work submitted (“Rate your confidence that you will get the mark or grade you expect for the work you submit”). Item 28 referred to students’ ability to produce work at the achievement standard that would ensure the mark they wanted (“Rate your ability to produce work at the achievement standard that will get you the mark or grade you want”), whilst Item 29 referred to students’ ability to use the criteria and achievement standards to guide them in producing the work that would get them the desired mark or grade (“Rate your ability to use the criteria and achievement standards to guide you in producing the work that will get you the mark or grade you want”). The relationship between these items is an indication of the value of reflecting on the expected mark or grade towards enhancing one’s ALit. For the purpose of this study, further discussions regarding Factor 6 and its items will be referred to ‘assessment expectations’ (AE).

Item 5 (“I think the university makes me do assessment to compare students with each other”) did not load well with Factor 2 (factor loading = 0.383) or with any other SALQ factor. This item will be discussed separately, and will be referred to as ‘CS’ (Q5).

Table 5-2: Pattern matrix: first-year Life Sciences students' responses

Pattern matrix						
	Factor					
	1	2	3	4	5	6
Q 1			-0.778			
Q 2			-0.822			
Q 3			-0.548			
Q 4			-0.614			
Q 5		0.383				
Q 6					-0.458	
Q 7					-0.717	
Q 8					-0.703	
Q 9	0.299				-0.481	
Q 10	0.365				-0.301	
Q 11		0.772				
Q 12		0.690				
Q 13		0.783				
Q 14		0.551				
Q 15					-0.493	
Q 16				0.648		
Q 17				0.793		
Q 18				0.845		
Q 19				0.814		
Q 20				0.610		
Q 21	0.293			0.513		
Q 22			-0.366	0.394		
Q 23	0.716					
Q 24	0.721					
Q 25	0.683					
Q 26	0.688					
Q 27						0.800
Q 28						0.853
Q 29						0.603

A variety of factor analysis criteria were upheld to ensure the validity of the SALQ:

- the KMO measure of sampling adequacy, was acceptable (0.851);
- Bartlett's test of sphericity was significant (χ^2 (406) = 3192.218, $p < .05$);
- item correlations to at least one other item by 0.3; and
- communalities were at least 0.3 or higher.

These results indicate that the SALQ was a valid instrument for measuring students' assessment literacy in this investigation.

5.2.2 Reliability and validity of the self-rating scale of self-directed learning

The calculated Cronbach alpha value for the five SRSSDL constructs ranged from 0.73 to 0.83, which confirms the reliability of the SRSSDL for the population for which it was used. This implies that the SRSSDL is reliable to create reproducible results. It also confirms that the SRSSDL was reliable within the context of this investigation, and hence data obtained from the SRSSDL was analysed and is reported. The SRSSDL is commonly used in SDL research in South Africa and in the university where this investigation was conducted, and the validity of the SRSSDL for the South African context has been established (Golightly & Brockett, 2010).

5.3 Influence of cooperative learning-embedded assessment on first-year Life Sciences students' assessment literacy

The research sub-question below is discussed in this section:

- What is the influence of CL-EA on first-year Life Sciences students' ALit?

In order to answer the above research question, descriptive and inferential statistics were used to analyse the quantitative data collected by means of the Student Assessment Literacy Questionnaire (SALQ).

The SALQ was answered on a 5-point Likert-type scale (see section 4.3.2.2), where 1 = "Strongly disagree" and 5 = "Strongly agree". The items in the 'assessment expectation' (AE) factor (27, 28 and 29) were also answered on a 5-point Likert-type scale; however, since these three questions relate to the way students rate themselves – 1 = "Very low" and 5 = "Very high". The SALQ was administered to the control groups (Campus A and Campus B) of Year 1, at the beginning and end of the first semester and at the end of the second semester (see section 4.3.2.2). As no intervention was implemented during Year 1 of the investigation, the control groups will be referred to as Campus A and Campus B (relating to the specific campus where the investigation was conducted). During Years 2 and 3 of the investigation, the participants of Campus A formed the control group, whilst the participants on Campus B formed the experimental group. Hence, for the purpose of this investigation, the researcher referred to the control and experimental groups. During Years 2 and 3 of the investigation, the SALQ was administered to the control and experimental groups at the beginning and end of the semester (see Figure 4-3). The independent t-test, comparing the pre-tests of the control and experimental groups for Year 2 is presented in Table 5-3 below. The p-values were calculated and are reported but were not used in the interpretation of the data as a random

sample was not used in this study. Therefore, only effect sizes (Cohen, 1988) were used to determine possible practical significant differences.

Table 5-3: Independent t-test: SALQ pre-tests of control and experimental groups for Year 2 per factor

SALQ factors	Campus	N	Mean	Std. deviation (SD)	Sig. (2-tailed)	Effect size
University's purpose	Control	64	4.30	0.49	0.53	0.11
	Experimental	56	4.36	0.49		
Comparing students	Control	62	2.56	1.12	0.77	0.05
	Experimental	56	2.50	1.25		
Assessment for learning	Control	64	4.37	0.49	0.25	0.20*
	Experimental	56	4.28	0.42		
Minimum effort orientation	Control	64	3.01	0.99	0.00	0.56**
	Experimental	56	2.45	0.96		
Assessment understanding	Control	64	4.13	0.50	0.44	0.13
	Experimental	56	4.19	0.40		
Assessment judgement	Control	63	3.97	0.54	0.03	0.34*
	Experimental	56	4.16	0.40		
Assessment expectations	Control	63	3.93	0.67	0.87	0.03
	Experimental	56	3.92	0.44		

* Small effect ** Medium effect

Evident from Table 5-3 is the medium practical significant difference between the pre-test mean values for MEO (d = 0.56). The mean value for the control group is significantly higher than the mean value of the experimental group. This result might indicate that the students in the control group were more oriented towards putting in a minimum effort for assessable tasks than the experimental group. This implies that the students in the experimental group were willing to put in more effort when doing tasks that were going to be assessed. The mean value for the control group for 'assessment for learning' was higher than the mean value for the experimental group, but the difference in mean values was of small practical significance (d = 0.20). The experimental group's mean value for the 'assessment judgement' factor is higher than the mean value of the control group, but the difference is of small practical significance (d = 0.34). No practical significant differences were found in the other SALQ factors.

In Table 5-4, the independent t-test, a comparison of the results of the pre-tests of the control and experimental groups for Year 3 is presented. The results indicate a medium practical significant difference between the mean values of the control and experimental groups within

the MEO factor (d = 0.53). The mean value for the control group was significantly higher than the mean value of the experimental group. This suggests that the control group was yet again oriented towards putting in the minimum amount of effort for assessable work merely to pass the module. For all the other factors, there were no practical significant difference between the pre-tests of the control and experimental groups for Year 3.

Table 5-4: Independent t-test: SALQ pre-test results of control and experimental groups for Year 3 per factor

SALQ factors	Campus	N	Mean	SD	Sig. (2-tailed)	Effect size
University's purpose	Control	64	4.3633	0.53686	0.56	0.10
	Experimental	44	4.2955	0.66847		
Comparing students	Control	63	2.6032	1.28941	0.45	0.15
	Experimental	44	2.4091	1.33501		
Assessment for learning	Control	65	4.3651	0.52936	0.71	0.07
	Experimental	44	4.3273	0.50071		
Minimum effort orientation	Control	64	3.0260	1.01051	0.00	0.53**
	Experimental	44	2.4943	1.00361		
Assessment understanding	Control	65	3.9410	0.62385	0.43	0.13
	Experimental	44	4.0227	0.46336		
Assessment judgement	Control	65	3.9808	0.60484	0.72	0.07
	Experimental	44	3.9394	0.55054		
Assessment expectations	Control	65	3.9205	0.71874	0.79	0.05
	Experimental	44	3.9545	0.50111		

** Medium effect

The following section (see section 5.3.1) presents the results of dependent t-tests, in order to establish possible significant differences between pre- and post-tests.

5.3.1 Difference between pre-tests and post-tests of control groups for Years 2 and 3 per SALQ factor

Dependent t-tests were conducted to establish possible significant differences between the pre- and the post-test of the SALQ for the control group for Years 2 and 3. This was done for each of the factors of the SALQ. The results for all factors are presented in Table 5-5 below and are outlined in this section.

Table 5-5: Dependent t-test: Control group pre- and post-test results for Years 2 and 3 within SALQ factors

Factor	Year		N	Mean	SD	p	d
University's purpose	2	SALQ_ Pre	4	4.37	0.32	0.10	1.16***
		SALQ_ Post	4	4.75	0.20		
	3	SALQ_ Pre	17	4.36	0.40	0.49	0.28*
		SALQ_ Post	17	4.25	0.56		
Assessment for learning	2	SALQ_ Pre	4	4.45	0.25	0.01	0.83***
		SALQ_ Post	4	4.66	0.23		
	3	SALQ_ Pre	17	4.48	0.29	0.08	0.80***
		SALQ_ Post	17	4.24	0.64		
Minimum effort orientation	2	SALQ_ Pre	4	2.81	1.35	0.15	0.46**
		SALQ_ Post	4	3.43	1.41		
	3	SALQ_ Pre	17	2.94	1.02	0.73	0.07
		SALQ_ Post	17	3.01	0.73		
Assessment understanding	2	SALQ_ Pre	4	4.46	0.79	0.54	0.18*
		SALQ_ Post	4	4.32	0.61		
	3	SALQ_ Pre	17	3.97	0.68	0.37	0.21*
		SALQ_ Post	17	3.83	0.69		
Assessment judgement	2	SALQ_ Pre	4	4.43	0.80	0.78	0.08
		SALQ_ Post	4	4.37	0.52		
	3	SALQ_ Pre	17	4.07	0.15	0.67	0.14
		SALQ_ Post	17	3.98	0.20		
Assessment expectations	2	SALQ_ Pre	4	4.33	0.47	0.71	0.35*
		SALQ_ Post	4	4.16	0.57		
	3	SALQ_ Pre	17	3.92	0.75	0.07	0.34*

Factor	Year		N	Mean	SD	p	d
		SALQ_ Post	17	4.17	0.62		
Question 5 – comparing students	2	SALQ_ Pre	4	2.75	0.95	1.00	0.00
		SALQ_ Post	4	2.75	2.06		
	3	SALQ_ Pre	17	2.35	1.27	0.59	0.14*
		SALQ_ Post	17	2.17	1.23		

* Small effect ** Medium effect *** Large effect

Evident in Table 5-5, is the large practical significant difference between the pre- and post-test SALQ mean values of Year 2 for the 'university's purpose' factor (d = 1.16) for the control group of Campus A. The high d-value for UP implies that students understood the university's purpose with assessment significantly better at the end of their semester in Year 2 than at the beginning of the semester. However, it should be noted that only four students were involved. During the following year (N = 17), there was a decrease in mean values of small practical significance (d = 28). The difference between the pre- and post-test mean values for the AL factor in Year 2 is of large practical significance (d = 0.83). A large practical significant difference between the pre- and post-test mean values for the same factor for Year 3, is also evident from Table 5-5 (d = 0.80). The post-test mean value for AL in Year 2 is higher than the pre-test mean value, suggesting that students' understanding that assessment could be used for monitoring and enhancing their learning increased during Year 2. During Year 3, the post-test mean value for AL was significantly lower than that of the pre-test. Keeping in mind that students in Year 3 of the investigation were in their first semester at university, the lower post-test mean value might suggest that students overrated themselves in their first semester at university. There is a medium practical significant difference between the pre- and post-test mean values for the MEO factor for Year 2 (d = 0.46). The significantly higher pre-test mean value for this factor – keeping in mind that these students were in their second semester at university – might be an indication that students' MEO towards achievement increased from the pre-test to the post-test in Year 2. The assessment practices to which students in Year 2 were exposed in their first semester, might have contributed towards their MEO in their second semester. The difference between the pre- and post-test mean values for AU for Year 2 is of small practical significance (d = 0.21). This is an indication that students' understanding of local assessment protocols and performance standards decreased during Year 2 of the investigation. It might be that students initially thought that they were aware of what the assessment protocols and performance standards were; hence, overrating themselves in this

SALQ factor. The practical significant differences between the pre- and post-test mean values for AE for Years 2 and 3 were of small effect (d = 0.35 and d = 0.34 respectively). No other practical significant differences were present for the other SALQ factors for the control group (Campus A).

In the following section (see section 5.3.2), differences between SALQ pre- and post-tests for the experimental groups (Years 2 and 3) are presented.

5.3.2 Difference between pre-tests and post-tests of experimental groups for Years 2 and 3 per SALQ factor

Dependent t-tests were calculated to establish possible differences between the pre-test SALQ and the post-test SALQ of the experimental group for Years 2 and 3. This was done for each of the factors of the SALQ. The results for all six factors are presented in Table 5-6 below and are outlined in this section.

Table 5-6: Dependent t-test: Experimental group pre- and post-test results for both years in terms of SALQ factors

Factor	Year	SALQ	N	Mean	SD	p	d
University's purpose	2	Pre	56	4.36	0.49	0.10	0.22*
		Post	67	4.47	0.40		
	3	Pre	44	4.19	0.70	0.11	0.33*
		Post	35	4.42	0.49		
Assessment for learning	2	Pre	56	4.27	0.41	0.25	0.17
		Post	67	4.34	0.46		
	3	Pre	44	4.28	0.53	0.68	0.06
		Post	35	4.32	0.42		
Minimum effort orientation	2	Pre	56	2.45	0.96	0.52	-0.07
		Post	67	2.38	0.95		
	3	Pre	44	2.52	1.04	0.66	-0.10
		Post	35	2.42	1.01		
Assessment understanding	2	Pre	56	4.19	0.40	0.21	0.17
		Post	67	4.26	0.45		
	3	Pre	44	3.95	0.45	0.01	0.59**
		Post	35	4.22	0.44		
Assessment judgement	2	Pre	56	4.15	0.39	0.02	0.30*
		Post	67	4.27	0.42		
	3	Pre	44	3.94	0.63	0.07	0.35*
		Post	35	4.17	0.51		
Assessment expectations	2	Pre	56	3.91	0.43	0.03	0.35*
		Post	67	4.07	0.47		
	3	Pre	44	3.94	0.47	0.18	0.22*

Factor	Year	SALQ	N	Mean	SD	p	d
		Post	35	4.05	0.56		
Comparing students	2	Pre	56	2.45	1.21	0.76	0.04
		Post	67	2.50	1.06		
	3	Pre	44	2.12	1.23	0.67	0.10
		Post	35	2.25	1.27		

*Small effect **Medium effect

As seen in Table 5-6, the difference in pre- and post-test mean values for the AU factor for Year 3 is of medium effect (d = 0.59). The practical significant difference between the pre- and the post-test mean value for this factor suggests that students' understanding of the protocol and performance standards of the university increased from the pre- to the post-test. A small practical significant difference between the pre- and post-test mean values for the '**university's purpose**' in Years 2 and 3 (d = 0.22 and d = 0.33) suggests that students' understanding of the purpose of the university with assessments increased in the post-tests in both years, and might be ascribed to the implementation of CL-EA. Small practical significant differences between the pre- and post-test mean values for AJ in both Years 2 and 3, are evident from Table 5-6 (d = 0.30 and d = 0.35 respectively), which implies that the first-year students' ability to judge their own word and that of their peers increased after being involved in the participative nature of the CL-EA intervention. Another small practical significant difference in pre- and post-test mean values was calculated for the AE factor (d = 0.35). This result suggests that the first-year students' ability to rate their confidence that they will achieve the expected grade or mark, increased. It might be that the reflective practices and feedback mechanism of the CL-EA intervention enabled students to predict the grade or mark that they expected to achieve accurately. There was no practical significant difference between the mean values for Question 5 for Years 2 or 3 (d = 0.04 and d = 0.10 respectively). Even though there was no practical significant difference for MEO (Years 2 and 3), the low mean values are noteworthy and suggest that students were not oriented towards putting in the minimum effort to pass the module.

The possible practical significant differences between the post-tests of the control and experimental groups for both Years 2 and 3 are presented in the following section (see 5.3.3).

5.3.3 Difference between post-tests of the control and experimental groups for Years 2 and 3 in terms of SALQ factors

An independent t-test was performed to compare the post-tests of the control and experimental groups for Year 2 in terms of the SALQ factors. The results are presented in Table 5-7.

Table 5-7: Independent t-test: Post-test results of the control and experimental groups in Year 2

SALQ factor	Group	N	Mean	SD	Sig. (2-tailed)	Effect size
University's purpose	Control	4	4.75	0.20	0.05	0.75**
	Experimental	67	4.45	0.40		
Assessment for learning	Control	4	4.67	0.23	0.05	0.70**
	Experimental	67	4.33	0.48		
Minimum effort orientation	Control	4	3.44	1.42	0.05	0.69**
	Experimental	67	2.46	0.95		
Assessment understanding	Control	4	4.32	0.61	0.81	0.09
	Experimental	67	4.26	0.45		
Assessment judgement	Control	4	4.37	0.52	0.68	0.18
	Experimental	67	4.28	0.43		
Assessment expectations	Control	4	4.17	0.58	0.66	0.19
	Experimental	67	4.06	0.47		
Comparing students	Control	4	2.75	2.06	0.86	0.10
	Experimental	66	2.55	1.12		

**Medium effect

Table 5-7 provided information about the comparison between the post-tests of the control and experimental groups during Year 2 of the investigation.

Evident from Table 5-7, is the medium practical significant differences between the post-test mean values of the control and experimental groups with regard to the UP, AL, as well as MEO factors (d = 0.75, d = 0.70 and d = 0.69 respectively). Traditional instruction and test-taking may lead to students being coached for tests and examinations; therefore, the higher post-test mean for UP of the control group might be ascribed to traditional instruction and test-taking experienced by the students in the control group. Noteworthy also, is the small population size (N = 4), which may have had an influence on the d-value (Cheung & Slavin, 2016). The higher post-test mean value for AL in the control group could be ascribed to the

small population size (N = 4). The questions grouped within the AL factor dealt with students' use of assessment tasks to enhance their learning and questions, such as:

> *I use assessment to figure out what is important to learn*.
>
> *I think the university makes me do assessment to produce work that can be judged for the university's marking and grading purposes*.

It may be that the four students, who were exposed to traditional instruction and test-taking, used the tests to identify which part of the work was important to learn. For the MEO factor of the SALQ, the post-test mean value for the experimental group was lower than that of the control group. This result might be an indication that the control group was oriented towards putting the minimum amount of effort into the production of assessable work necessary merely to pass the module requirements. This might be an indication that the CL-EA intervention enabled the students to have a maximum effort orientation towards the production of assessable work, instead of wanting to put in the minimum amount of effort. No practical significant differences existed in any of the other SALQ factors. Noteworthy, however, is the low mean values for both the control and experimental groups with regard to comparing students, which implies that students did not necessarily perceive the assessments of the university as a way of comparing students to each other.

An independent t-test was performed to compare the post-tests of the control and experimental groups for Year 3 in terms of the SALQ factors. The results are presented in Table 5-8.

