Self-Directed Learning for the 21st Century

Implications for Higher Education

Edited by
Elsa Mentz, Josef de Beer & Roxanne Bailey

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AOSIS

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Research Justification

This book is devoted to scholarship in the field of self-directed learning in the 21st century, with specific reference to higher education. The target audience of the book includes scholars in the field of self-directed learning and higher education. The book contributes to the discourse on the quality of education in the 21st century and adds to the body of scholarship in terms of self-directed learning, and specifically its role in higher education. Although all the chapters in the book directly address self-directed learning, the different foci and viewpoints raised make the book a rich knowledge bank of work on self-directed learning. The content of this book (except for two chapters) was selected from 28 papers presented at the Second International Self-Directed Learning Conference held in November 2018 in Potchefstroom. The call for papers resulted in 39 papers being submitted, followed by a thorough double-blind peer review. Two independent reviewers with expertise in the specific field were appointed for evaluation of each paper to provide feedback. All the reviewers selected were renowned national or international scholars in their field of expertise from outside the higher education institution that organised the conference. The review was intended for the assessment of scientific rigour and contribution of each paper to the field of self-directed learning. We also (as volume editors) did a *Turn-it-in* screening of all the papers to ensure that the similarity index for each paper was within the acceptable norm, and that no plagiarism was evident. We selected 28 papers for the conference, and the authors had to submit a change log with their revised paper before final acceptance to present at the conference. The best nine papers, based on, firstly, the reviewers' feedback and, secondly, on their unique contribution to the discourse or project, were selected to be included in this book. Two additional papers were added to the nine chapters to contribute to the full scope of scholarship addressed in this book. The 11 chapters, although eclectic in approach, and based on both empirical research and systematic reviews of literature, advance the scholarship of self-directed learning. The authors of the selected chapters, who agreed to have their contributions published in this book, had to revise, extend and adjust their papers to be suitable as a chapter in an academic book. After submission of the final chapters, the three editors of this book were responsible for reviewing the content of each chapter and provided final feedback to each author to make emendations where needed. We are confident that the 11 chapters in this book will serve as a valuable contribution to the body of scholarship.

In accordance with the requirements of the Department of Higher Education and Training, this book contains more than 50% of original content not published before and no part of the book has been plagiarised.

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List of Abbreviations

AaL	Assessment as Learning
CAPS	Curriculum and Assessment Policy Statement
CL	Cooperative Learning
CLT	Cognitive Load Theory
CoI	Community of Inquiry
CS	Computer-supported
DBR	Design-based Research
DL	Deeper Learning
DML	Debriefing for Meaningful Learning
DSDL	Deeper Self-directed Learning
EKI	Ethnobotanical Knowledge Index
ICT	Information and Communication Technology
LMS	Learning Management System
LTM	Long-term Memory
MOOC	Massive Open Online Courses
MSDLCL	Motivated Self-directed Learning and Collaborative Learning
MSL	Mobile Seamless Learning
NA	Not Applicable
NRC	National Research Council
NRF	National Research Foundation
NWU	North-West University
OCL	Online Collaborative Learning
OCW	Open Courseware
OER	Open Educational Resources
PAP	Participative Assessment Practices

PBL	Problem-based Learning
PCK	Pedagogical Content Knowledge
PDF	Portable Document Format
PLE	Personal Learning Environments
POL	Process-oriented Learning
POSTT	Pedagogy of Science Teaching Test
PPC	Person–Process–Context
PRO	Personal Responsibility Orientation
SCT	Social Constructivist Theory
SD	Standard Deviation
SDL	Self-directed Learning
SDLCSAF	SDL Competencies Self-Appraisal Form
SDLRS	Self-directed Learning Readiness Scale
SDLS	Self-directed Learning System
SDLT	self-directed Learning with Technology
SLP	Short Learning Programme
SRL	Self-regulated Learning
SRSSDL	Self-Rating Scale of Self-Directed Learning
SSDL	Staged Self-Directed Learning
STEM	Science, Technology, Engineering and Mathematics
TEL	Technology-enhanced Learning
TSCL	Technology-supported Cooperative Learning
TULA	Taxonomy for U-learning Approaches
WM	Working Memory
ZPD	Zone of Proximal Development