Table 5-8: Independent t-test: Post-test results of the control and experimental groups in Year 3

SALQ factors	Group	N	Mean	SD	Sig. (2-tailed)	Effect size
University's purpose	Control	17	4.25	0.56	0.17	0.38*
	Experimental	35	4.46	0.49		
Assessment for learning	Control	17	4.24	0.64	0.43	0.19
	Experimental	35	4.36	0.43		
Minimum effort orientation	Control	17	3.01	0.73	0.16	0.39*
	Experimental	35	2.58	1.13		
Assessment understanding	Control	17	3.83	0.69	0.00	0.64**
	Experimental	35	4.28	0.46		
Assessment judgement	Control	17	3.98	0.86	0.47	0.19
	Experimental	35	4.15	0.51		
Assessment expectations	Control	17	4.18	0.62	0.42	0.22*
	Experimental	35	4.03	0.54		
Comparing Students	Control	17	2.18	1.24	0.49	0.20*
	Experimental	35	2.46	1.40		

*Small effect **Medium effect

The d-value (0.64) for AU indicates a medium practical significant difference between the post-test mean values of the control and experimental groups. The significantly higher mean value of the experimental group might be an indication that the CL-EA intervention influenced students' understanding of local protocols and assessment standards. Evident from Table 5-8, is that with a few exceptions, the control group had lower post-test mean values than the experimental group. Participants in Year 3 of the investigation, in both the control and experimental groups, were first-year students in their first semester at university. It might be that the students, who were just out of high school, had a lower level of understanding of aspects needed to become more assessment-literate than the students who were in their second semester (Year 2). The increase in mean value for the experimental group with regard to UP was of small practical significance (d = 0.38), and may be an indication that students in the experimental group understood the purpose of the university with assessment better after being involved in the CL-EA intervention. The post-test mean value for the control group with regard to the MEO factor was higher than that of the experimental group, and the d-value indicates that the difference was of small practical significance (d = 0.39). This result suggests that students in the control group were more orientated towards putting in the minimum effort for assessable work than the experimental group. The CL-EA intervention might have enabled students in the experimental group to want to have a maximum input towards assessable work in order to pass the module. Not having a MEO suggests that students were not in a hurry to

complete assessable tasks, but rather taking their time to complete such assessments for maximum learning opportunity.

In order to determine whether there was evidence that the CL-EA intervention had an influence on the first-year Life Sciences students' ALit, the mean values of the post-tests of all the participants in the control group (Years 2 and 3) were compared with the mean values of the post-tests of all the participants in the experimental group (Years 2 and 3) by means of an independent t-test. The results are outlined in Table 5-9 below.

Table 5-9: Independent t-test: Combined post-test data for the control and experimental groups

SALQ factors	**Group**	**N**	**Mean**	**SD**	**Sig. (2-tailed)**	**Effect size**
University's purpose	Control	21	4.35	0.55	0.33	0.20*
	Experimental	102	4.45	0.43		
Assessment for learning	Control	21	4.32	0.61	0.88	0.03
	Experimental	102	4.34	0.46		
Minimum effort orientation	Control	21	3.09	0.87	0.01	0.59**
	Experimental	102	2.50	1.01		
Assessment understanding	Control	21	3.92	0.69	0.04	0.50**
	Experimental	102	4.27	0.45		
Assessment judgement	Control	21	4.06	0.81	0.34	0.22*
	Experimental	102	4.24	0.46		
Assessment expectations	Control	21	4.17	0.60	0.32	0.20*
	Experimental	102	4.05	0.49		
Comparing students	Control	21	2.29	1.38	0.45	0.17
	Experimental	102	2.51	1.22		

*Small effect **Medium effect

Evident from Table 5-9, is that there was a medium practical significant difference between the post-test mean values for the MEO and AU factors (d = 0.59 and d = 0.50 respectively), and a small practical significant difference between the post-test mean values of the control and experimental groups for the UP, AJ and AE factors (d = 0.20, d = 0.22 and d = 0.20 respectively). For the MEO and AE factors, the mean values of the control group were higher than the mean values of the experimental group, but for the rest, the mean values for the experimental group were higher than those for the control group. With regard to the MEO factor, the result might be an indication that the CL-EA intervention influenced students' mindfulness regarding MEO. With regard to AU, the result suggests that the CL-EA intervention enabled the first-year Life Sciences students in the experimental group to

understand local protocols and assessment standards (i.e. “I understand what I need to do in the assessment task to get the mark or grade I want”, “I feel confident that the assessment is conducted fairly”) better than the students in the control group.

All the above results were presented in order to determine the influence of the CL-EA intervention on first-year Life Sciences students’ ALit. A practical significant difference of medium effect for the AU factor was found between the experimental and control group with mean values of the experimental group higher than those of the control group for the AU SALQ factor. A practical significant difference of medium effect for the MEO factor was found between the experimental and control group with mean values of the experimental group lower than those of the control group for the MEO SALQ factor. This result, together with the small practical significant difference between the mean values of the UP, AJ and AE SALQ factors, with the mean values of the experimental group higher than the mean values of the control group for the UP and AJ factors, is an indication that the implementation of CL-EA might have had a positive influence on the ALit of the first-year Life Sciences students.

The quantitative results pertaining to the influence of the CL-EA on students’ SDL, are presented and discussed in section 5.4 below.

5.4 The influence of cooperative learning-embedded assessment on first-year Life Sciences students’ self-directed learning

The following research sub-question is discussed in this section:

- What is the influence of CL-EA on first-year Life Sciences students’ SDL?

In order to answer the above research sub-question, the researcher made use of descriptive and inferential statistics to analyse the quantitative data collected. For this study, t-tests were performed to indicate any practical significant difference between the control group and the experimental group of Years 2 and 3.

During the study, the researcher made use of the Self-Rating Scale of Self-Directed Learning (SRSSDL) to determine the first-year Life Sciences students’ level of self-directedness. The SRSSDL is a standardised questionnaire, which was developed by Williamson (2007) (see section 2.6). In order to establish whether the intervention (CL-EA) had an influence on the first-year Life Sciences students’ level of self-directedness, the SRSSDL questionnaire was administered at the beginning and end of each Life Sciences module for Years 1, 2 and 3 (see Figure 4-3). The analysis of the SRSSDL data for the control group and the experimental group is presented in the following sections (see sections 5.4.1 to 5.4.4).

5.4.1 SRSSDL: pre- and post-test results of Year 1 control groups per SRSSDL construct

During this study, the first-year Life Sciences students completed the SRSSDL pre-tests at the beginning and the post-tests at the end of each of the two Life Sciences modules on both Campus A (control group) and Campus B (experimental group) (see Figure 4-3). The total SRSSDL mean values for students from Campus A and Campus B, before any intervention took place (Year 1), are presented below.

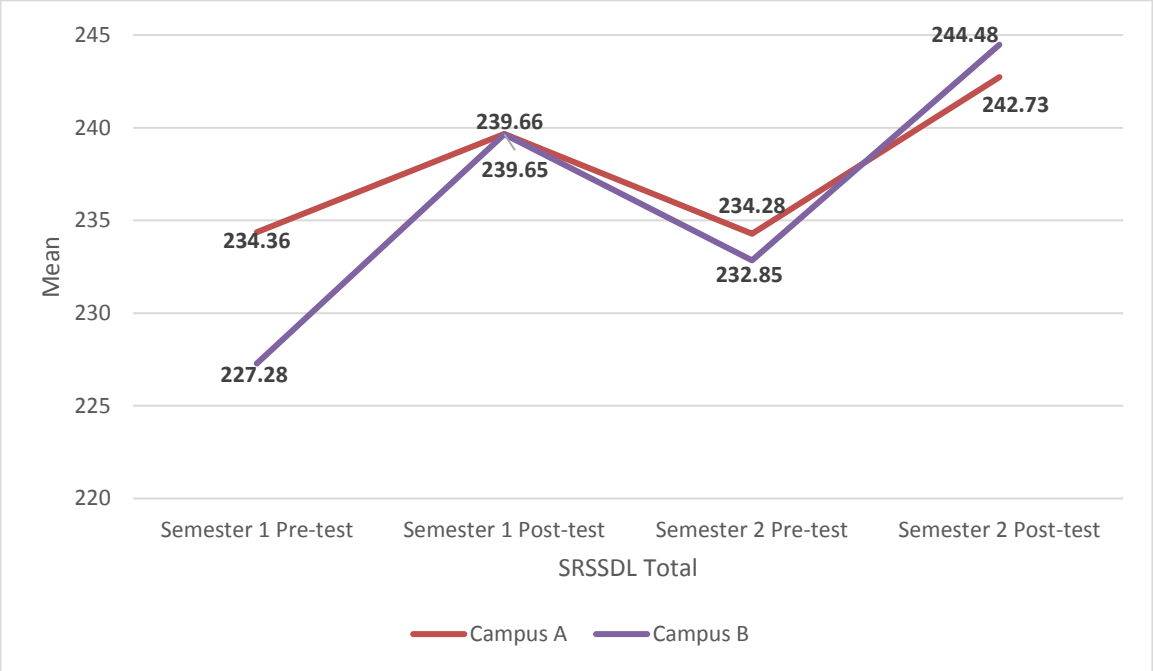


Figure 5-1: SRSSDL pre-test and post-test mean values of the control groups on Campus A and Campus B of Year 1

One of the measures of central tendency, used in descriptive statistics to describe the arithmetic average for a set of values, is the mean value. Evident from Figure 5-1, is that the mean values of the Semester 1 pre-test were lower for Campus B than for Campus A. The Semester 2 post-test mean value of Campus B were however higher than the mean value of Campus A. All students can be categorised within the high SRSSDL category, as mean values in all cases were above 221. Noteworthy is that all the SRSSDL total scores were in the high category (see section 4.3.2.2), suggesting that the students already had a high level of self-directedness towards their learning. From Figure 5-1, it is furthermore evident that there was a difference in the SRSSDL mean value for Campus A and B at the start of the semester, but this difference decreased toward the end of the first semester, and by the end of the second

semester there was no significant difference between the SDL scores of students from the two campuses.

In order to establish practical significant differences between the pre-test results of the control and experimental groups per year, independent t-tests were done. The results follow in section 5.4.2 below.

5.4.2 Independent t-test: SRSSDL pre-test results of the control and experimental groups

During this investigation, the first-year Life Sciences students completed the SRSSDL pre-tests at the beginning of Years 2 and 3 (see Figure 4-3). The independent t-test results of the pre-tests for Years 2 and 3 are presented in Tables 5-10 and 5-11 respectively.

Table 5-10: Independent t-test: SRSSDL pre-test results of control and experimental groups per construct for Year 2

SRSSDL constructs	Group	N	Mean	SD	Sig. (2-tailed)	Effect size
Awareness	Control	64	4.08	0.41	0.58	0.10
	Experimental	63	4.12	0.38905		
Learning strategies	Control	64	3.99	0.46636	0.91	0.02
	Experimental	63	3.99	0.45726		
Learning activities	Control	64	3.88	0.49072	0.87	0.03
	Experimental	63	3.89	0.43673		
Evaluation	Control	64	3.94	0.47604	0.59	0.09
	Experimental	63	3.89	0.43240		
Interpersonal skills	Control	64	3.98	0.43448	0.74	0.06
	Experimental	63	3.96	0.40897		
SRSSDL total	Control	64	238.58	21.89798	0.94	0.01
	Experimental	63	238.30	21.19082		

Evident from Table 5-10, is that there were no practical significant differences between the pre-test results of the control and experimental groups in Year 2 with regard to their SDL readiness. This suggests that the control and experimental groups were similar in their SDL readiness at the beginning of the investigation in Year 2.

Table 5-11: Independent t-test: SRSSDL pre-test results of control and experimental groups per construct for Year 3

SRSSDL constructs	Group	N	Mean	SD	Sig. (2-tailed)	Effect size
Awareness	Control	67	3.9856	0.43089	0.65	0.08
	Experimental	50	3.9465	0.48621		
Learning strategies	Control	67	3.8936	0.44212	0.67	0.07
	Experimental	50	3.8544	0.54975		
Learning activities	Control	67	3.7304	0.54770	0.17	0.24*
	Experimental	50	3.8617	0.45910		
Evaluation	Control	66	3.9534	0.47252	0.22	0.21*
	Experimental	50	3.8364	0.55385		
Interpersonal skills	Control	66	3.9591	0.50332	0.57	0.10
	Experimental	50	4.0112	0.45360		
SRSSDL total	Control	67	234.0706	22.77631	0.99	0.00
	Experimental	50	234.1222	24.14378		

Only for the 'learning activities' and 'evaluation' constructs, a small practical significant difference between the pre-test mean values was obtained (d = 0.24 and d = 0.21 respectively). The mean values for the 'learning activities' construct was higher for the experimental group than for the control group, implying that the experimental group might be familiar with specific activities that enhances SDL. No practical significant differences were found between the mean values of any of the other constructs.

In order to establish possible practical significant differences between the pre- and post-tests of the respective groups, dependent t-tests were performed, and the results are presented in section 5.4.3.

5.4.3 Difference between pre- and post-test results of the control and experimental groups for Years 2 and 3

First, the SRSSDL total mean values of the control and experimental groups were compared by performing dependent t-tests. These results are presented in Table 5-12 below.

Table 5-12: Dependent t-test: Total SRSSDL pre- and post-test results of the control and experimental groups for Years 2 and 3

Year	Group		Mean	N	SD	p	d
2	Control	Pre	248.50	4	41.49	0.62	0.10
		Post	252.50	4	27.69		
	Experimental	Pre	237.76	56	20.37	0.08	0.17
		Post	241.15	56	19.72		
3	Control	Pre	231.41	12	17.87	0.17	0.53**
		Post	240.91	12	30.53		
	Experimental	Pre	231.75	35	26.72	0.00	0.45**
		Post	243.72	35	23.77		

**Medium effect

Evident from Table 5-12, is that students from both groups had a high level of self-directedness, as all SRSSDL mean values were above 221 (see section 4.3.2.2). All the SRSSDL mean values of the experimental groups increased even though only Year 3 indicated a medium practical significance. The increase in mean values for both the control and experimental groups during Year 3 of the investigation was of medium effect (d = 0.53 and d = 0.45 respectively). Noteworthy is that the participants in Year 3 of the investigation were first-year students in their first semester as opposed to the participants in Year 2 who were in their second semester.

In order to establish whether the differences in mean values within the SRSSDL constructs were of practical significance, a dependent t-test was performed for each of the SRSSDL constructs. The results of the dependent t-test for the control group are presented in Table 5-13 below.

Table 5-13: Dependent t-test results: Control group for Years 2 and 3 per SRSSDL construct

SRSSDL constructs	Year		N	Mean	SD	p	d
Awareness	Year 2	Pre	4	4.00	0.81	0.11	0.66**
		Post	4	4.45	0.43		
	Year 3	Pre	12	3.86	0.51	0.00	0.74**
		Post	12	4.24	0.59		
Learning strategies	Year 2	Pre	4	4.06	0.69	0.53	0.15
		Post	4	3.95	0.58		
	Year 3	Pre	12	3.80	0.41	0.10	0.71**
		Post	12	4.09	0.60		
Learning activities	Year 2	Pre	4	4.18	0.71	0.21	0.09
		Post	4	4.12	0.64		

SRSSDL constructs	Year		N	Mean	SD	p	d
	Year 3	Pre	12	3.50	0.54	0.26	0.38*
		Post	12	3.70	0.62		
Evaluation	Year 2	Pre	4	4.12	0.76	0.63	0.14
		Post	4	4.22	0.43		
	Year 3	Pre	12	3.98	0.43	0.61	0.13
		Post	12	3.93	0.62		
Interpersonal skills	Year 2	Pre	4	4.33	0.50	0.10	0.29*
		Post	4	4.18	0.40		
	Year 3	Pre	12	4.12	0.36	0.84	0.08
		Post	12	4.09	0.55		

**Medium effect

As seen in Table 5-13, there was a practical significant difference of medium effect within the 'awareness' construct of the SRSSDL during Years 2 and 3 of this investigation (d = 0.66 and d = 0.74 respectively). This in an indication that during Years 2 and 3, the participants in the control group became increasingly aware of the factors contributing to becoming a self-directed learner (i.e. "*I am able to select the best method for my own learning"*). During Year 3, there was a medium practical significant difference between the pre- and post-test mean values with regard to the 'learning strategies' construct (d = 0.71). This result suggests that students became increasingly aware of learning strategies needed to enhance their SDL. The small practical significant difference between the pre- and post-test mean values for the 'learning activities' SRSSDL construct during Year 3 of the investigation (d = 0.38) might be an indication that the students in Year 3 were more aware of the learning activities in which they should be involved for the enhancement of SDL than the students in Year 2. Also evident from Table 5-13, is the small practical significant difference between the pre- and post-test mean values for the 'interpersonal skills' SRSSDL construct in Year 2. No practical significant differences were obtained between the pre- and post-test mean values of any of the other constructs.

In order to establish whether the difference in mean values of the experimental group pre- and post-tests was of practical significance, a dependent t-test was performed for each of the SRSSDL constructs (see Table 5-14).

Table 5-14: Dependent t-test results: Experimental group for Years 2 and 3 per construct

SRSSDL constructs	Group		N	Mean	SD	p	d
Awareness	Year 2	Pre	56	4.10	0.38	0.49	0.08
		Post	56	4.07	0.35		
	Year 3	Pre	35	3.94	0.55	0.03	0.24*
		Post	35	4.07	0.42		
Learning strategies	Year 2	Pre	56	3.96	0.45	0.43	0.08
		Post	56	4.00	0.40		
	Year 3	Pre	35	3.78	0.57	0.00	0.40*
		Post	35	4.01	0.44		
Learning activities	Year 2	Pre	56	3.88	0.42	0.15	0.16
		Post	56	3.95	0.41		
	Year 3	Pre	35	3.82	0.46	0.03	0.40*
		Post	35	4.01	0.44		
Evaluation	Year 2	Pre	56	3.91	0.41	0.01	0.30*
		Post	56	4.03	0.41		
	Year 3	Pre	35	3.79	0.58	0.00	0.42*
		Post	35	4.04	0.59		
Interpersonal skills	Year 2	Pre	56	3.93	0.39	0.08	0.21*
		Post	56	4.02	0.40		
	Year 3	Pre	35	3.96	0.50	0.00	0.39*
		Post	35	4.16	0.47		

*Small effect

Evident from Table 5-14, is the difference between the pre- and post-test mean values within the ‘awareness’ construct in Year 3, which was of small practical significance (d = 0.24). It seems that more students became mindful of the factors that contribute to becoming a self-directed learner. The small practical significant difference between the pre- and post-test mean values for the ‘learning strategies’ construct during Year 3 (d = 0.40) might suggest that more students seemed to have become aware of the learning strategies needed to become more self-directed in their learning processes during Year 3 of the investigation. The difference in pre- and post-test mean values for the ‘learning activities’ construct during Year 3 (d = 0.40), was of medium practical significance and might be an indication that the increase in post-test mean value was due to students becoming increasingly mindful of the necessity of engaging in specific learning activities in order to become more self-directed learners (i.e. “*I keep an open mind to other’s point of view”*). The d-value for the ‘evaluation’ construct for Year 2 (d = 0.30) points towards a small practical significant difference between the pre- and post-test mean values, whilst a medium practical significant difference between the pre- and post-test mean values in Year 3 is indicated by the d-value of 0.42. These results suggest that students

in the experimental group in Year 3 realised the need for specific qualities to help monitor their learning activities better than those in Year 2. The small practical significant difference between the pre- and post-test mean values for the 'interpersonal skills' construct during Years 2 and 3 (d = 0.21 and d = 0.39 respectively) might be an indication that more students became mindful of the necessity of interpersonal skills for SDL (i.e. "*I am able to identify my role within a group"*) after the CL-EA intervention.

In order to determine possible differences between the pre- and post-test results for the control group and experimental group, the data for all control group participants in Years 2 and 3, as well as the data for all the experimental group participants in Years 2 and 3, was merged and used to perform a paired t-test. The results of the paired t-test are presented in Table 5-15 below.

Table 5-15: Dependent t-test: Pre- and post-test results for the control and experimental groups per construct

Group	SRSSDL construct	N	Mean	SD	p	d
CONTROL GROUP	Awareness – pre	16	3.90	0.58	0.00	0.73**
	Awareness – post	16	4.32	0.56		
	Learning strategies – pre	16	3.87	0.48	0.17	0.40*
	Learning strategies – post	16	4.06	0.58		
	Learning activities – pre	16	3.67	0.64	0.32	0.21*
	Learning activities – post	16	3.81	0.64		
	Evaluation – pre	16	4.02	0.51	0.87	0.03
	Evaluation – post	16	4.00	0.58		
	Interpersonal skills – pre	16	4.18	0.40	0.60	0.14
	Interpersonal skills – post	16	4.12	0.51		
	SRSSDL total – pre	16	235.69	25.24	0.13	0.32*
	SRSSDL total – post	16	243.81	29.39		
EXPERIMENTAL GROUP	Awareness – pre	91	4.04	0.46	0.38	0.07
	Awareness – post	91	4.08	0.38		
	Learning strategies – pre	91	3.90	0.51	0.00	0.22*
	Learning strategies – post	91	4.01	0.42		
	Learning activities – pre	91	3.86	0.44	0.00	0.26*

Group	SRSSDL construct	N	Mean	SD	p	d
	Learning activities – post	91	3.98	0.43		
	Evaluation – pre	91	3.87	0.49	0.00	0.35*
	Evaluation – post	91	4.04	0.48		
	Interpersonal skills – pre	91	3.95	0.44	0.00	0.29*
	Interpersonal skills – post	91	4.08	0.43		
	SRSSDL total – pre	91	235.45	23.07	0.00	0.29*
	SRSSDL total – post	91	242.14	21.28		

*Small effect **Medium effect

Evident from Table 5-15, is a medium practical significant difference between the pre- and post-test mean values for the control group within the 'awareness' construct (d = 0.73). This might be an indication that an increasing number of students became aware of their own responsibility towards their learning. Although the same result was not obtained for the experimental group, the high pre- and post-test mean values might be an indication that these students were already aware of the characteristics needed to become increasingly self-directed in their learning. The d-values with regard to the 'learning strategies' construct of the control and experimental groups indicate a small practical significant difference between the pre- and post-test mean values for both groups (d = 0.40 and d = 0.22 respectively). Noteworthy is that the mean values for the experimental group might be an indication that the students were already involved in learning strategies that enhance SDL (i.e. "*I am able to decide my own learning strategy*"). The practical significant difference in pre- and post-test mean values in both the control and experimental groups with regard to 'learning activities' was of small effect (d = 0.21 and 0.26 respectively). It is notable that the experimental group's mean values were higher in both the pre- and post-tests within the 'learning activities' construct, which might be an indication that the CL-EA intervention had a positive effect on these students' orientation towards SDL. With regard to the 'evaluation' and 'interpersonal skills' constructs, no practical significant differences between the pre- and post-test mean values were evident for the control group. However, the experimental group had a small practical significant difference between the pre- and post-test mean values in both the 'evaluation' and 'interpersonal skills' constructs (d = 0.35 and d = 0.29 respectively). These results suggest that the intervention may have had an influence on the students' SDL with regard to their ability to monitor their learning, as well as their interpersonal skills. The cooperative nature of the CL-EA intervention seems to have influenced students' ability to evaluate their own work (i.e. "*I am able to identify my areas of strengths and weaknesses"*),

as well as the ability to value peer assessment (i.e. "*I appreciate when my work can be peer assessed*").

In order to establish possible practical significant differences between the post-test mean values of the control and experimental groups, an independent t-test was performed.

5.4.4 Difference between post-test results of the control and experimental groups for Years 2 and 3 within the SRSSDL constructs

The results of the independent t-test indicated whether there was evidence that the differences in means of the post-tests of the control and experimental groups, were of practical significance. Tables 5-16 below presents the results of the independent t-test for Year 2, whilst Table 5-17 presents the results of the independent t-test for Year 3. Results are presented below.

Table 5-16: Independent t-test: Post-test results of control and experimental groups for Year 2 within the SRSSDL learning constructs

SRSSDL constructs	Group	N	Mean	SD	Sig. (2-tailed)	Effect size
Awareness	Control	4	4.54	0.43	0.01	1.07***
	Experimental	67	4.08	0.34		
Learning strategies	Control	4	3.96	0.59	0.86	0.07
	Experimental	67	3.99	0.41		
Learning activities	Control	4	4.12	0.64	0.38	0.31*
	Experimental	67	3.93	0.42		
Evaluation	Control	4	4.23	0.43	0.36	0.44*
	Experimental	67	4.04	0.39		
Interpersonal skills	Control	4	4.19	0.40	0.44	0.40*
	Experimental	67	4.01	0.43		
SRSSDL total	Control	4	252.50	27.69	0.25	0.43*
	Experimental	67	240.70	19.53		

* Small effect ***Large effect

There was a large practical significant difference between the post-test mean values of the control and experimental groups with regard to the 'awareness' construct, with the post-test mean value for the control group being significantly higher (d = 1.07). When interpreting the results, the small population size (N = 4) should be considered, as Cheung and Slavin (2016) caution that small sample sizes could have large effect sizes. Evident from Table 5-16 also, is that the difference between the post-test mean values of the control and experimental groups

with regard to the 'learning activities', 'evaluation', and 'interpersonal skills' constructs were of small practical significance (d = 0.31, d = 0.44, and d = 0.40 respectively). A small practical significant difference between the SRSSDL total post-test mean values of the control and experimental groups is also evident in Table 5-16.

Tables 5-17 below presents the results of the independent t-test for Year 3, which are discussed below.

Table 5-17: Independent t-test: Post-test results of control and experimental groups for Year 3 in terms of the SRSSDL constructs

SRSSDL constructs	**Group**	**N**	**Mean**	**SD**	**Sig. (2-tailed)**	**Effect size**
Awareness	Control	12	4.24	0.60	0.39	0.28*
	Experimental	35	4.08	0.43		
Learning strategies	Control	12	4.10	0.60	0.67	0.14
	Experimental	35	4.01	0.45		
Learning activities	Control	12	3.71	0.63	0.07	0.48*
	Experimental	35	4.01	0.45		
Evaluation	Control	12	3.93	0.62	0.57	0.18
	Experimental	35	4.04	0.59		
Interpersonal skills	Control	12	4.10	0.55	0.70	0.12
	Experimental	35	4.16	0.47		
SRSSDL total	Control	12	240.92	30.53	0.74	0.09
	Experimental	35	243.72	23.77		

* Small effect

The d-value for the 'awareness' construct indicated a small practical significant difference between the post-test mean values of the control and experimental groups (d = 0.28). The higher mean value for the control group suggested that the control group students' awareness for the factors needed to be a self-directed learner increased during Year 3 of the investigation. The practical significant difference between the post-test mean values for the 'learning activities' construct indicated that the difference was of small practical significance (d = 0.48). The higher post-test mean value for the experimental group suggests an increased involvement in specific learning activities, which enhance one's SDL (i.e. "*I am able to critically reflect on new ideas, information or any learning experience*"). None of the other SRSSDL constructs indicated a practical significant difference between the post-test mean values for the control and experimental groups.

Further analysis, by means of an independent t-test, was done in order to determine possible differences between the post-test mean values of the control and experimental groups. The means of all the participants in the control group (Years 2 and 3) were compared with the means of all the participants in the experimental group (Years 2 and 3) by means of an independent t-test. Table 5-18 reflects the results of the independent t-test.

Table 5-18: Independent t-test: Post-test results of merged control and experimental groups in terms of the SRSSDL constructs

SRSSDL constructs	Group	N	Mean	SD	Sig. (2-tailed)	Effect size
Awareness	Control	16	4.32	0.56	0.12	0.42*
	Experimental	102	4.08	0.37		
Learning strategies	Control	16	4.06	0.58	0.70	0.10
	Experimental	102	4.00	0.42		
Learning activities	Control	16	3.81	0.64	0.39	0.23*
	Experimental	102	3.96	0.43		
Evaluation	Control	16	4.00	0.58	0.78	0.06
	Experimental	102	4.04	0.47		
Interpersonal skills	Control	16	4.12	0.51	0.65	0.11
	Experimental	102	4.06	0.45		
SRSSDL total	Control	16	243.81	29.39	0.73	0.07
	Experimental	102	241.73	21.01		

* Small effect

The results presented in Table 5-18 indicate a small practical significant difference between the post-test mean values of the control and experimental groups with regard to the 'awareness' construct (d = 0.42). The post-test mean value within this construct was higher for the control group than for the experimental group. The difference between the post-test mean values for the 'learning activities' construct was of small practical significance (d = 0.23). The participative and social nature of the CL-EA intervention may have contributed to students being able to analyse and reflect critically on new ideas, information or any learning experiences (amongst others).

All the results in this chapter (see section 5.4) are presented in order to determine the influence of CL-EA on the first-year Life Sciences students' SDL. The inferential statistics revealed a medium practical significant difference between the pre- and post-test SRSSDL total mean values for both the control and experimental groups during Year 3 of the investigation (see Table 5-12). A clear indication that the intervention contributed to this difference, was thus not possible. Paired t-tests revealed practical significant differences of small effect within the

'evaluation', and 'interpersonal skills' constructs of the SRSSDL for the experimental group. Similar results were not obtained for the control group (see Table 5-15). A significantly higher mean value for the experimental group within the 'learning activities' construct was reported, and this difference in mean values was of small practical significance (see Table 5-18). All the reported practical significant differences for the experimental group might be due to the implementation of the CL-EA intervention, as similar results were not obtained for the control group. Upon drawing conclusions from the results presented, the possibility that students overrated themselves during the pre-tests, the small population size of the control group, the possible influence of the teaching and learning strategy to which the control group was exposed, and the relatively short intervention period were taken into account.

5.5 The relationship between students' assessment literacy and their self-directedness to learning

In order to establish the relationship between the first-year Life Sciences students' ALit and their self-directedness towards their learning, Spearman's rho (r_s) correlation coefficients were calculated between the SALQ factors and the SRSSDL constructs. The factor correlation matrix is specified in Table 5-19, and indicates the extent to which different factors and constructs correlated with one another.

Table 5-19: Factor correlation matrix for identified factors and constructs

Factors or constructs			SRSSDL constructs					SRSSDL total
			Awareness	Learning strategies	Learning activities	Evaluation	Interpersonal skills	
SALQ Factors	UP	Correlation coefficient	.22*	.28*	.28*	.33**	.26*	.31**
		Sig. (2-tailed)	0.016	0.002	0.002	0.000	0.005	0.001
		N	118	118	118	118	118	118
	Q5	Correlation coefficient	-0.06	0.00	0.04	0.03	-0.01	-0.01
		Sig. (2-tailed)	0.506	0.975	0.686	0.744	0.872	0.912
		N	117	117	117	117	117	117
	AL	Correlation coefficient	.40**	.45**	.38**	.51**	.43**	.52**
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000
		N	118	118	118	118	118	118
	MEO	Correlation coefficient	0.10*	0.01	0.06	0.09	0.06	0.08
		Sig. (2-tailed)	0.268	0.876	0.513	0.310	0.489	0.364
		N	118	118	118	118	118	118
	AU	Correlation coefficient	.27*	.18*	.31**	.35**	.20*	.30**
		Sig. (2-tailed)	0.003	0.049	0.001	0.000	0.028	0.001
		N	118	118	118	118	118	118

Factors or constructs			SRSSDL constructs					SRSSDL total
			Awareness	Learning strategies	Learning activities	Evaluation	Interpersonal skills	
	AJ	Correlation coefficient	.24*	.33**	.33**	.33**	.36**	.38**
		Sig. (2-tailed)	0.009	0.000	0.000	0.000	0.000	0.000
		N	118	118	118	118	118	118
	AE	Correlation coefficient	.18*	.29*	.35**	.29*	.29*	.34**
		Sig. (2-tailed)	0.042	0.002	0.000	0.001	0.001	0.000
		N	118	118	118	118	118	118

* Weak correlation ** Moderate correlation

UP (university's purpose) indicated a weak correlation with 'awareness', 'learning strategies', 'learning activities', and 'interpersonal skills' (r_s = 0.22, 0.28, 0.28, and 0.26 respectively), and showed a strong correlation with 'evaluation' (r_s = 0.33) and the SRSSDL total (r_s = 0.31). These results indicate the relationship between students' perception of the purpose of the university with assessment and their own self-directed learning readiness. Consequently, it seems that an increase in students' understanding of the purpose of the university with assessment would increase students' ability to evaluate and monitor their learning (and vice versa). Question 5 (Q5) (comparing students) indicated no correlations with any of the SRSSDL constructs. AL (assessment for learning) indicated moderate correlations with 'awareness', 'learning strategies', 'learning activities', and 'interpersonal skills' (r_s = 0.40, 0.45, 0.38, and 0.43 respectively). AL also indicated a moderate correlation with 'evaluation' (r_s = 0.51) and the SRSSDL total (r_s = 0.52). These results are an indication that an increase in students' perception that assessment tasks were used for enhancing or monitoring learning, results in an increase in their self-directed learning readiness (and vice versa). For MEO, there were no correlations with the SRSSDL constructs, expect for the weak correlation with 'awareness' (r_s = 0.10). Wanting to pass a module with as little effort as possible does not seem to correlate with SDL. This implies that an increase in MEO will not result in an increase in SDL. AU indicated a weak correlation with 'awareness' (r_s = 0.27), 'learning strategies' (r_s = 0.18), 'interpersonal skills' (r_s = 0.20), as well as with the SRSSDL total (r_s = 0.30). AU also indicated a moderate correlation with 'learning activities' and 'evaluation' (r_s = 0.30 and 0.35 respectively). These results indicate the relationship between students' understanding of local protocols and performance standards and their SDL. Except for 'awareness' (r_s = 0.24), AJ indicated moderate correlations with all SRSSDL constructs, as well as with the SRSSDL total (r_s = 0.33, 0.33, 0.33, 0.356, and 0.38 respectively). This indicates a strong relationship between AJ and SDL. An increase in students' ability to judge their own work and the work of their peers, may result in an increase in their self-directed learning readiness. AE indicated weak correlations with 'awareness', 'learning strategies', 'evaluation', and 'interpersonal skills' (r_s = 0.19, 0.29, 0.29, and 0.29 respectively), whilst indicating a moderate correlation with 'learning activities' (r_s = 0.35) and the SRSSDL total (r_s = 0.34). These results indicate the relationship between students' expectations of their assessment grade and their SDL.

From the above results, it is evident that students' assessment literacy might influence their self-directed learning. Conclusions regarding these findings are elaborated upon in Chapter 6.

In order to clarify and explain the above quantitative results, the qualitative results obtained from the cooperative learning-embedded questionnaire and interviews are outlined in section 5.6 below.

5.6 First-year Life Sciences students' perceptions of cooperative learning-embedded assessment

At the end of the LIFE modules in the experimental groups (Years 2 and 3), five open-ended questions were asked in a CL-EA questionnaire (CL-EAQ), and semi-structured interviews were conducted with a total of 11 students (five from Year 2 and six from each Year 3). The aim of the CL-EAQ and the interviews was to obtain a clear picture pertaining to the first-year Life Sciences students' perceptions of the CL-EA intervention.

The following sections (see 5.6.1 and 5.6.2) contain the qualitative results from the CL-EAQ and semi-structured interviews respectively.

5.6.1 Students' responses to the CL-EAQ regarding their perception of cooperative learning-embedded assessment

Qualitative results from the CL-EAQ are discussed next in order to determine first-year Life Sciences students' perception of the CL-EA intervention.

After the CL-EAQ had been completed, the data was analysed with the aid of ATLAS.ti™ version 8. Codes and group codes applicable to the research sub-question pertaining to students' perception of CL-EA were identified.

The CL-EAQ consisted of the following five questions (see also 4.3.3.2):

Q1 – What is, according to you, the purpose of assessment in this LIFE module?

Q2 – Please explain the role that assessment played in your learning process throughout the LIFE module.

Q3 – In which way did the assessment practices used in this LIFE module influence your learning throughout the semester?

Q4 – In which way did the assessment practices used in this LIFE module influence your preparation for the examination?

Q5 – What is your general feeling regarding the assessment practices, which were implemented in the LIFE module?

The above-mentioned questions were asked in an attempt to determine students' perception of CL-EA with regard to the perceived purpose of CL-EA, the perceived role of CL-EA in their learning process, as well as the perceived influence of CL-EA on their learning process. The data of the CL-EAQ is discussed by means of a code-document table (Table 5-20), as well as Table 5-21, which presents the code groups, codes and quotes associated with the students' perception of CL-EA.

Table 5-20 presents the code-document table for all the CL-EAQ questions, with the number of codes per question. The codes in the code-document table below are arranged alphabetically and not according to the number of quotes per code (Gr = groundedness). Evident from Table 5-20, is that 'diagnosing learning needs' is the code with the highest G-count, which means that 'diagnosing learning needs' had the highest number of linked quotes (G-count = 69). Noteworthy is that 'diagnosing learning needs' was not only identified as the purpose of CL-EA but was also perceived to play a role in learning and contributing towards the first-year Life Sciences students' learning and preparation for the examination. This implies that the CL-EA intervention was perceived as playing an important role in assisting students to identify their learning needs, which is one of the characteristics of a self-directed learner (see section 2.6). The high G-count of 'promote learning' appears to highlight the important role CL-EA played in the improvement of student learning (G-count = 58). Notable is that students perceived the purpose of CL-EA as well as the role and influence of CL-EA on their learning and preparation for the examination as promoting and improving their learning. This result suggests that CL-EA enabled the students to learn through doing the assessments, which is one of the characteristics of CL-EA (see Figure 3-1).

Table 5-20: Code-document table for all the questions in the cooperative learning-embedded questionnaire and number of codes per question

Codes	Cooperative learning-embedded assessment questionnaire questions				
	Purpose of CL-EA	Role of CL-EA in learning process	CL-EA's influence on learning	Influence of CL-EA on examination preparation	General feeling regarding CL-EA
○ **Applying knowledge** Gr = 7		3	3	1	
○ **Better prepared** Gr = 1				1	
○ **Created curiosity** Gr = 1		1			
○ **Diagnosing learning needs** Gr = 69	14	29	12	11	3
○ **Encouraged me to prepare** Gr = 4		1	1	2	
○ **Enhanced critical thinking** Gr = 4		1	3		
○ **Feedback mechanism** Gr = 25	5	10	7		3
○ **Group work** Gr = 8		2	4	1	1
○ **Identifying achievement standards** Gr = 11			3	7	1
○ **Identifying important content** Gr = 8	3	1	2	1	1
○ **Identifying strengths and weaknesses** Gr = 10	4	2	3	1	

Codes	Cooperative learning-embedded assessment questionnaire questions				
	Purpose of CL-EA	Role of CL-EA in learning process	CL-EA's influence on learning	Influence of CL-EA on examination preparation	General feeling regarding CL-EA
○ **Improved work** Gr = 1		1			
○ **Increased understanding of content** Gr = 18	8	5	2	1	2
○ **Learn better on my own** Gr = 2			1		1
○ **Learned easier** Gr = 13			3	7	3
○ **Learned new skills** Gr = 2			2		
○ **Learning from peers** Gr = 14	2	2	7		3
○ **Less stressful** Gr = 2				1	1
○ **Logical answering** Gr = 1				1	
○ **Monitoring progress** Gr = 42	26	13	2	1	
○ **More independent learning** Gr = 3	1	1	1		
○ **Motivation to learn** Gr = 10		3	2	1	4
○ **Need more feedback** Gr = 2			1		1
○ **No difference** Gr = 3	1		0	2	0

Codes	Cooperative learning-embedded assessment questionnaire questions				
	Purpose of CL-EA	Role of CL-EA in learning process	CL-EA's influence on learning	Influence of CL-EA on examination preparation	General feeling regarding CL-EA
○ **Own future classroom practice** Gr = 26	8	8	6		4
○ **Positive outlook on assessment** Gr = 1					1
○ **Prepared me for the examination** Gr = 32		2	2	26	2
○ **Problem solving** Gr = 1			1		
○ **Promote learning** Gr = 58	12	13	23	3	7
○ **Selecting appropriate learning strategies** Gr = 28	1	7	12	6	2
○ **Teaching and learning strategy** Gr = 2	1	1			
○ **Testing knowledge** Gr = 22	20	2			
○ **Time management** Gr = 6			1	5	

[Gr = G-count = groundedness] – refers to the number of linked quotations.