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Foreword

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Self-directed learning refers to an educational approach in which the student assumes responsibility for his or her own learning. Although this approach has likely had at least some role throughout the history of education, research focused on self-directed learning gained prominence only during the past several decades. Recently, however, self-directed learning has gained wider interest as researchers, employers and policymakers have advocated for new kinds of knowledge and skills to meet the demands of work and life in an increasingly technological and rapidly globalising world. Present-day students will need to continue to learn long after completion of their formal education. Empowered with motivation, metacognition, self-regulation and knowledge of the learning process, self-directed learners are well equipped for lifelong learning.

This book is an outgrowth of the Second Self-Directed Learning Conference, held from 05 to 07 November 2018 at North-West University (NWU) in Potchefstroom, South Africa. Building on an earlier publication, *Self-Directed Learning Research: An Imperative for Transforming the Educational Landscape*, this collection, intended primarily for researchers, documents the evolution of scholarship and latest findings resulting from collaborative research with a distinctive focus on self-directed learning. The many pedagogical examples described in this book also offer educators practical illustrations of several important educational approaches, and the extensive literature

reviews make this a valuable resource for those engaged in teacher preparation and development.

The introductory chapter (Chapter 1) by Bosch, Mentz and Goede provides a conceptual overview of self-directed learning. In doing so, it also discusses influential models and offers guidelines for the implementation of self-directed learning. In Chapter 2, Johnson and Johnson consider the importance of learning goals and assert that self-directed learning is facilitated and enhanced when conducted in combination with cooperative learning. Next, Van Zyl and Mentz (Chapter 3) argue the case that deeper self-directed learning, with a focus on transfer of knowledge and skills into new contexts, is essential for the preparation of students to face the challenges of work and life in the 21st century. In Chapter 4, De Beer addresses the relatively under-researched importance of context in self-directed learning literature and uses data from two different studies involving indigenous knowledge in South Africa to illustrate the role of context in fostering self-directed learning.

Ensuing chapters explore the roles and implications of technology in support of self-directed learning. Kruger (Chapter 5) describes a study of distance learning for teacher development, which is considered crucial for improving South Africa's standard of education, and suggests that teacher understanding, practice, motivation and reflective learning can be developed using online portfolios. In Chapter 6, Olivier explores the concepts of self-directed learning and Open Educational Resources (OER) and develops a multiliteracies framework in support of self-directed learning through OER to further research and measure multiliteracies. Based on a systematic review of the literature, Mentz and Bailey (Chapter 7) summarise the theories that underpin technology-supported cooperative learning (TSCL) for enhancing self-directed learning and endorse the implementation of the five elements of TSCL for enhancing self-directed learning. Laubscher, Bailey, Bergamin and Van der Westhuizen (Chapter 8) summarise the literature on cooperative learning and Socratic

questioning and encourage further research on the role of adaptive systems that use cooperative learning and Socratic questioning to promote self-directed learning.

In Chapter 9, Van der Westhuizen and Golightly explore the impact of online problem-based learning on student perceptions of self-directed learning skills in a Geography course and discuss the impacts of different pedagogical tools on group work. Following an examination of the literature for congruencies between self-directed learning and entrepreneurship education, which is considered essential by many for helping South African learners overcome the challenges of poverty and unemployment, Du Toit (Chapter 10) offers suggestions on how the constructs of self-directed learning could support entrepreneurship education. A study of the 'assessment as learning' approach by Lubbe and Mentz (Chapter 11) emphasises the importance of the nature of learning assessments on the development of important self-directed learning skills.

Collectively, the contributions in this book provide not only up-to-date findings but also illustrate the breadth of research on self-directed learning; they provide overviews of the history and evolution of our understanding of this important educational approach; they offer practitioners examples of self-directed learning in diverse contexts; and they suggest directions for further research. Importantly, the contributing authors also demonstrate the meaningful changes to student learning that are possible from a collaborative research effort and evidence-based teaching practices. Researchers and educators alike stand to gain much inspiration and many insights into self-directed learning from this book.