The first-year Life Sciences students furthermore perceived that CL-EA enabled them to monitor their learning progress. The ability to monitor one's learning progress is also an SDL characteristic (see section 2.6). The G-count of 42 is an indication of the high number of linked quotations to this code. Notable is that the majority of the quotes were linked in the narrative pertaining to the purpose of CL-EA, which suggests that the first-year Life Sciences students perceived the role of CL-EA first and foremost to be one of monitoring their learning progress. Preparing students for the examinations, was another perception the first-year Life Sciences students held of CL-EA (G-count = 31). Students also perceived CL-EA to enable them to select appropriate learning strategies (G-count = 28). Being able to select appropriate learning strategies is also a characteristic of a self-directed learner. The perception that CL-EA enabled the first-year Life Sciences students to select appropriate learning strategies might be a result of the immediate feedback and reflective opportunities that were provided by CL-EA. An inspiring result is the perception that CL-EA seemed to have influenced the first-year Life Sciences students' own future classroom practice (G-count = 26). This might be ascribed to students' positive experience with being involved in the CL-EA intervention. Students perceived CL-EA as a feedback mechanism (G-count = 25), and they highlighted the role of CL-EA in their learning process as providing feedback. The immediate feedback provided by peers within CL-EA seemed to have been of value to students' learning processes. Giving and receiving feedback is not only an SDL characteristic (see section 2.6), but also an important (often neglected) aspect of successful assessment (see section 2.4). Effective feedback feeds forward and improves student learning (amongst others) (see Table 2-3). Evident from Table 5-18, is that students perceived CL-EA to provide them with the opportunity to test their knowledge (G-count = 22) as well as an 'increased understanding of the content' (G-count = 18). Students did not perceive that the purpose of CL-EA was to have them work in groups, but group work (G-count = 8) seems to have played a role in the learning process and students' preparation for the examination. This result suggests that the cooperative, participative and social nature of CL-EA enabled the first-year Life Sciences students to value the contribution of group work towards their learning processes.

Upon analysing the above-mentioned codes, the following code groups concerning the students' perception of CL-EA were identified. These were analysed and will be discussed briefly:

- curiosity and motivation;
- enabling feedback;
- enhanced learning;
- preparation for the examination;
- identifying learning gaps;

- own development as a teacher;
- participative assessment; and
- testing knowledge.

Table 5-21 presents the codes, code groups and some quotes associated with students' overall perception of CL-EA.

Table 5-21: Code groups, codes and some quotes associated with the students' overall perception of cooperative learning-embedded assessment

Code group	Code	Some quotes
Curiosity and motivation	Created curiosity	*"Assessment [CL-EA] … created curiosity to learn more and develop as a student."*
	Encouraged me to prepare	*"It [CL-EA] encouraged me to prepare."*
	Motivation to learn	*"Because I go through an assessment, I have to be fully prepared. And the way we do our assessment [CL-EA] encourages me to study."*
Enables feedback	Feedback mechanism	*"After the assessment [CL-EA], I will know where I need to focus more, especially after getting the feedback."*
	Need more feedback	*"More feedback is required."*
Enhanced learning	Apply knowledge	*"It [CL-EA] helped me to understand the work better through applying it."*
	Enhanced critical thinking	*"They [CL-EA] made me use critical thinking."*
	Identifying important content	*"[I]t [CL-EA] helped me realise what is important and what not."*
	Identifying achievement standards	*"[I]t [CL-EA] helped me to see what is expected of you and gives an indication of what is needed to know."*
	Improved work	*"It [CL-EA] helped me to improve the work that is assigned to me."*
	Increased understanding of content	*"[T]hrough the assessment [CL-EA], I gained knowledge."*
	Learned easier	*"[I]t's [CL-EA] an easier way to learn."*
	Learned new skills	*"I acquired new skills."*
	Monitoring progress	*"The assessment influenced my performance as I used all the resources which were provided to help myself to evaluate on how much I have learned on a certain content."*
	More independent learning	*"The aim thereof [CL-EA] was to enable me to work and to be less dependent on the lecturer."*
	Problem solving	*"I am able to sort things out easily."*
	Promote learning	*"It [CL-EA] was difficult yet a pleasant experience and it helped me get through difficult parts of the work."*

Code group	Code	Some quotes
	Selecting appropriate learning strategies	*"It [CL-EA] taught me to use different methods of learning or analysing concepts."*
	Teaching and learning strategies	*"The tests we wrote helped me a lot as they served as summaries for my work."*
Examination preparation	Better prepared	*"I was better prepared and already had an idea of the content I had to study [for the examination]."*
	Less stressful	*"They [CL-EA] make tests less stressful overall increasing our marks in my opinion as well."*
	Logical answering	*"[H]ow to tackle questions and answer them in a more logical way."*
	No difference	*"I learned the work in the same manner as always."*
	Prepared me for the examination	*"They [CL-EA] helped to prepare for my examinations."*
	Time management	*"It [CL-EA] helped me to spend less time on unnecessary information and focus more on reaching the outcomes of each chapter. It helped me to manage my time."*
Identifying learning gaps	Diagnosing learning needs	*"[T]o help students either by identifying what they or what they don't know. This helps them in identifying what they need to study."*
	Identifying strengths and weaknesses	*"I was able to identify my strengths and weaknesses."*
Own development as a teacher	Own future classroom practice	*"It [CL-EA] also played a big role in preparing me for my classroom when I become a teacher."*
	Positive outlook on assessment	*"Gives you a more positive outlook on assessment."*
Participative assessment	Group work	*"It [CL-EA] taught me how to interact and work in groups successfully."*
	Learn better on my own	*"I am someone who studies better on my own in silence."*
	Learning from peers	*"I feel very pleased with the assessments [CL-EA] that was used because I was exposed to writing tests with my peers and got to see how to approach tests."*
Testing knowledge	Testing knowledge	*"To test how much the learner knows of the content."*

Evident from the analysis of the students' responses to the CL-EAQ, was that students' perceived CL-EA to be of value in their learning process. A discussion of each of the identified code groups follows in sections 5.6.1.1 to 5.6.1.8.

5.6.1.1 Curiosity and motivation

Students indicated that CL-EA created curiosity, encouraged them to prepare for the examinations, and motivated them to learn.

One student said,

> *It [CL-EA] made me realise to do more preparation*.

Another student said,

> *I'm feeling determined to put efforts due to the different techniques which were applied for assessment practices*.

The CL-EA activities seemed to have created curiosity in students, which in turn may have encouraged learning and preparation. Furthermore, the CL-EA intervention motivated students to learn. As none of the students indicated that they were motivated by marks or grades, it may be an indication that CL-EA intrinsically motivated students. Students mentioned that they felt more motivated because of their involvement in CL-EA, as CL-EA activities equipped them to achieve better in the examination.

5.6.1.2 Enables feedback

Although two students indicated the need for more feedback, the majority of the students perceived CL-EA as a feedback mechanism, which also provided students with the opportunity to learn from their mistakes.

One student said,

> *I can understand the module fully because in every written test [CL-EA] there is a feedback, so it gives us an opportunity to fix our mistakes as learners*.

Noteworthy is that the whole-class group processing at the end of a CL-EA activity (see section 3.4) was also perceived as feedback and encouragement, and a student said,

> *It [CL-EA] gives learners the encouragement because lecturers provide positive feedback and help me see where my developmental needs are*.

Students seemed to have made use of the feedback opportunities structured within CL-EA and saw the value of the immediate feedback.

This might be the reason why it was said,

> *[CL-EA] has had a positive impact on my learning, because I immediately got feedback on what I know well enough and what I need to revise for the exam*.

Students not only indicated the value of CL-EA in terms of receiving feedback, but also in terms of providing feedback. This is indicated by the association between 'learning from peers' and feedback (see Figure 5-2). Cooperative learning-embedded assessment within this investigation was structured to include opportunity for immediate feedforward (see section 3.4) through CL and the associated basic elements. It seems that this participative nature of CL-EA provided the first-year Life Sciences students with the opportunity to give and receive feedback, as well as to value the giving and receiving of feedback as promotive to their learning progress. The ability to give and receive feedback is an important characteristic of a self-directed learner (see section 2.6). Merely receiving feedback without knowing what to do with it or not having the opportunity to act on it, is not conducive to learning, and suggests a low level of assessment literacy (see section 2.5).

5.6.1.3 Enhanced learning

Figure 5-2 presents the relationship network for the codes associated with the 'enhanced learning' code group.

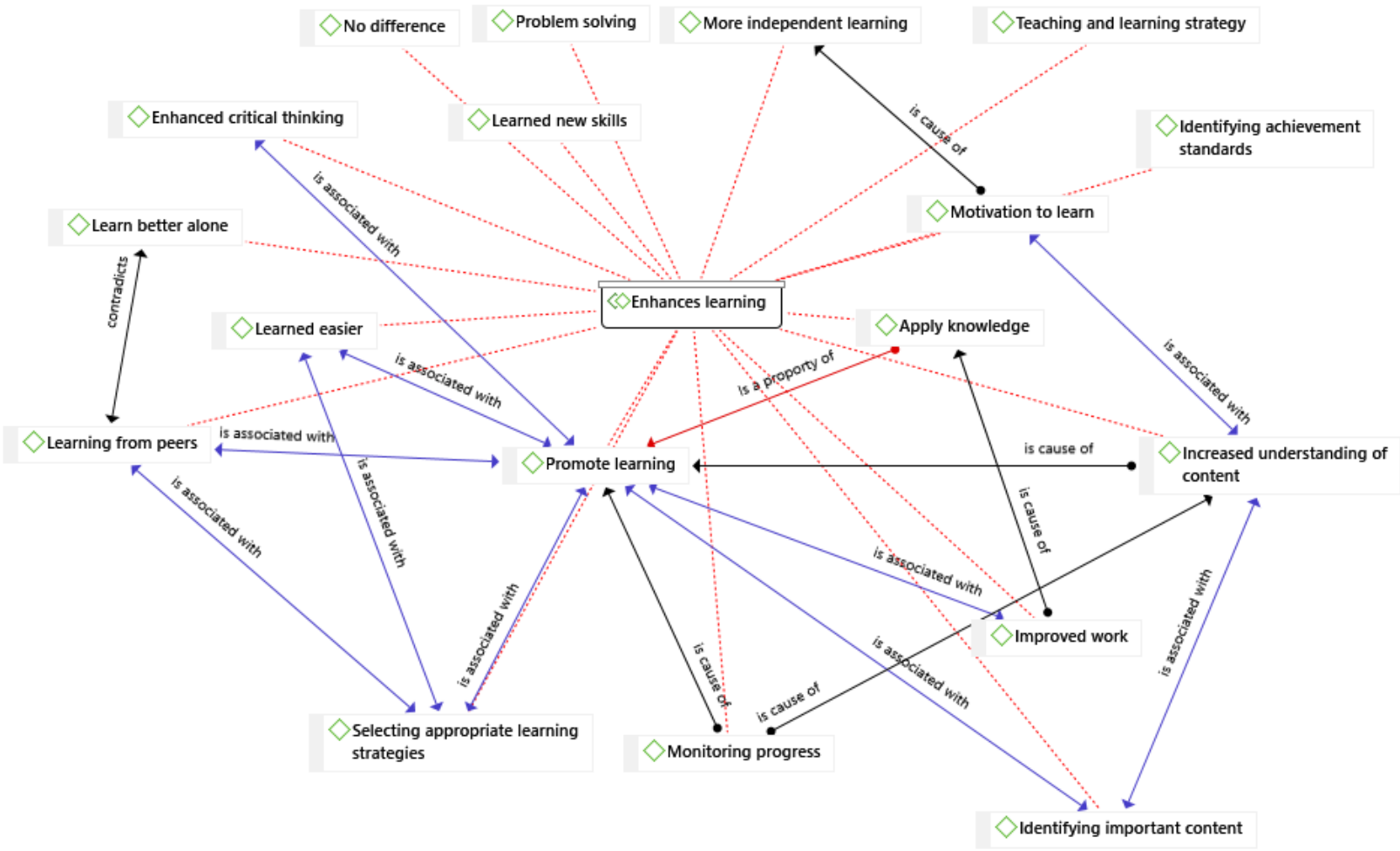


Figure 5-2: Relationship network for codes associated with the 'enhanced learning' code group

Students indicated that CL-EA provided the opportunity to apply knowledge and students said,

> *I was more focused on applying the work, rather than just wanting to study everything. It required me understanding what I was learning*,

And

> *Assessments helped me apply the knowledge I learnt from the classroom*.

It was indicated that CL-EA enhanced students' critical thinking skills, not just in answering the questions, but also with regard to the implementation of CL-EA and a student said,

> *This [CL-EA] has influenced me by looking more critically at the type of assessment done*.

Thinking more critically about the type of assessment that was done is an important skill of someone who is assessment-literate (see section 2.5.1). Another important characteristic of an assessment-literate student is the ability to identify achievement standards (see section 2.5.4), and students indicated that CL-EA enabled them to identify the achievement standards. A student said,

> *[CL-EA] enabled me to identify performance standards and expected skills.*

The following response is an indication that students perceived CL-EA to assist in identifying important content,

> *I could identify which work was important*.

Being able to identify important content relates to identifying learning gaps, which is another important SDL characteristic (see section 2.6). It seems that being involved in CL-EA enabled students to identify learning gaps through establishing what is important and monitoring their progress. The following quotes are evidence that students perceived CL-EA to play an important role in monitoring their progress:

> *I would go through all the assessment work again to see if I understand the work better than I did before*.

> *The assessment [CL-EA] influenced my performance as I used all the resources which were provided to help myself to evaluate on how much I have learned on a certain content.*

The ability to monitor one's learning progress is characteristic of someone who is self-directed in his or her learning process (see section 2.6). It seems that the nature of the implemented CL-EA intervention provided a platform for students to develop the skill of monitoring their

learning progress. A self-directed learner can select appropriate learning strategies after diagnosing learning needs and evaluating his or her learning progress (see section 2.6). It was indicated that CL-EA played a role in assisting students to select appropriate learning strategies based on feedback provided within the CL-EA.

One student said:

> *Assessment has helped me improve my learning methods. Through assessment I saw that I had to adjust my learning to understand the work and not just to learn the work.*

Another student said:

> *It [CL-EA] forced me to learn in more detail. To experiment with various learning methods. Use various resources during the learning process*.

Students furthermore indicated that CL-EA improved their work, increased their understanding of the content, enabled them to learn easier, harder and more, enabled them to learn new skills, had a positive influence on their learning, enabled them to use problem-solving skills, and guided them in their learning process.

Students perceived CL-EA also to support independent learning and said,

> *Its [CL-EA] purpose is to make learners work themselves and to rely less on the lecturer.*

Being more independent in one's learning is seen as an important SDL characteristic (see section 2.6). Several of the responses made by students regarding their perception of CL-EA pointed towards the ability of CL-EA to promote learning.

One student said,

> *The assessment gave all of us the opportunity to improve our learning because it was fair and available for everyone*.

Another student said,

> *It [CL-EA] was a good way of learning new things*,

which is also an indication that students learned while doing the CL-EA activities; hence, learning through assessment. It was furthermore indicated that CL-EA was used as a teaching and learning strategy as it was mentioned that one of the purposes of CL-EA is to explain the content of the module to students. The fact that the implemented assessment activities were embedded within the CL teaching strategy, might have contributed to the fact that students

perceived CL-EA as more than assessment, but rather as a teaching and learning strategy also.

5.6.1.4 Examination preparation

It seemed that students perceived CL-EA to have contributed to them being better prepared for the examination.

A student said,

> *I was better prepared [for the examination] and already had an understanding of the content I needed to learn*.

It might be that the discussions and feedback in CL-EA prepared students better for the examination.

Another student said that CL-EA shows,

> *how to tackle questions and answer them in a more logical way*,

which might also lead to better preparation. Several students indicated that CL-EA enabled further learning and said,

> It [*CL-EA] gave me confidence and it made me see difficult perspectives regarding this [LIFE] module and to learn more*.

The participative nature of CL-EA might have contributed towards further learning. Although three students indicated that CL-EA had no influence on the way in which they prepared for the examination, several students indicated that CL-EA assisted them in preparing for the examination. The following quotes reflect students' perception regarding examination preparation:

> *Can now remember long-term work needed for exams and I know what to work on*,

and

> *It [CL-EA] helped me to prepare more than I used to prepare.*

It seems that the feedback nature of CL-EA also contributed to students being better prepared for the examination and they said,

> *The feedback that I got helped me to prepare for this exam*.

CL-EA furthermore assisted students during their preparation for the examination by indicating what is important for the examination and helping students with time management. It might be that knowing what is expected in the examination, being better prepared for the examination, and managing one's time during preparation for examination caused the examinations to be less stressful.

A student remarked,

> *They [CL-EA] make tests less stressful overall, increasing our marks in my opinion as well*.

5.6.1.5 Identifying learning gaps

Being able to diagnose learning needs is an important characteristic of a self-directed learner (see section 2.6), and implies that one identifies problem areas, as well as strengths and weaknesses with regard to content. Several students indicated that CL-EA enabled them to diagnose learning needs, and it was said,

> *The assessment helped me realise my knowledge capability, how much I know and also guided me in terms of areas that I need to put more effort in.*

Another student said,

> *Through assessment I noticed my mistakes and identified my problem areas.*

Identifying strengths and weaknesses was mentioned by a couple of students as an important aspect of CL-EA and a student said,

> *Assessment helped me know my areas of strength and weakness and what I need to do to improve my performance*.

The participative nature and feedback component of CL-EA might have created opportunities for the first-year Life Sciences students to identify their learning needs.

5.6.1.6 Own development as a teacher

Several first-year Life Sciences students indicated that CL-EA influenced their development as future teachers and said,

> *These assessments helped me to figure out the type of teacher I want to become.*

Being able to select appropriate assessment methods is a characteristic of an assessment-literate person (see section 2.5.2). The following response indicates that CL-EA contributed to students becoming aware of different ways of assessment,

> *We were exposed to different ways of assessment so that we will be able to use it in our own class environment*.

Students' positive outlook on assessment might be a result of the positive role CL-EA played in their learning process and preparation for the examination. In turn, this might be the reason why students would want to implement similar assessments in their classrooms in the future.

5.6.1.7 Participative assessment

Despite two students indicating that they learn better on their own, several students mentioned the value of the group work (cooperative learning) component of CL-EA and said that CL-EA, "*was very advantageous because we can discuss some of the aspects we do not fully understand*".

Another student said,

> *The tests we wrote together really helped me a lot, because I could learn from the other people so many times. Two heads are always better than one!*

The CL component of CL-EA provided students with the opportunity to learn from each other. Seeing peers as resources is another SDL characteristic, and it was said,

> *In a way that I was able to learn in different ways and learn from fellow students*.