Chapter 1

Self-directed learning: A conceptual overview

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■ Abstract

Self-directed learning is an approach to education where learners take responsibility for their own learning; as such, students who are actively involved in and take control of their own learning process can be referred to as self-directed students. These students have the ability to choose their own learning strategies,

resources and outcomes in order to reach their desired goals. This chapter aims to give a conceptual overview of self-directed learning, discusses some of the most influential models for the implementation of self-directed learning and also proposes some guidelines for its implementation.

■ Introduction

Self-directed learning (SDL) is an approach to education where students take responsibility for their learning process (Bosch 2017). According to Boyer et al. (2014), self-directed students determine their own learning goals, select resources to achieve these goals, choose their preferred learning strategies and reflect on the outcome of the learning process. According to Knowles (1975:18), SDL usually takes place in association with others. It can be teachers, tutors, parents, mentors and other knowledgeable people or peers. Loyens, Magda and Rikers (2008:414) are of the opinion that 'when learning is placed on a continuum, it can range from being educator-oriented at one end to self-directed at the other end'. Self-directed learning emphasises knowledge construction through discussion and dialogue (Boyer et al. 2014) and de-emphasises teaching as a process in which an educator is the main source of information.

For the purpose of the discussion in this chapter, the point of departure will be Knowles' (1975) definition of SDL:

> 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. (p. 18)

Although SDL is well-researched, there are some misconceptions about it. The term SDL is sometimes used interchangeably with self-regulated learning, self-study, self-education and self-paced learning, to name a few. There exists a need for clarity in terms of terminology as well as for specific guidelines on how to practically implement SDL. The purpose of this chapter is not to explain the

differences in terminology of related concepts, but to provide a conceptual overview of what SDL entails. In order to do this, seven of the most influential models for the implementation of SDL are discussed, after which guidelines for the implementation of SDL are proposed. This chapter draws on research conducted in a Magister of Education (MEd) study of the first author (née Tredoux) (Tredoux 2012).

■ Brief history of self-directed learning

Adult self-direction in learning has a long history. It dates back as far as the Greek philosophers Socrates, Plato and Aristotle (Brockett & Hiemstra 1991). Many well-known people, such as Abraham Lincoln, Thomas Jefferson, Isaac Newton and Benjamin Franklin, would not have achieved their success or brought about changes in modern technology without self-education and self-direction. Hiemstra (1994:5395) is of the opinion that 'social conditions in Colonial America and a corresponding lack of formal educational institutions necessitated that many people learn on their own'.

The literature of the 1800s that refers to SDL is mostly in the form of biographies and autobiographies, as many of the prominent figures in society were largely, if not entirely, self-taught (Kett 1994). Before the emergence of formal schooling, most people were self-taught (Candy 2009). In 1840, the first edition of Craik's *Pursuit of Knowledge under Difficulties: Its Pleasures and Rewards* was published in the United States. The book documented and celebrated the self-education efforts of several people, showing that efforts to understand SDL were being made (Craik 1830). In 1859, Smiles published a book in Great Britain, entitled *Self-Help*, which applauded the value of personal development. These books were reprinted many times over the years, and multiple editions were distributed (Candy 2009).

Malcolm Shepherd Knowles, who wrote popular works on self-direction, was a central figure in the realm of adult education in the United States in the 1900s. His work was substantial and influential in reorienting adult educators from 'educating people'

to 'helping people learn' (Knowles 1950). In 1961, Houle published his book, *The Inquiring Mind: A Study of the Adult Who Continues to Learn*, which legitimised the study of SDL (Candy 2009).

In 1971, Allan Tough published his book, *The Adult Learning Projects*, which focused on the planning and deciding aspects of the learning project (Brockett et al. 2000). His work became a vital part of education literature (Brockett et al. 2000). Knowles also continued his work on SDL in the 1970s, and in 1975 he published a book titled *Self-Directed Learning*. According to Knowles (1975), SDL is divided into three distinct sections, namely, (1) the student, (2) the educator and (3) a set of learning resources. In the first section, which focusses on the student, Knowles discusses the importance of SDL and how SDL differs from educator-directed learning. In the second part, the focus falls on the educator and his or her role in SDL. Knowles guides the reader through a very detailed process of how a learning facilitator can take a group of students through a self-discovery process. The last section consists of exercises to help one take responsibility for one's own learning. He argues that this tends to increase self-esteem and produces an inquiring mind (Knowles 1975).