The CL component of CL-EA facilitated students to develop social skills, which is a characteristic of a self-directed learner, and it was said,

> *It [CL-EA] developed my skills in learning to work with others [peers].*

Students indicated that CL-EA contributed to the acquisition of the ability to self- and peer assess. The participative and cooperative nature of CL-EA might have provided an environment conducive to the development of these assessment literacy skills (see section 2.5.1).

5.6.1.8 Testing knowledge

Several students indicated that the purpose of CL-EA was to test their knowledge. It was indicated that the purpose of CL-EA is,

To assess the learners' knowledge and the understanding of the LIFE module.

Another student said that the purpose of CL-EA is to,

Check our understanding of the content [LIFE module] thus far.

Testing knowledge, within the context of CL-EA, might be linked to students diagnosing their learning needs.

Additional qualitative data was gathered by means of semi-structured individual interviews with a total of eleven first-year Life Sciences students, aimed at determining their perceptions of CL-EA. The results of the analysed data are presented in section 5.6.2 below.

5.6.2 Students' interview responses regarding their perception of cooperative learning-embedded assessment

Upon analysing the transcribed data, the following code groups concerning the students' perception of CL-EA were identified:

- contributed to learning;
- valuable feedback;
- group composition;
- implementation in other modules;
- own future classroom practice;
- participating in CL-EA activities;
- reflection component; and
- valuable.

Table 5-22 presents the code groups, codes and some quotes from interviews pertaining to the first-year Life Sciences students' perception of CL-EA.

Table 5-22: Code groups, codes and some quotes pertaining to students' perception of cooperative learning-embedded assessment

Code groups	Codes	Some quotes
Contributing to learning	CL-EA: Helpful	*"Personally, it was a good experience. It was something new I've never done. And seeing that it was in my first year, it was quite fun as well. So, I learned and had fun at the same time. It was really helpful. It would've been better if we still do that for every year, not just the first year. But it was helpful."*
	CL-EA: Independent learning	*"It's not always about a teacher giving you a test and then you have to write all the correct answers and everything."*
	Diagnosing learning needs	*"[A]nd you get the opportunity to see where I am now and where am I improving. And you get the opportunity to say what you think about the content what you've studied."*
	Improved learning	*"To use assessment as a tool to enhance my learning, because if only you learn without assessment there is no way that you can be able to learn properly. Because you learn from these assessments … so that you know you can learn more than what is needed … maybe the effort that is needed to put in those activities."*
	Improved understanding	*"And to work together, to hear others' knowledge, builds your knowledge."*
	Learned better	*"I learned a lot more than I did in Maths, for example, with normal tests."*
	Learning from discussions	*"Because I believe when I'm helping someone most specially when I'm giving that person information, particularly academically, I'm also learning. It's more like I'm rehearsing."*
	Learning from peers	*"And they [CL-EA] give us the opportunity to learn from other people, and not rely on your own information."*
	Provided opportunity to learn	*"The assessment activities gave me more opportunity to learn."*
	Seeing mistakes	*"Because after I did my individual test, I would see my mistakes."*

Code groups	Codes	Some quotes
	Selecting learning strategies	*"Because they [CL-EA] were strategies that I used to learn, and they [CL-EA] were strategies that I used to study."*
	Testing knowledge	*"Tests my knowledge of the module."*
Valuable feedback	Feedback mechanism	*"At the same time, you are able to evaluate and know where you went wrong."*
Group composition	Assigned to groups	*"One other thing is that you get to know more people, like now I know more people because of that."*
	Choosing own groups	*"I think it is better to choose my own group."*
	Disadvantage of choosing	*"[W]ith friends you can't say certain things … to kind of shelter the friendship to keep the friendship intact. So, with other people, it's okay to say something. And they won't take it hard, because they don't really know each other."*
Implementation in other modules	Implemented in other modules	*"I would like this to be implemented definitely more … in education. For too long, education has been very structured, and it was built for a certain type of mind … and it almost form children's minds in a certain type of way … but this gives us a route … to spread basically, to reach different minds."*
	Module specific	*"[B]ut with LIFE I think it might be more suited to LIFE, because LIFE is a very complex subject."*
	Element of surprise	*"The element of surprise was so much better. It was shocking at times, because there was one test where we had to write down … we wrote … so everyone was nervous … it's test and the questions were difficult. So, we had to write it down … And then it was like, peer assessment … we had to mark each other, the peer had to make corrections based on what they know, on what they understand. It was helpful. The element of surprise worked. If we would've known, we wouldn't have studied."*
Own future classroom practice	Future classroom	*"I would definitely take a lot of this into the school environment when I start teaching. Definitely. I think it is very important for learners to be interactive. For too long education has been very formal, so I think this is something that I will take into my teaching environment."*

Code groups	Codes	Some quotes
Participating in CL-EA activities	Confidence to participate	*"So, I fully participated. I will talk about it, go through it word by word, eliminate (if it was multiple choice) eliminate the answers … until I understood the question and also the answer. Let's say there were different answers, until I understood what each answer or the concept of each answer is."*
	Standing back	*"I would easily stand back. I have a gentle personality and would rather stand back."*
Reflection component	Providing opportunity to reflect	*"Well, I would say the assessments done in this module were very, very fair and it gave us the opportunity … you know … it gave us the opportunity to study, and then to reflect and see what we know and what we don't know … it gave us that opportunity."*
	Online reflections: negative	*"[T]hey [online reflections] were not working for me, because some of them I didn't understand what to do, so they were not that much of help to me."*
	Online reflections: selecting learning strategy	*"The first one [post-assessment-reflection] helped me to change my learning strategy."*
	Helpful	*"I think it was very helpful. It's always helpful to reflect. When you write a reflection, even if it is online or on paper, it's very helpful."*
	Motivating me	*"[B]ut then it's like motivation … because then you feel okay, I haven't put in enough time now … and I haven't thought so hard about my strategy and … then you start thinking about such things … are going to spend more time on it now."*
	Valuable in identifying learning gaps	*"And post-assessment … what I like about it, it is almost like rewriting the test, but I am not rewriting the test … just checking up on myself, checking up where I am, what I know. So, it actually does contribute a lot."*
	Valuable in learning process	*"Definitely, it's half like a guideline … now you have to learn something in such and such way, rather than learning in another way."*
	Reflections paper-based	*"I think so because … sometimes I do not have access to the online information. But only if the information is on paper, I can use that information when I study."*

Code groups	Codes	Some quotes
Valuable	Helpful	*"In terms of learning, in terms of structuring, in terms of understanding … as a whole. As a whole it helped me feel more stable. Yes, yes. Especially because we have different teaching and learning styles as students. And for me, structured teaching learning doesn't work, and I know there are other students like me. This was a different approach to learning, to writing tests, to writing papers … so, it was actually helpful."*
	Enjoyable	*"It was quite enjoyable."*
	Less stressful	*"[I]t meant a lot to me because it took stress … pressure off me. Because I struggled … like … how the lecturer was going to ask, especially in the beginning … because I just struggled, it was so hard for me, because you never know … and the book … the book is in English, then … do I use the right words? So, it [CL-EA] would have been better for me … to work with someone again and go through it again."*
	Motivation	*"Now it [CL-EA] motivates you, because you see you can actually do well. I like that."*
	Valued	*"It means a lot."*

Evident from the analysis of the students' responses to the semi-structured interviews, is that students perceived CL-EA to be of value to their learning process. A discussion of each of the identified code groups will follow.

5.6.2.1 Contributing to learning

Several students indicated that the CL-EA intervention was helpful in their learning process.

Student 3 said:

> *In terms of learning, in terms of structuring, in terms of understanding … as a whole. As a whole it helped me feel more stable. Yes, yes. Especially because we have different teaching and learning styles as students. And for me, structured teaching learning doesn't work, and I know there are other students like me. This was a different approach to learning, to writing tests, to writing papers … so, it was actually helpful*.

Another student indicated that CL-EA enabled her to be more independent in their learning, and less dependent on the lecturer. Student 8 indicated that CL-EA enabled him to diagnose their learning needs, and said that CL-EA assisted her, "*to see where I need to improve, where is there room for improvement, where to learn harder*". Being able to identify learning gaps is an important characteristic of a self-directed learner (see section 2.6). A self-directed learner furthermore acts to fill the identified gaps in his or her learning (see section 2.6), and this was indicated by several students.

Student 9 said,

> *The assessment activities [CL-EA] gave me more opportunity to learn, and they enhanced my learning. Because they [CL-EA] were strategies that I used to learn, and they were strategies that I used to study*.

Because students perceived CL-EA to enhance their learning, it might contribute to students' improved understanding and ability to learn better. Students also indicated that CL-EA enabled them to learn from discussions and from peers, and Student 9 said,

> *That is what I am saying, I was confident to agree with the answer and to disagree. But only I was not disagreeing, I was learning from those discussions that we had*.

The cooperative and social nature of CL-EA seemed to have contributed to students learning from each other during discussions when writing assessment activities together. Being able to learn from peers (seeing peers as resources) is an SDL characteristic (see 2.6). Student 3 also said:

> *You accepted okay … I was wrong, I did miss this … I think it's being open to accepting that someone else can also help you. Someone on your level, a peer, the answer is not always from a lecturer or from a hierarchy. Someone on your level can help you with that*.

Student 1 said,

> *Like yes, it only helps if people reason it out and because we are [pre-service] teachers it also helps a lot because you improve your ability to explain that someone else understands what you thought.*

This might be an indication that students realised the importance of social skills for their own professional development as a teacher. The cooperative and social nature of CL-EA might also have caused students to change their learning strategies. Student 8 said:

> *I enjoy learning in groups, so when I hear it too … if someone else explains it, because someone explains it … is also like lecturers, each one explains it in their own way. And it's nice to hear rhymes or rather draw a picture or something like that … what someone else will say, it's easier to learn that way … it's new techniques you learn.*

It was also indicated that CL-EA provided an opportunity for the students to learn, and Student 1 said,

> "*the point of a test is that I gain more knowledge, so that if I step away – even if we have the answer wrong – that we have a better understanding of the answer*".

It seems that the individual component of the CL-EA activities provided students with the opportunity to see their mistakes, as Student 10 said,

> "*I think they [CL-EA] were very helpful. Because after I did my individual test, I would see my mistakes*."

Student 8 pointed out that CL-EA helped him in the learning process by testing knowledge and said,

> "*I think it is to test what my knowledge is for the subject. For myself, to see where I need to improve, where is there room for improvement, where to learn harder*."

This result revealed that, although students might see CL-EA as a way of testing their knowledge, they used the information from the testing aspect of CL-EA to identify gaps in their knowledge.

5.6.2.2 Valuable feedback

Several students indicated the valuable feedback which CL-EA provided, and Student 5 said,

> *At the same time you are able to evaluate and know where you went wrong and everything. You are able to see where you went wrong*.

The immediate feedback provided during CL-EA was also pointed out by students, and Student 1 said, "*because you get quick feedback, so like your misunderstandings don't have very long to capture*". Student 3 said:

> *So, when you write the test, you write, and you don't know. I never go back to my paper and see what I did wrong, what I missed, go back to my text books … oh, this is what the answer is supposed to be … never. Move on, to the exams. But with this, you allow yourself to go back and … oh, so this is what I missed. So, you get that second opportunity rewrite, to maybe write it in a pair or individually. You have a 'aha' moment. You know, so really, it's learning. It's a learning process in testing yourself. It's almost like you write your test before you write the exam to check how much you know*.

Being able to recognise feedback and act on the feedback is one of the skills of a person who is assessment literate (see section 2.5). It seems that CL-EA provided students not only with the opportunity to obtain immediate feedback, but also with the opportunity to act on the feedback.

5.6.2.3 Group composition

Students had varied perceptions regarding the group composition for CL-EA. Several students indicated that it is best if students were assigned to the groups within which the CL-EA activities could be implemented. Student 9 said:

> *If only they choose a friend, they know that friends prepare up to here and sometimes it is ineffective to learn from friends. If only you as a lecturer choose groups for us, it is quite better because you are nervous, you don't know the people, so you want to prove that you can do something, you want to show them that you are learning something. If only you are working with your friends, I don't think it's effective. And it will be different when you as a lecturer compile the groups and choose different people to work with. If only you work with your friends, you know their strengths and weaknesses, but somebody new you know nothing about them. So, I think it is better to work in a group with quite different people*.

Student 11 pointed out:

> *For some activities, to be honest…for some activities whereby I didn't understand, it was a disadvantage. But for some it wasn't a disadvantage, because I knew the work. And for the others, I didn't, so I needed the peer help.*

On the other hand, several students indicated that they preferred choosing their own groups. Student 1 said:

> *I personally would want to choose, because then I know I'd rather go with my friends. Not because I'm like comfortable, but for knowing I will be able to say "listen here, that's how I just reasoned", and they'll tell me "listen here you're wrong", or "it's actually so" … if you are between strange people and they are too scared to express their opinions, or there is one very strong personality and the other is very gentle, and that person actually knows nothing, then nobody wants to say anything.*

An Afrikaans-speaking student (Student 6) stated that it is best to choose your own group members, because it is then possible to choose people with the mother tongue language,

> *It was only once that I worked in another group … Then I worked with another student and English students, so that was all a bit difficult*.

5.6.2.4 Implementation in other modules

Although Students 9 and 11 indicated that CL-EA is subject-specific, the majority of students indicated that CL-EA could be and should be implemented in other modules as well and Student 1 specifically referred to Physics when she said:

> *I think so, yes. Like especially, I have Physics as a subject, so, especially to get faster feedback on Physics, but these are half-memorised answers … if I can put it that way … because your sum is either right, or it's not right. And, like I said, you're not going to write something you know is wrong. You're going to think you're right. So, doing a turn-around test and working with someone and identifying your mistakes faster will certainly help you do better. Especially with things you haven't dealt with yet, I think … yes, it's very valuable and I really think it can be applied to other subjects*.

Students also indicated that it is best not to know beforehand that assessment activities will comprise CL-EA. Student 5 indicated that she would also make use of the element of surprise when implementing CL-EA in her classroom in future by saying:

> *It's a good thing, because … it's a good thing I can tell you that. I will also do that as a teacher, because I didn't know that it was going to be a group test … I wrote … gave all my best, and after that we had to write as a group.*

5.6.2.5 Own future classroom practice

Four students indicated that they would make use of CL-EA activities in their classrooms one day. Student 10 indicated that he is using CL-EA during his work-integrated learning (WIL) period and said,

> *As a student, during my WIL practicals [work-integrated learning lessons], I used most of them. When you give us the papers, I would keep them, and then on WIL I would use them*.

It seems that this first-year student took initiative at the school where he conducts his WIL lessons. Being able to take initiative is a characteristic of a self-directed learner (see section 2.6). It might be that the perceived learning benefit of CL-EA caused students to implement CL-EA during WIL and their plans to implement CL-EA in their own classrooms.

5.6.2.6 Participating in cooperative learning-embedded assessment activities

Student 8 indicated that he did not have the confidence to voice possible differences in opinions during CL-EA discussions and said,

> *"I would easily stand back. I have a very gentle personality, so I'll stand back."*

Other students indicated that they had the confidence to participate due to the perceived learning opportunity, and Student 9 said:

> *So, that gave me an opportunity to gain confidence, because … for example, when we were doing group work, I had to disagree with other students, because I knew what I learned, and I was confident that this is the right answer. Because some of the things that I do, I do not rely on this group, I would go the extra mile to learn something, especially when I do not understand something. And I ask questions. And I ask some of the people*.

It seemed that the perceived learning benefit of CL-EA enabled students to have confidence to discuss their own views and opinions with regard to the content of the LIFE modules.

5.6.2.7 Reflection component

Students stated that the reflection component of CL-EA (P-A-R and paper-based reflection of the P-I-P&S) did indeed provide an opportunity to reflect and was valuable in their learning process. Student 5 said:

> *Well, I would say the assessments done in this module were very, very fair and it gave us the opportunity … you know … it gave us the opportunity to study, and then to reflect and see what we know and what we don't know … it gave us that opportunity*.

It seems that the reflection component also enabled students to identify possible gaps in their learning and Student 9 stated:

> *These questions were very, very useful because you are already estimating the mark that you are going to get … then after a test you are getting the mark, you'll be surprised … maybe it's more or maybe it's less. Now you know what I am going to do, what am I going to improve on.*

Student 1 said:

> *So your reflection was also more effective in the sense of, you can do better … like specifically pin point where or what you need to improve, or learn more, or do not understand yet. True, if you're reflecting on a normal test, then that's half okay, but I don't know. You are now waiting for your point*.

The following response by Student 3 also indicates that the reflection component of CL-EA were perceived as helpful to their learning progress:

> *It is a good self-evaluation, I mean besides that fact that it got to do with school work … it's also about discovering yourself as a student … how you progress, how you learn, the pace you work at. I think that is very important for students.*

Student 2 indicated the motivational influence of the CL-EA reflections and said:

> *[B]ut then it's like motivation … because then you feel okay, I haven't put in enough time now … and I haven't thought so hard about my strategy and … then you start thinking about such things … are going to spend more time on it now*.

It seems that the reflection component of CL-EA motivated students to work harder and to adapt their learning strategies. Being intrinsically motivated and being able to adapt one's learning strategies are both characteristics of someone who is self-directed in his or her learning process (see section 2.6). Student 5 specifically highlighted the influence of the online post-assessment reflection (P-A-R) in enabling her to select appropriate learning strategies. Student 9 perceived the online nature of the reflection activities as negative, and stated that paper-based reflection activities would have been better. It seems that, despite the online nature of the reflections being negatively perceived by one student, the majority of students valued the opportunity to reflect, and indicated the influence of these reflections on their learning process.

5.6.2.8 Valuable

Students indicated that CL-EA was enjoyable, valued and helpful in their learning process and Student 11 said:

> *Personally, it was a good experience. It was something new I've never done. And seeing that it was in my first year, it was quite fun as well. So, I learned and had fun at the same time. It was really helpful. It would've been better if we still do that for every year, not just the first year. But it was helpful*.

Four students specifically referred to CL-EA being valuable due to its motivational influence. Being probed to elaborate on the value of CL-EA, Student 2 said:

> *It helped, definitely, especially because … like if you have to work closely with people, then you actually feel responsibility to prepare, because you don't just let yourself down. You let everyone down. It motivated me. And gave me responsibility*.

CL-EA was also valued for decreasing the stressful nature of assessment, and Student 6 said:

> *And then about stress I do a thing, and then I don't usually do well because I think about it. And with that [CL-EA] it was more enlightening … "you'll be okay" … It was fun for me. Yes, I really enjoyed that*."

All the above-mentioned results highlighted the perceived value of CL-EA. The first-year Life Sciences students indicated the role CL-EA played in their learning process. CL-EA furthermore enabled feedback, which was valuable in their learning process and learning progress. Students perceived CL-EA to influence their professional development as teachers. The reflection component of CL-EA was also perceived as a valuable aspect. Students provided valuable information regarding group composition, implementation possibilities in other modules, as well as aspects influencing students' confidence to contribute during CL-EA activities. CL-EA was also perceived to assist students in their preparation for the examination, as well as assisting in testing their knowledge. The qualitative data presented in this section, was used to draw conclusions regarding the first-year Life Sciences students' perceptions of CL-EA, which are reported on in Chapter 6.

The possible relationship between the first-year Life Sciences students ALit and SDL is presented in section 5.7 below.

5.7 Discussion

The qualitative data, which was gathered from the experimental groups (Years 2 and 3) by means of an open-ended questionnaire (CL-EAQ) and semi-structured interviews, was analysed using ATLAS.ti™ version 8. Analysis of the CL-EAQ showed the perceived role CL-EA played in the first-year Life Sciences students' learning process. Students indicated that they perceived the purpose of the CL-EA intervention to –

- monitor their learning progress;
- provide them, amongst others, with an increased understanding of the module content;
- help to identify strengths and weaknesses; and
- enable further learning.

Students also indicated that CL-EA enabled feedback, which was valuable in their learning process and learning progress. Students perceived CL-EA to influence their professional development as teachers, which means that even though the students were in their first year at university, CL-EA provided an opportunity for them to be mindful of their own future classroom practice. The analysis of the semi-structured interviews indicates that the reflection component of CL-EA was perceived as valuable to their learning process. Students provided constructive information regarding group composition, implementation possibilities in other modules, as well as aspects influencing students' confidence to contribute during CL-EA activities. CL-EA was perceived to assist students in their preparation for the examination, as well as to assist in testing their content knowledge. These qualitative results added valuable meaning to the quantitative results, which were obtained by means of the SALQ and the SRSSDL (see sections 5.3 and 5.4). Analysis of the SALQ (see Table 5-9) indicated that the experimental group had a significantly higher mean value after the CL-EA intervention in the following SALQ factors: UP, AU, as well as AJ. With regard to the experimental group's MEO, their mean value was lower than the mean value of the control group after the CL-EA intervention (see Table 5-9). The qualitative results confirm these results (see Table 5-21) as students indicated in the CL-EAQ that the intervention helped them to enhance their learning (UP), identify achievement standards (AU), and enabled them to use feedback (AJ) from the CL-EA intervention to judge their own progress. Although results and analysis from the SRSSDL did not produce adequate evidence that the CL-EA intervention influenced the first-year Life Sciences students' SDL, the qualitative results provide a clear picture of the contribution of CL-EA towards the development of SDL skills (such as diagnosing learning needs, identifying strengths and weaknesses, monitoring progress, motivation for learning, and enjoyment of learning) (see Table 5-21). Furthermore, it is worth focusing on the established relationship between students' SDL and ALit and this will be elaborated upon in

Chapter 6 (see section 6.5). The qualitative results, specifically obtained from the interviews, provide valuable insights into how students perceived various aspects of CL-EA, e.g. the group composition and the reflective practice (see Table 5-22). An unexpected, yet highly welcomed, result, is that the CL-EA intervention positively influenced the first-year Life Sciences students' orientation towards assessment to such an extent that the students indicated that they would implement CL-EA in their future classrooms.

5.8 Summary

The aim of this chapter was to report on 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, which included independent and dependent t-tests. The quantitative results indicated a medium practical significant difference between the post-tests in the MEO and AU factors of the SALQ. This is an indication that the implementation of CL-EA might have had a positive influence on the ALit of the first-year Life Sciences students. Even though no statistical evidence was found that CL-EA influenced students' SDL, the qualitative results painted a different picture. Results from the Spearman's correlation coefficients indicated a relationship between students' ALit and their self-directed learning readiness. Chapter 6 will report on the findings of this investigation, provide conclusions of the most important aspects, and conclude with recommendations for further investigation.

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The question that guided this investigation was –

"What is the influence of cooperative learning-embedded assessment (CL-EA) on first-year Life Sciences students' assessment literacy (ALit), and what are the implications thereof on the students' self-directed learning (SDL)?"

In attempting to answer this question, the researcher identified the following sub-questions:

- What do CL-EA and ALit within the context of social constructivism entail?
- How can CL-EA be implemented in first-year Life Sciences classes?
- What is the influence of CL-EA on first-year Life Sciences students' ALit?
- What is the influence of CL-EA on first-year Life Sciences students' SDL?
- What are first-year Life Sciences students' perceptions of CL-EA?
- What is the relationship between students' ALit and their self-directedness to learning?

In this chapter, we first focus on the conclusions drawn from the literature study (Chapters 2 and 3) and the empirical study (Chapters 4 and 5). Recommendations, based on the results of the empirical study, are made regarding the design and implementation of CL-EA. The chapter concludes with some final remarks.

6.2 Conclusions regarding the literature study

Sections 6.2.1 and 6.2.2 contain conclusions regarding the literature study reported on in Chapters 2 and 3 respectively.

6.2.1 CL-EA and ALit within the context of social constructivism

With regard to the first research sub-question, as first stated in section 1.3.3, several aspects concerning CL-EA and ALit within the context of social constructivism became clear. The findings based on the literature study are discussed in this section, starting with what CL-EA entails within the context of social constructivism.

The social constructivist theory (SCT) was discussed in Chapter 2 (see section 2.2.2) by means of Slavin's (2012) principles of SCT, namely *cognitive apprenticeship*, *social endeavour*, *mediated learning*, as well as *zone of proximal development* (ZPD) (see Figure 2-

3). Social constructivists believe that learning is socially enabled with students' ZPD, with scaffolding, within groups.

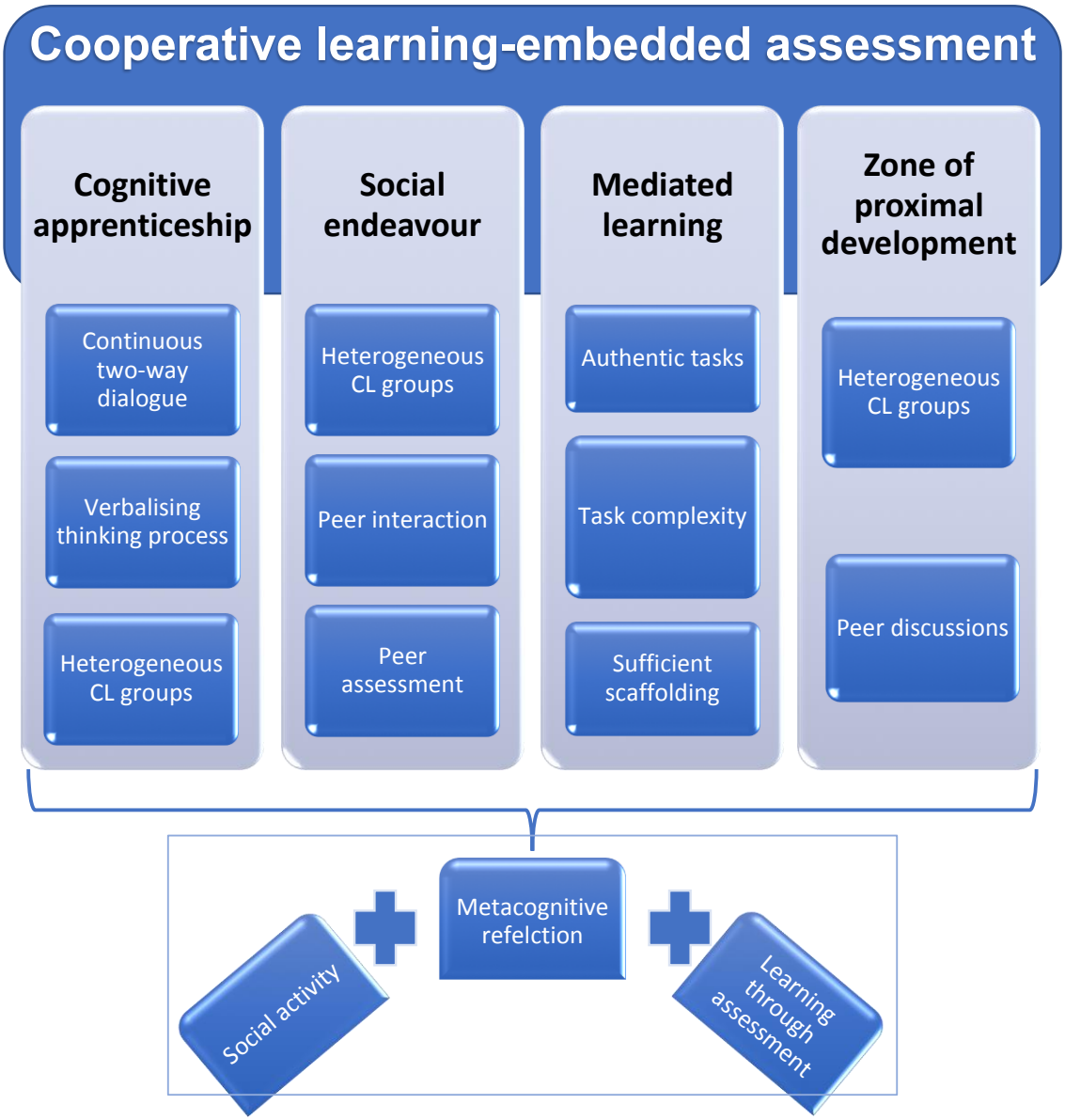


Figure 6-1: CL-EA within the social constructivist approach

Source: Author's own

From the literature (see section 2.2.2 and Figure 2-3), CL-EA within the context of social constructivism is summarised in Figure 6-1 and is elaborated upon below.

- *Cognitive apprenticeship*

  As discussed in Chapter 2 (see section 2.2.2), cognitive apprenticeship entails the gradual acquisition of cognitive skills and expertise when interacting with a more knowledgeable person. In the case of CL-EA, the more knowledgeable person can be peers and/or the facilitator (Schreiber & Valle, 2013). Therefore, opportunities for students to acquire knowledge and cognitive skills gradually through interacting within heterogeneous groups or mixed-ability groups are purposefully built into CL-EA activities. The discussions within such groups, amongst peers, comprise continuous two-way dialogue, which promotes conceptual change (Slavin, 2012). For students to acquire the cognitive skills, they need to be supported through appropriate scaffolding (Eggen & Kauchak, 2012). The scaffolding can be provided by the facilitator and/or peers, and includes giving students the opportunity to verbalise their thinking processes. The diversity of the CL group within which the CL-EA takes place, as well as working with peers while discussing problems and reaching consensus on possible answers, provides students with the opportunity to verbalise their thinking processes. Hence, CL-EA is a learning opportunity instead of being an add-on to teaching and learning.

- *Social endeavour*

  The social component provides students who are interacting within heterogeneous CL groups, with opportunities to negotiate meaning of the content socially (Schreiber & Valle, 2013). The multiple perspectives that are present within heterogeneous groups are utilised during knowledge construction. Peer assessment is used, as student engagement is encouraged (Jensen & Frederick, 2016). Therefore, CL-EA is a social activity through which students are provided with opportunities to discuss and negotiate meaning from hearing multiple points of view. CL-EA also utilises peer assessment within the CL-groups, maximising the dialogue between peers for constructing knowledge together. CL-EA cannot take place without it being a social endeavour.

- *Mediated learning*

  Making use of authentic activities will ensure the transferability and application of knowledge (Eggen & Kauchak, 2012). The authenticity of assessment can be ensured by a variety of strategies (Wiggins, 1989). The authenticity of CL-EA is ensured by:

  - involving peer and self-assessment;
  - allowing feedback;

- recurring assessments;
- enabling students to identify strengths and weaknesses regarding the content; and
- engaging students in the assessment activities.

Because authentic assessments should be multifaceted and difficult, it should be accompanied by appropriate scaffolding. Such scaffolding structures comprise:

- reflective prompts;
- feedback from the facilitator and peers; and
- leaving some choice to the students (Wass & Golding, 2014).

CL-EA should include opportunity for effective feedback (see Table 2-3), which will enable students to act upon the feedback to accelerate their learning and close the gap between current and desired knowledge. Chapter 2 reflects a detailed discussion on the role of feedback in assessment (see section 2.4), and CL-EA within the social constructivist context reports on feedback, which is a two-way communication process.

- *Zone of proximal development (ZPD)*

  The ZPD is defined as the range of activities that students will only be able to do with appropriate scaffolding, e.g. guidance of more knowledgeable peers (see section 2.2.2). Working with peers within CL-EA enables students to explain things to each other in an easy and comprehendible way, as students are learning through their interactions with peers (see section 2.2.2).

As is evident in Figure 6-1 and the discussion above, the rootedness of CL-EA in social constructivism accounts for the following CL-EA characteristics: social activity, metacognitive reflection, and learning through assessment (see Figure 3-1).

Assessment and its centrality to learning were discussed in Chapter 2 (see section 2.3), and this discussion formed the backdrop against which ALit was discussed (see section 2.5). A person's understanding of basic assessment concepts (see Figure 2-4) and processes are known as assessment literacy (Popham, 2011). From the literature (see section 2.3, section 2.5 and Figure 2-4), it is evident that ALit within the context of social constructivism entails students working with peers while familiarising themselves with standards against which their work will be assessed. Working within CL-groups, students increasingly make use of the identified assessment standards to reflect on their assessable work, whilst making use of peer

and self-assessment. The understanding of and familiarising with assessment standards are socially negotiated by making use of each other's perspectives. Thus, students are actively engaged in becoming more assessment-literate, while being supported with scaffolds through facilitator and peer feedback. Within the social constructivist environment, students furthermore realise that assessments are learning opportunities.

6.2.2 Implementation of CL-EA in first-year Life Sciences classes

Chapter 3 contains a detailed discussion of the conceptual model of CL-EA, as well as general guidelines for developing and implementing CL-EA. This discussion will form the backdrop for answering the following research sub-question:

How can CL-EA be implemented in first-year Life Sciences classes?

In Figure 6-2 below, an outline of the way in which CL-EA can be implemented in first-year Life Sciences classes.

It is evident from Figure 6-2 that the success of the implementation of CL-EA depends on well-considered and thorough planning, which is based on the guidelines and characteristics of CL-EA. It is suggested that the facilitator starts the planning process by deciding on the assessment instrument to be used (e.g. a test), keeping the length of a class period in mind. The participative nature of CL-EA means that assessment instruments or activities takes longer than, for example, the traditional individual tests. In this investigation, class periods were 75 minutes each, and the researcher planned the CL-EA instruments accordingly.

Next, the facilitator needs to decide on the assessment tool (e.g. a memorandum), the assessment method (e.g. peer assessment), as well as the form of assessment (e.g. summative or formative). Keeping in mind that CL-EA is rooted in social constructivism, the inclusion of peer assessment is vital for the success thereof. The inclusion of peer and self-assessment will also have an influence on the way the CL-EA instrument is structured and will depend on the time available. Time management is therefore also an important factor in the implementation of CL-EA. The inclusion of peer assessment will further contribute to ensuring that CL-EA is a social activity through which continuous dialogue is taking place. The composition of the CL groups should be decided upon (i.e. whether students will be allowed to form their own groups of four, or whether the facilitator will randomly assign students to a group). A crucial step in the planning of CL-EA is to ensure the presence of all five of the CL basic elements (positive interdependence, individual accountability, face-to-face promotive interaction, small-group social skills, and group processing) (see Table 4-2 and section 3.4.5). The type of metacognitive reflection opportunities should be decided upon. The facilitator

needs to decide whether a paper-based reflective prompt will be part of the CL-EA activity, or whether the reflection will be done by means of an online learning management system (LMS).

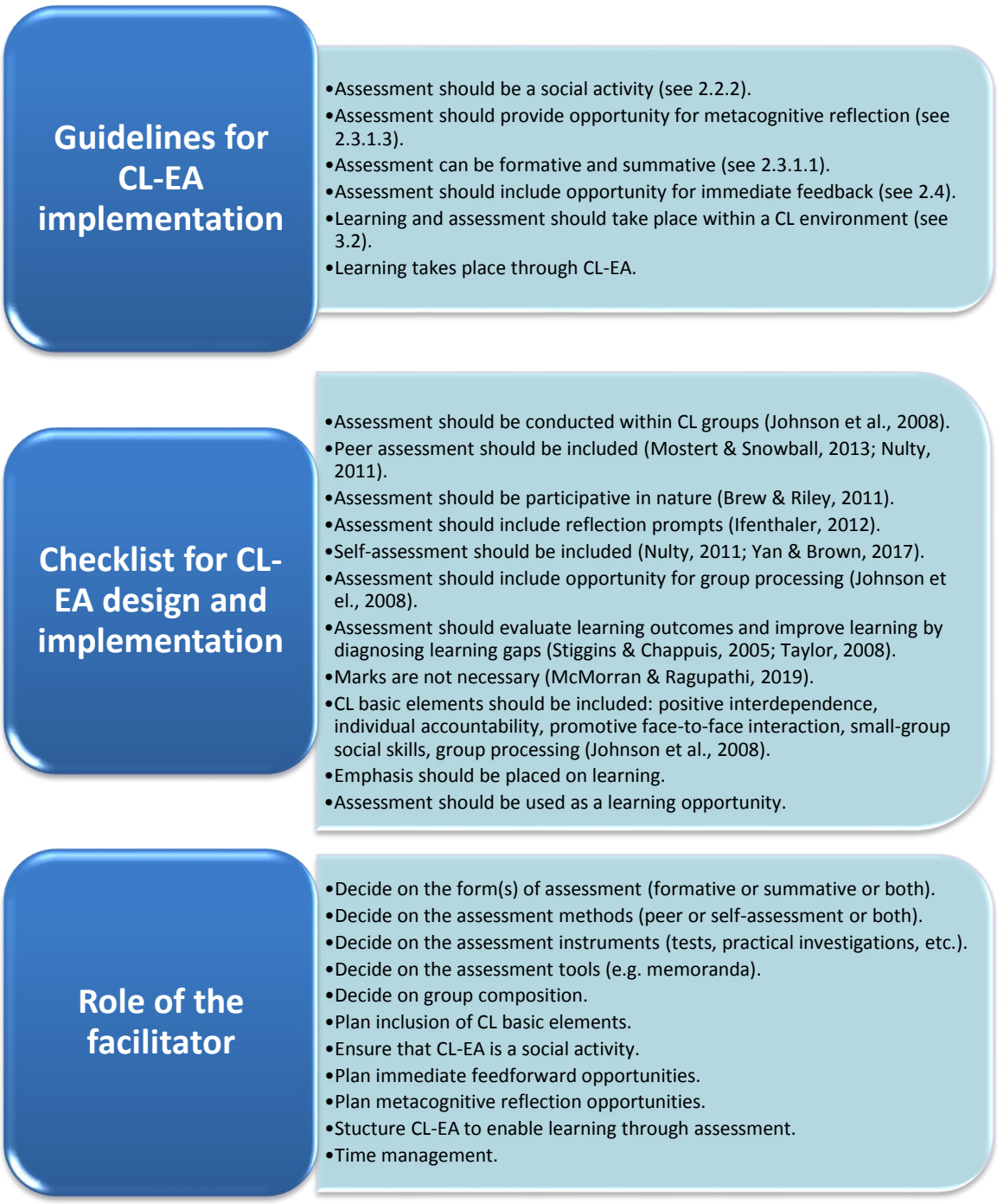


Figure 6-2: Outline for implementation of CL-EA

Source: Author's own

The structuring of the metacognitive reflection opportunities should also be considered, and facilitators should decide on the questions to be asked. It is important to remember that

metacognitive reflection is not merely a couple of random questions that students need to answer; these questions should provide the opportunity for students to think about their choice of learning strategy, for example. Immediate feedforward opportunities should also be explicitly planned to give students the opportunity not only to identify mistakes, but also to have enough time to act on the feedback and learn from those mistakes. Including an individual and group component to the CL-EA instrument (see section 4.6) gives students the opportunity to discuss possible solutions to problems or answers to a question. Including peer assessment will also contribute towards feedforward, as students will have the opportunity to discuss each other's work and help one another to identify possible learning gaps. The inclusion of group processing at the end of a CL-EA activity will furthermore provide an opportunity for students to receive constructive and specific feedback upon which they can act.

Structuring CL-EA activities in a way that enables learning to take place, influences the way in which the assessment instruments are developed. If, for example, the facilitator decides on a test as the assessment instrument, the types of questions asked should not be questions that require students to regurgitate memorised facts. Instead, the questions should be structured in such a way that the students should be working within their ZPD, and will learn something new by answering the question. The peer discussions within the CL groups when writing a CL-EA test, for example, will provide an opportunity for students to learn from one another while writing the test.

Evident from the discussion above, is the importance of purposefully planning and designing CL-EA with the CL-EA characteristics in mind. As this experience might initially be uncertain and daunting, the CL-EA planning document might be useful (see Addendum D). This planning document was compiled to enable facilitators to make provision for all the CL-EA characteristics when planning such an activity.

6.3 Conclusions regarding the empirical study

The following sections (6.3.1–6.3.5) reflect the conclusions from the empirical study as outlined in Chapters 4 and 5.

6.3.1 Influence of CL-EA on first-year Life Sciences students' ALit

The SALQ was the instrument used to determine the first-year Life Sciences students' ALit (see section 4.3.2.2). The implementation of CL-EA in the first-year Life Sciences modules had an influence on understanding that the university's purpose with assessment (UP) is to advance student's learning, to help them ascertain the quality of their work, to produce work

that can be judged by the university for marking and grading purposes, as well as to provide them with a grade so they can progress through their course (see Table 5-10). Furthermore, in the current study, CL-EA had an influence on students' understanding of performance standards (see Table 5-10), and students' responses showed that they understood the criteria against which their work was assessed. Students also indicated that they understood the achievement standards against which their work was assessed, and what they had to do to advance their learning to achieve their objective. According to Smith et al. (2013), students firstly need to understand the purpose of assessment and the way in which assessment links to their learning progress.

The CL-EA intervention also had an influence on the first-year students' orientation towards putting in the minimum amount of effort to complete assessable work. Students indicated that they did not aim to pass the module with as little work as possible, nor to use assessment to work out the minimum work needed to pass or doing assessment because they had to. From the results (see Table 5-10), it is evident that the CL-EA intervention had a maximum effort orientation as opposed to the minimum effort orientation of the control group (see Table 5-10). Being involved in CL-EA activities seems to have been a worthwhile learning experience because students did not indicate that they wanted to complete the CL-EA activities with as little effort as possible merely to pass the module. This result was also confirmed by the qualitative responses of the students in the CL-EAQ (see Table 5-21). Students perceived CL-EA to enhance their learning, creating curiosity and motivation for learning. The CL-EA intervention increased the students' ability to judge their own work and that of their peers (see Table 5-10).

The first-year Life Sciences students' ability to judge their own work and that of their peers using their knowledge of the criteria and achievement standards was increased due to their involvement in the CL-EA intervention. Findings from a study by Smith et al. (2012) show the importance of developing students' ALit (judging own work and that of other) to achieve the same learning gains that would have been attributable to more detailed feedback provided by the facilitator. An implication is that the development of students' ALit can be enhanced by CL-EA instead of the facilitator spending more time on providing detailed feedback. This finding supports the view that interventions that provide students with opportunities to practice the development of judging own work, as well as the work of peers, will lead to the development of ALit (judging dimension), and in turn, students will be able to perform better in future on similar assessments (Smith et. al., 2012).

Regardless of the findings indicating no practical significant difference between the post-tests of the control and experimental groups in the AL factor (see Table 5-10), the qualitative data

indicated that students perceived CL-EA to enhance and monitor their learning (see Tables 5-22 and 5-23). The items within the AL SALQ factor that came forth from the CL-EAQ were:

- *"I use assessment to figure out what is important."*
- *"I learn more when I do the assessment tasks."*
- *"I use assessment to show me how much of the course content I understand."*
- *"I use assessment to work out what are the expected achievement standards.*"

Being involved in the CL-EA intervention enabled students to learn while doing the assessments, and indicates that CL-EA results in learning **through** assessment. It can be concluded therefore that CL-EA is a valuable tool for developing assessment-literate first-year Life Sciences students and, according to Boud and Falchikov (2006), ALit is an important aspect that should be addressed in 21st-century higher education.

6.3.2 Influence of CL-EA on first-year Life Sciences students' SDL

Students' perceived that SDL readiness was measured by means of the SRSSDL instrument (see section 5.2.3). The analysis of the SRSSDL results indicated that the implementation of CL-EA in the first-year Life Sciences modules did not have a significant influence on the students' perceived SDL readiness (see Table 5-17). The only area of SDL that was higher in the experimental group than in the control group was learning activities (see Table 5-17). This construct refers to the learning activities in which students should actively engage for the enhancement of SDL (Williamson, 2007). This finding reflects the value of the participative nature of CL-EA by providing students with the opportunity to partake in, and engage with, various learning activities that develop SDL.

Although the quantitative results are not conducive to the influence of CL-EA on SDL, the qualitative data indicated that several SDL characteristics were identified among the participants (see Tables 5-22 and 5-23). Curiosity and motivation, enhanced learning, identifying learning gaps, and participative assessment are the identified code groups that can be connected to several characteristics of a self-directed learner (Guglielmino, 1978; Knowles, 1975; Warburton & Volet, 2012) (see Table 2-4). The CL-EA intervention enabled students to –

- be motivated to learn (see section 5.6.1.1);
- take initiative in their learning process (see section 5.6.1.1);
- take responsibility for their learning (see section 5.6.1.3);
- formulate their learning goals (see section 5.6.1.3);
- select appropriate learning strategies (see section 5.6.1.3);

- evaluate their learning experiences (see sections 5.6.1.2 and 5.6.1.5); and
- see their peers as resources (see section 5.6.1.7).

The inclusion of the five basic CL elements in the CL-EA intervention should contribute to the development of several skills related to SDL (Breed, 2016). According to Johnson and Johnson (2013), an increased degree of personal interdependence and individual accountability will result in students being able to formulate their learning goals and to take responsibility for their learning process and progress, all of which are SDL characteristics that were identified in the qualitative responses. Theoretically, the purposeful inclusion of promotive interaction and social skills within CL-EA should enable students to build a trusting relationship with peers, and thus communicate effectively (Johnson & Johnson, 2013).

6.3.3 First-year Life Sciences students' perceptions of CL-EA

Students' responses to an open-ended CL-EA questionnaire as well as during the semi-structured individual interviews (see section 4.3.3) were used to answer the following research sub-question:

"What are first-year Life Sciences students' perceptions of CL-EA?"

Analysis of the gathered data (see section 5.6), indicated that the first-year Life Sciences students perceived that CL-EA created curiosity and motivation. Being curious and motivated to learn is an identified characteristic of a self-directed learner (see section 2.6). CL-EA was also perceived to enable feedback, which is identified to play a vital and central role in successful 21st-century assessment (see section 2.4).

Being able to recognise feedback, and acting on it, is not only an important skill of a student who is assessment-literate (see section 2.5), but also a key feature of feedback literacy (Carless & Boud, 2018), and enables students to identify learning gaps and close such gaps (Sadler, 1989). The participative and social nature of CL-EA, together with the five basic CL elements, enabled students to give and receive feedback, which was timely enough for them to act upon. Positive interdependence ensures positive relations and social support amongst group members, which could lead to group members respecting one another's perspectives and more integrative communication (Johnson & Johnson, 2009). Within the context of social constructivism, feedback is co-constructed amongst peers through dialogue (Rust, O'Donovan, & Price, 2005). The positively interdependent CL groups within which the CL-EA intervention was implemented, were able to provide one another with feedback. Students indicated that CL-EA enhanced and contributed towards their learning process as they acted

on the received feedback, which indicates that the first-year Life Sciences students learned more by being involved in CL-EA. Hence, learning through assessment took place.

From the qualitative data obtained from this investigation, it is also evident that the CL-EA aided students in their preparation for the examination by supporting them to prepare better, and consequently to be less stressed about writing the examination. CL-EA assisted students in identifying their learning gaps, which means that learning needs had been diagnosed. The ability to diagnose learning needs is an important characteristic of a self-directed learner (see section 2.6). This finding can probably be ascribed to the social nature of CL-EA that enables ongoing dialogue between group members, as well as the metacognitive reflection opportunities of CL-EA. Metacognition nurture students' learning and awareness of their learning process (Mills, 2016).

A surprising yet welcoming finding is that students indicated that CL-EA influenced their own future classroom practice in terms of their perception of assessment and its ability to enhance learning. This suggests that the students' experience of how CL-EA enhanced their learning and improved their ALit with regard to linking assessment to their learning trajectory (see section 2.5.3).

Students saw their peers as resources to enhance their learning. The ability to see peers as resources is an SDL characteristic (see section 2.6). This finding can be ascribed to the students explaining their ideas and answers to one another within their CL groups (Boud, 2001). It is not surprising that the first-year Life Sciences students perceived CL-EA to test their knowledge, as tests are traditionally perceived as a way of testing a student's knowledge. From the responses of the students (see Table 5-21 and section 5.6.1.8), it is evident that testing knowledge, within the context of the CL-EA implementation in this investigation, might be linked to students diagnosing their learning needs after being tested on their current knowledge. This means that the first-year Life Sciences students used CL-EA to assist them in identifying their learning gaps after being tested on their content knowledge.

The reflective component of CL-EA was also emphasised by the first-year Life Sciences students. The P-A-R and reflective prompt after the P-I-P&S test (see section 4.6) provided students with the opportunity to think about and reflect on their learning strategies, as well as their learning gaps (see section 5.6.2.7). The reflective component of CL-EA enabled students to adapt their learning strategies if and where necessary before another CL-EA opportunity.

Students' responses were also valuable in terms of their perception of the CL group composition, the implementation of CL-EA in other modules, as well as the confidence they

had in participating in the CL-EA activities. Students had diverse perceptions regarding the CL group composition, and some students indicated that it is best when the facilitator assign the groups, while others preferred choosing their own groups. Students indicated that being assigned to a group enabled them to get to know more students and prevented them from working with friends all the time. All, expect one student, indicated that CL-EA can and should be implemented in other modules as well.

An interesting finding is that the students' confidence to participate in the CL-EA activities did not depend on the group composition, but rather on their personalities and preparation. Students who were better prepared for the CL-EA activities had more confidence to participate in those activities and to voice their viewpoints. These aspects should be taken into consideration when planning and implementing CL-EA and will be elucidated on in section 6.4. In conclusion, from the discussion above, it is evident that students perceived CL-EA to enhance their learning as well as to develop vital SDL skills.

6.3.4 Relationship between students' ALit and their self-directedness to learning

With regard to the last research sub-question (see section 1.3.3), as depicted in Chapter 5 (see section 5.5), a Spearman's rank-order correlation was run to determine the relationship between first-year Life Sciences students' ALit and their self-directedness to learning. The results (see Table 5-19) indicated that there is a linear relationship between students' ALit and their SDL readiness. It seems that an increase in students' understanding of the UP with assessment will increase their SDL, especially with regard to their ability to evaluate their own learning and their SRSSDL total score. It was also apparent that students' increased understanding that assessment is used to enhance and monitor their learning, will result in an increase in their SDL readiness. When students' understanding of local assessment protocols and assessment standards increases, their SDL readiness will also increase. It is evident that an increased ability to judge one's own work as well as the work of one's peers will result in an increase in SDL readiness. This indicates the influence of peer and self-assessment on students' SDL. It seems that students' ability to predict their assessment grades successfully has an influence on their SDL readiness. It can therefore be concluded that there is a positive relationship between students' ALit and their self-directed learning readiness.

Certain limitations, various aspects to consider for future investigation, and recommendations were identified and will be discussed in sections 6.5 and 6.6.

6.4 Summary of conclusions regarding the research question for this investigation

"What is the influence of cooperative learning-embedded assessment on first-year Life Sciences students' assessment literacy, and what are the implications thereof on the students' self-directed learning?"

The research question can be answered from the answers generated for the research sub-questions of this investigation. To answer the research question and to make recommendations regarding the implementation of CL-EA to improve ALit and SDL, Figure 6-3 provides a summary of the influence of CL-EA on ALit and SDL.

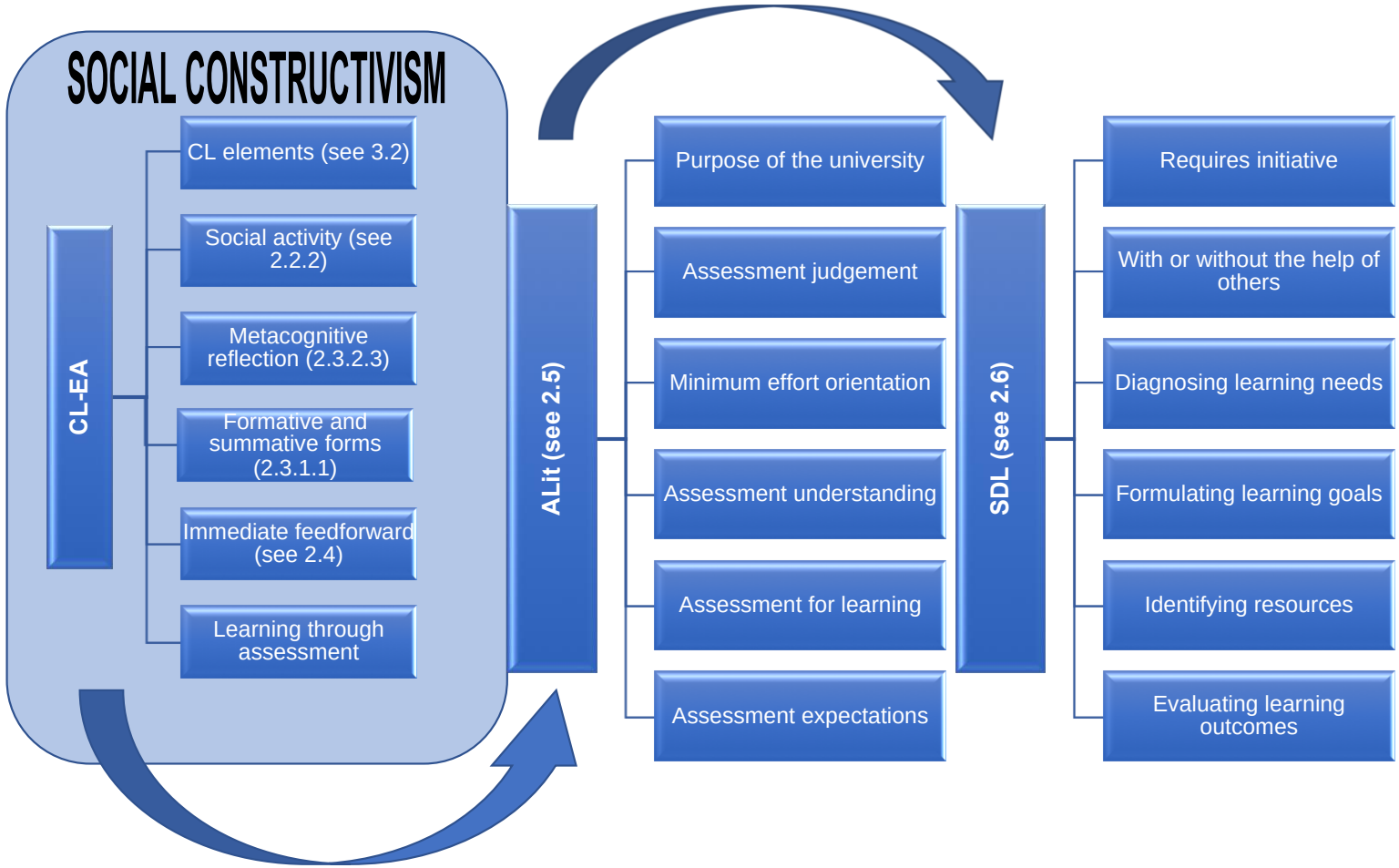


Figure 6-3: Summary of the influence of CL-EA on ALit and SDL

Source: Author's own

Figure 6.3 shows how this investigation took place within the context of a social constructivist environment (see section 2.2.2). The aim of this investigation was to study the influence of a CL-EA intervention on students' ALit, and the implications thereof on their SDL. Figure 6-3 firstly indicates the characteristics of CL-EA (see section 3.3 and Figure 3-1). For CL-EA to be successful, the facilitator needs to ensure that all the CL-EA characteristics are included before implementation. The importance of planning assessment for the successful development of students' ALit is also highlighted by Price et al. (2012). The implementation of CL-EA had a positive influence on the first-year Life Sciences students' ALit (see Table 5-9), especially with regard to students' MEO and their understanding of assessment protocols and achievement standards. The importance of ALit was discussed in Chapter 2 (see section 2.5), and entails that students understand the purpose of assessment and how it links to their learning, that they should be conscious of the processes of assessment, as well as be provided with opportunities for self-assessment (Smith et al., 2013). When self-assessment abilities are developed over time, it will lead to improved judgement of one's own performance (Boud, Lawson, & Thompson, 2015).

Although the quantitative results did not provide conclusive evidence that the implementation of CL-EA had an influence on the first-year Life Sciences students' SDL (see Table 5-18), the qualitative results suggest that SDL was promoted through the implementation of CL-EA (see Tables 5-21 and 5-22). As part of the CL-EA intervention, students were expected to work together in CL groups, with the five basic CL elements present, to complete participative assessments (i.e. memo-peer test). The implementation of CL-EA enabled the first-year Life Sciences students to:

- be motivated to learn;
- take initiative;
- take responsibility for learning;
- formulate learning goals;
- select appropriate learning strategies;
- evaluate their learning experiences; and
- see peers as resources (see Tables 5-21, 5-22 and 6-1).

These skills support the development of SDL (see section 2.6 and Table 2-4). Figure 6-3 furthermore indicates the linear relationship between ALit and SDL (see Table 5-19). According to Price et al. (2010), students can increase their learning when they become more assessment-literate.

6.5 Recommendations regarding the design and implementation of CL-EA

The following recommendations are presented for further and future research:

Specific to the planning and implementation of CL-EA

- Making use of the CL-EA planning document will help the facilitator to plan according to all the CL-EA characteristics.
- Enough time should be provided for the implementation of CL-EA.
- The five CL basic elements should always be part of any CL-EA tool implemented.
- Assign four students randomly to CL groups for each CL-EA opportunity.
- Although the online P-A-R works well, it is suggested that a hard copy reflection prompt be considered and given to students when they receive their assessed tests.
- Continuous dialogue between the facilitator and the students is vital and can be ensured through whole-class group processing.
- The turn-around, memo-peer, and the P-I-P&S tests works well within the CL groups.
- It is suggested that the memo-peer test be administered after students had had the opportunity to practice compiling memorandums. This will ensure that no time is wasted on the structure and necessary components of a memorandum.
- The facilitator should continuously have open discussions with the students in terms of the role that assessment plays in the learning process.

General recommendations

- It is suggested that the same investigation be conducted on students from different year groups.
- Future research might comprise expanding the investigation to other modules (subjects).
- Further investigation on the implementation of CL-EA in an online-environment is crucial. The global shift towards more open and distance higher education necessitates the need for innovative online assessments.
- For CL-EA to be implemented in other modules, greater support and commitment from the university is necessary to facilitate the development of facilitators' ability to plan and implement CL-EA (thus enhancing the facilitator's ALit).

6.6 Limitations in this investigation

The following limitations were identified after the literature study, empirical research and results of the investigation had been taken into consideration:

- It was unfortunate that the duration of the intervention was brief. Prolonging the intervention to more than one semester could have had an influence on the quantitative findings of this investigation.
- It is unfortunate that, due to ethical reasons, the researcher had no control over the number of participants who completed both the pre- and post-tests for the respective questionnaires (SALQ and SRSSDL). This led to a small participant group, especially on Campus A, and could have had an influence of the findings of this investigation.
- Because the participants of this investigation were first-year students at a tertiary institution, it might be that they initially over- or underestimated themselves regarding their ALit and SDL.
- When using the results in this investigation to draw conclusions, it should be taken into account that the researcher was also the lecturer of the experimental group. The intervention could have been carried out with greater fidelity than one would typically expect in practice.

6.7 Contribution of this investigation

In this investigation, the researcher identified the aspects that should be kept in mind when planning and implementing CL-EA. These aspects were used to create guidelines on how to plan and implement CL-EA to enhance students' ALit and SDL. Although assessment and CL are well researched, not much research on the implementation of assessment practices, which are embedded within CL, could be found. Similarly, no research on the influence of CL-EA on students' ALit and SDL could be found. Therefore, this investigation contributes towards the body of knowledge with regard to CL-EA, students' ALit and students' self-directed learning readiness. It is worth stipulating that the pedagogical investment with regard to the planning and implementation of CL-EA, produced a good educational return. Furthermore, learning was enhanced through CL-EA.

6.8 Summary

In this investigation, promoting ALit and SDL through the implementation of CL-EA in first-year Life Sciences modules were researched. This research report comprised six chapters. Chapter 1 contained the introduction and problem statement. The motivation for the

investigation was explained, and the aim and sub-aims of the investigation were outlined. Chapter 2 was the first of two literature chapters, and dealt with assessment, ALit and SDL, including ways in which ALit and SDL can be measured. In Chapter 3, the literature study on CL was reported and the case for CL-EA was proposed, including the characteristics of CL-EA. In Chapter 4, the research design and methodology, observed from a constructivist perspective, were discussed. A mixed-method research approach was used, and both the quantitative and qualitative methods were discussed. The chapter concluded with a discussion of the CL-EA intervention. Chapter 5 contained the results of the quantitative and qualitative research. In this final chapter, the conclusions relating to each of the research sub-aims and the overall aim of the investigation were discussed.

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ADDENDUM A: STUDENT ASSESSMENT LITERACY QUESTIONNAIRE

Dear student

Research on the improvement of education can be seen as a continuing process and it is a necessity in order to ensure quality teaching and learning at this institution. With this questionnaire, we aim to get an overview of your learning and study orientation in order to ensure that our teaching is of high quality. This forms part of a research project that aims to improve teaching strategies. Your participation is non-obligatory and will be anonymous – the student number that you provide is solely for the purpose of comparing your answers before and after this course. Your choice to participate in this research project may be revised at any stage. It will not reflect negatively upon you if you decide to participate or not. If you do complete the questionnaire, you give your permission that the data may be used for research purposes.

Student Assessment Literacy Questionnaire

Student number:

		Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
	I think the University makes me do assessment to:					
1	… advance my learning.	1	2	3	4	5
2	… help me ascertain the quality of my work.	1	2	3	4	5
3	… produce work that can be judged for the University's marking and grading purposes.	1	2	3	4	5
4	… provide me with a grade so I can progress through my degree.	1	2	3	4	5
5	… compare students with each other.	1	2	3	4	5
6	I use assessment to figure out what is important.	1	2	3	4	5
7	I learn more when I do the assessment tasks.	1	2	3	4	5
8	I use assessment to show me how much of the course content I understand.	1	2	3	4	5
9	I use assessment to work out what are the expected achievement standards.	1	2	3	4	5
10	I use assessment to work out how well I am doing.	1	2	3	4	5
11	I aim to pass the course with as little work as possible.	1	2	3	4	5
12	I do assessment because I have to.	1	2	3	4	5
	I use assessment to work out the minimum work needed to pass.					
13	I use assessment to decide what level of work I have to do to get the mark or grade I want.	1	2	3	4	5
14	I am more interested in advancing my understanding in this course than just passing.	1	2	3	4	5

		Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
15	I understand the rules applying to assessment.	1	2	3	4	5
16	The Faculty's assessment procedures are clear to me.	1	2	3	4	5
17	I understand the criteria against which my work will be assessed.	1	2	3	4	5
18	I understand the achievement standards against which my work will be assessed.	1	2	3	4	5
19	I understand what I need to do to advance my learning to achieve the standard I want.	1	2	3	4	5
20	I understand what I need to do in the assessment task to get the mark or grade I want.	1	2	3	4	5
21	I feel confident that the assessment is conducted fairly.	1	2	3	4	5
22	I feel confident I could judge my own work accurately using my knowledge of the criteria and achievement standards provided.	1	2	3	4	5
23	I feel confident I could judge my peer's work accurately using my knowledge of the criteria and achievement standards provided.	1	2	3	4	5
24	I feel confident that I use the criteria and achievement standard guidelines provided in order to help me improve my work.	1	2	3	4	5
25	I see the value in using the criteria and achievement standards provided to improve the work I produce.	1	2	3	4	5
26	Rate your confidence that you will get the mark or grade you expect for the work you submit.	1	2	3	4	5
27	Rate your ability to produce work at the achievement standard that will get you the mark or grade you want.	1	2	3	4	5
28	Rate your ability to use the criteria and achievement standards to guide you in producing the work that will get you the mark or grade you want.	1	2	3	4	5

ADDENDUM B: SELF-RATING SCALE OF SELF-DIRECTED LEARNING

Dear student

Research on the improvement of education can be seen as a continuing process and it is a necessity in order to ensure quality teaching and learning at this institution. With this questionnaire, we aim to get an overview of your learning and study orientation in order to ensure that our teaching is of high quality. This forms part of a research project that aims to improve teaching strategies. Your participation is non-obligatory and will be anonymous – the student number that you fill in on the multiple-choice form is solely for the purpose of comparing your answers before and after this course. Your choice to participate in this research project may be revised at any stage. It will not reflect negatively upon you if you decide to participate or not. If you do complete the questionnaire, you give your permission that the data may be used for research purposes.

1. Gender

Male	1	Female	2

2. Age

18	1	19	2
20	3	21	4
22 -older	5		

Response key: 1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Always							
1	I identify my own learning needs.	1	2	3	4	5
2	I am able to select the best method for my own learning.	1	2	3	4	5
3	I consider teachers as facilitators of learning rather than providing information only.	1	2	3	4	5
4	I keep up to date on different learning resources available.	1	2	3	4	5
5	I am responsible for my own learning.	1	2	3	4	5
6	I am responsible for identifying my areas of deficit.	1	2	3	4	5
7	I am able to maintain self-motivation.	1	2	3	4	5
8	I am able to plan and set my learning goals.	1	2	3	4	5
9	I have a break during long periods of work.	1	2	3	4	5
10	I need to keep my learning routine separate from my other commitments.	1	2	3	4	5
11	I relate my experience with new information.	1	2	3	4	5
12	I feel that I am learning despite not being instructed by a lecturer.	1	2	3	4	5
13	I participate in group discussions.	1	2	3	4	5
14	I find peer coaching effective.	1	2	3	4	5
15	I find “role play” is a useful method for complex learning.	1	2	3	4	5
16	I find inter-active teaching and learning sessions more effective than just listening to lecturers.	1	2	3	4	5
17	I find simulation in teaching and learning useful.	1	2	3	4	5
18	I find learning from case studies useful.	1	2	3	4	5
19	My inner drive directs me towards further development and improvement in my learning.	1	2	3	4	5
20	I regard problems as challenges.	1	2	3	4	5

Response key: 1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Always						
21	I arrange my self-learning routine in such a way that it helps develop a permanent learning culture in my life.	1	2	3	4	5
22	I find concept mapping is an effective method of learning.	1	2	3	4	5
23	I find modern educational interactive technology enhances my learning process.	1	2	3	4	5
24	I am able to decide my own learning strategy.	1	2	3	4	5
25	I rehearse and revise new lessons.	1	2	3	4	5
26	I identify the important points when reading a chapter or an article.	1	2	3	4	5
27	I use concept mapping/outlining as a useful method of comprehending a wide range of information.	1	2	3	4	5
28	I am able to use information technology effectively.	1	2	3	4	5
29	My concentration intensifies and I become more attentive when I read complex study content.	1	2	3	4	5
30	I keep annotated notes or a summary of all my ideas, reflections and new learning.	1	2	3	4	5
31	I enjoy exploring information beyond the prescribed course objectives.	1	2	3	4	5
32	I am able to relate knowledge with practice.	1	2	3	4	5
33	I raise relevant question(s) in teaching-learning sessions.	1	2	3	4	5
34	I am able to analyse and critically reflect on new ideas, information or any learning experiences.	1	2	3	4	5
35	I keep an open mind to others' point of view.	1	2	3	4	5
36	I prefer to take a break in between learning tasks.	1	2	3	4	5
37	I self-assess before I get feedback from instructors.	1	2	3	4	5
38	I identify the areas for further development in whatever I have accomplished.	1	2	3	4	5
39	I am able to monitor my learning progress.	1	2	3	4	5
40	I am able to identify my areas of strength and weakness.	1	2	3	4	5
41	I appreciate when my work can be peer reviewed.	1	2	3	4	5
42	I find both success and failure inspire me to further learning.	1	2	3	4	5
43	I value criticism as the basis of bringing improvement to my learning.	1	2	3	4	5
44	I monitor whether I have accomplished my learning goals.	1	2	3	4	5
45	I check my portfolio to review my progress.	1	2	3	4	5
46	I review and reflect on my learning activities.	1	2	3	4	5
47	I find new learning challenging.	1	2	3	4	5
48	I am inspired by others' success.	1	2	3	4	5
49	I intend to learn more about other cultures and languages I am frequently exposed to.	1	2	3	4	5
50	I am able to identify my role within a group.	1	2	3	4	5
51	My interaction with others helps me to develop the insight to plan for further learning.	1	2	3	4	5
52	I make use of any opportunities I come across.	1	2	3	4	5
53	I need to share information with others.	1	2	3	4	5
54	I maintain good interpersonal relationships with others.	1	2	3	4	5
55	I find it easy to work in collaboration with others.	1	2	3	4	5
56	I am successful in communicating verbally.	1	2	3	4	5
57	I identify the need for inter-disciplinary links for maintaining social harmony.	1	2	3	4	5
58	I am able to express my ideas effectively in writing.	1	2	3	4	5
59	I am able to express my views freely.	1	2	3	4	5
60	I find it challenging to pursue learning in a culturally diverse milieu.	1	2	3	4	5

(Self-directed learning of teacher trainees, Williamson, 2007)

ADDENDUM C: POST-ASSESSMENT REFLECTION

Post-Assessering-Refleksie / Post-Assessment-Reflection

Handig asseblief jou refleksie van klastoets EEN in. / Please submit your reflection regarding cla test ONE.

* Required

1. **Email address** *

2. **Naam en Van / Name and Surname** *

3. **Studentenommer / Student number** *

4. **Wat is jou individuele punt uit 35 vir Klastoets EEN? / What is your individual mark out of 35 for Class Test ONE?** *

5. **Gee jou individuele punt as 'n % (bv. 24/35 x 100). / Give your individual mark as a % (e.g. 24/35 x 100).** *

6. **Wat was julle "Turn-Around" Toets se punt uit 25 vir Klastoets EEN? / What was your "Turn-Around" Test mark out of 25 for Class Test ONE?** *

7. **Gee julle "Turn-Around" Toets se punt as 'n % (bv. 19/25 x 100). / Give your "Turn-Around" Test mark as a % (e.g. 19/25 x 100).** *

8. **Is jou individuele punt minder of meer as jou "Turn-Around" punt? / Is your individual mark less or more than your "Turn-Around" mark?** *

   Check all that apply.

   ☐ Individuele punt is MINDER as Turn-Around punt / Individual mark is LESS than Turn-Around mark

   ☐ Individuele punt is MEER as Turn-Around punt / Individual mark is MORE than Turn-Around mark

9. **Verskaf kortliks 'n moontlike rede vir jou antwoord in die vraag hierbo. / Briefly give a possible reason for your answer in the question above.** *

10. **Beskryf kortliks die wyse waarop jy vir hierdie klastoets voorberei het. / Briefly describe the way in which you prepared for this class test.** *

11. **Is jou finale punt vir Klastoets EEN 'n ware refleksie van die mate van inspanning (tyd wat jy studeer het)? Verduidelik kortliks jou antwoord. / Is your final mark for Class Test ONE a true reflection of your level of effort (time spend studying)? Briefly explain your answer.** *

12. **Een aspek waarop ek graag wil verbeter voor Klastoets TWEE, is... / One aspect that I would like to improve on before Class Test TWO, is...** *

13. **Het jy die "Turn-Around" toets as 'n waardevolle leergeleentheid ervaar? / Did you experience the "Turn-Around" test a valuable learning opportunity?** *

Check all that apply.

- [ ] Ja / Yes
- [ ] Nee / No

14. **Verduidelik kortliks jou antwoord hierbo. / Briefly explain your answer above.** *

15. **Wat is, volgens jou mening, positiewe aspekte van die "Turn-Around" toets? / What, in your opinion, are positive aspects of the "Turn-Around" test?** *

16. **Wat is, volgens jou mening, negatiewe aspekte van die "Turn-Around" toets? / What, in your opinion, are negative aspects of the "Turn-Around" test?** *

Post-Assessering-Refleksie / Post-Assessment-Reflection

Handig asseblief jou refleksie van Klastoets TWEE in. / Please submit your reflection regarding Class Test TWO.

* Required

1. **Naam en Van / Name and Surname** *

2. **Epos adres / Email address** *

3. **Studentenommer / Student Number** *

4. **Finale punt vir Klastoets TWEE / Final mark for Class Test TWO** *

5. **Beskryf kortliks die wyse waarop jy vir hierdie klastoets voorberei het. / Briefly describe the way in which you prepared for this class test.** *

6. **Is jou finale punt vir Klastoets TWEE 'n ware refleksie van die mate van inspanning (tyd wat jy spandeer het)? Verduidelik kortliks jou antwoord. / Is your final mark for Class Test TWO a true reflection of your level of effort (time spent studying)? Briefly explain your answer.** *

7. **Jy moes gedurende die P-A-R na Klastoets EEN, een aspek identifiseer waarop jy graag wou verbeter voordat jy Klastoets TWEE skryf. Sou jy sê dat jy op daardie aspek verbeter het? Verduidelik kortliks jou antwoord. / During the P-A-R done after Class Test ONE, you had to identify one aspect that you would've like to improve on before writing Class Test TWO. Would you say that you improved on this aspect? Briefly explain your answer.** *

8. **Twee aspekte waarop ek graag wil verbeter voor Klastoets DRIE, is... / Two aspects that I would like to improve on before Class Test THREE, are...** *

ADDENDUM D: COOPERATIVE LEARNING-EMBEDDED ASSESSMENT PLANNING DOCUMENT

Module: _____ **Date:** _____

Pre-instructional decisions

- **Group composition**

Group size: _____ **Ensuring random assignment:** _____

- **Assessment specifics**

Form(s) of assessment: _____

Method(s) of assessment: _____

Assessment instrument: _____

Assessment tool(s): _____

- **Cooperative structure**

Positive Interdependence:

_____

_____

Individual Accountability:

_____

_____

Promotive Interaction:

_____

_____

Small-group social skills:

_____

_____

Group processing:

_____

_____

- **Metacognition**

_____

_____

_____

- **Feedback**

_____
_____
_____

- **Time allocation**

_____
_____
_____

Facilitator's observations

Expected behaviors: _____

Observed behaviors: _____

Positive Feedback to Students: _____

Facilitator's reflections & recommendations

What worked well?

_____
_____

What should be improved?

_____
_____

Additional notes:

_____
_____
_____

Visual representation of CL-EA:

ADDENDUM E: 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 2016
Fax: +27 0 87 231 5294
Email: suria.ellis@nwu.ac.za

17 October 2019

Re: Thesis, Me A Lubbe, student number 12080454

We hereby confirm that the Statistical Consultation Services of the North-West University analysed the quantitative data 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

Prof SM Ellis (Pr. Sci. Nat)
Associate Professor: Statistical Consultation Services

ADDENDUM F: 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 APSTrans No. 1000017
Member of the Professional Editors' Group (PEG) No. VIL003
Member of Safrea No. SAF03316

☎ +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.

The track changes function was used and the author was responsible for accepting the editor's changes and for finalising the reference list.

Title of thesis:

COOPERATIVE LEARNING-EMBEDDED ASSESSMENT: IMPLICATIONS FOR STUDENTS' ASSESSMENT LITERACY AND SELF-DIRECTEDNESS IN LEARNING

The editor did not write or rewrite any part of the thesis on behalf of the client, including passages that may have been plagiarised. The academic content is the sole responsibility of the client as author of the work. The editor could not and did not test definitively for plagiarism, nor is there any explicit or implicit guarantee that the content that was edited contained no material used without consent. The editor accepts no responsibility for any failure on examination of the thesis by the university.

JACKIE VILJOEN
Strand
South Africa
18 November 2019

ADDENDUM G: ETHICS APPROVAL LETTER

NORTH-WEST UNIVERSITY
YUNIWESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

Private Bag X6001, Potchefstroom,
South Africa, 2520
Tel: (018) 299-4900
Faks: (018) 299-4910
Web: http://www.nwu.ac.za

Institutional Research Ethics Regulatory Committee
Tel: +27 18 299 4849
Email : Ethics@nwu.ac.za

ETHICS APPROVAL CERTIFICATE OF STUDY

Based on approval by the **Ethics Committee of the Faculty of Education Sciences (ESREC) on 23/02/2017** after being reviewed at the meeting held on **24/11/2016**, the North-West University Institutional Research Ethics Regulatory Committee (NWU-IRERC) hereby **approves** your study as indicated below. This implies that the NWU-IRERC grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: Cooperative learning-embedded assessment: Implications for students' assessment literacy and self-directedness in learning.

Project Head: **Prof E Mentz**
Project Team: **A Lubbe, Prof K Lombard.**

Ethics number:

N	W	U	-	HS	-	2	0	1	6	-	0	1	7	8
Institution				Study Number					Year		Status			

Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Application Type: N/A
Commencement date: 2017-02-23 **Expiry date**: 2018-02-23 **Risk:** N/A

Special conditions of the approval (if applicable):

- Translation of the informed consent document to the languages applicable to the study participants should be submitted to the ESREC (if applicable).
- Any research at governmental or private institutions, permission must still be obtained from relevant authorities and provided to the ESREC. Ethics approval is required BEFORE approval can be obtained from these authorities.

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 study leader (principle investigator) must report in the prescribed format to the NWU-IRERC via ESREC:*
  - *annually (or as otherwise requested) on the progress of the study, and upon completion 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.*
  - *Annually a number of projects may be randomly selected for an external audit.*
- *The approval applies strictly to the proposal as stipulated in the application form. Would any changes to the proposal be deemed necessary during the course of the study, the study leader must apply for approval of these changes at the ESREC. Would there be deviated from the study proposal 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-IRERC via ESREC and new approval received before or on the expiry date.*
- *In the interest of ethical responsibility the NWU-IRERC and ESREC retains the right to:*
  - *request access to any information or data at any time during the course or after completion of the study;*
  - *to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process.*
  - *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 ESREC 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.*
- *ESREC can be contacted for further information or any report templates via Erna.Conradie@nwu.ac.za or 018 299 4656*

The IRERC 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 IRERC or ESREC for any further enquiries or requests for assistance.

Yours sincerely

Prof LA Du Plessis
Digitally signed by Prof LA Du Plessis
Date: 2017.02.27 12:13:12 +02'00'

Prof Linda du Plessis
Chair NWU Institutional Research Ethics Regulatory Committee (IRERC)