Bouchard (1994:13) is of the opinion that 'Spear and Mocker (1984) have contributed the notion of "organizing circumstance" as a framework for SDL'. In 1984, they published 'The organizing circumstance: Environmental determinants in self-directed learning', which showed the importance of understanding a student's environmental circumstances in promoting SDL. Furthermore, Bouchard (1994:13) states that Spear and Mocker (1984) asserted that 'the consciously acknowledged "learning need" and the "inner disposition" of the individual do not fully account for the emergence of SDL'. In their opinion, 'SDL exists within the larger system of interacting influences in a person's life, and may, therefore, be said to construe SDL as a systemic variable' (Bouchard 1994:8).

In 1991 (Brockett & Hiemstra 1991):

> Brockett and Hiemstra developed the Personal Responsibility Orientation (PRO) model based on the premise that self-direction

in learning refers to both the external characteristics of an instructional process and the internal characteristics of the learner, where the individual assumes primary responsibility for a learning experience. (p. 24)

In that same year, Pilling created the SDL test named the SDL Perception Scale. The SDL Perception Scale was 'designed to assess the degree to which an environment is conducive to self-direction in learning' (Guglielmino, Hiemstra & Long 2004:8). Roberson (2005) is of the opinion that Candy's (1991) book, *Self-Direction for Lifelong Learning*:

[*S*]eems to be a bridge between the extensive SDL research in the 1980's and the need for future direction. This comprehensive and theoretical book, based on previous research, sets forth the autodidactic learner as the cornerstone of the learning society. (p. 5)

In this publication, Candy published his model for SDL, in which he proposes four stages of readiness for SDL and discusses appropriate instructional approaches for each. The model evoked great interest and discussion and is often cited. In 1992, Garrison explored the links between SDL and critical thinking (Garrison 1992). He continued his work throughout the 1990s, and in 1997 developed the self-directed reaming model. This model includes three overlapping dimensions, namely, self-management, self-monitoring and motivation. Over the years, a number of models for SDL have been developed. Each researcher concentrated on only a few of the characteristics of SDL. In his doctoral thesis, Oswalt (2003) developed a new model for SDL, taking into consideration all of the overlapping concepts of the previous SDL model. This model takes nine characteristics of SDL into account and provides a more complete picture of the process of SDL (Oswalt 2003). Since 2000, research on SDL has been incorporated with online and web-based learning. In 2007, Song and Hill introduced a research-based conceptual model intended to assist in understanding SDL within online contexts. They felt the need to introduce new perspectives on the influence of context on SDL (Song & Hill 2007). In the section on 'Models for self-directed learning', some of the models that were developed to better understand SDL are discussed.

■ Models for self-directed learning

Researchers have tried to find ways to create a better understanding of SDL and how to foster it in educational environments. In the next section, some of the most influential models of SDL over the past three decades will be discussed. Other authors have also presented models for SDL; however, because of similarities with the models presented below, the authors of this chapter are of the opinion that the selected models give a comprehensive understanding of SDL.

■ Long's self-directed learning instructional model (1989)

Long's (1989) instructional model for SDL provides a framework for instruction supporting SDL. Although most of the other models for SDL focus on adult learning, Long's model is based on younger students. The model focusses on the interaction between pedagogical control and psychological control. Pedagogical control refers to the degree to which students have the freedom to determine learning goals, seek resources and set the mode of evaluation, while psychological control focusses on the willingness of students to maintain active control of the learning process (Long 1989). When these two forms of control are equal, or when psychological control exceeds pedagogical control, the situation can be defined as an SDL condition (Long 1989).

Long's (1989) model suggests four quadrants (see Figure 1.1). Quadrant I describes a situation of low pedagogical control and high psychological control. This instance refers to a match between a student who demonstrates self-directedness and a facilitator who takes less control of the learning situation. In Quadrant II, a situation of high pedagogical control and high psychological control is described. In this instance, the fact that the facilitator controls the learning situation conflicts with the student's self-directedness. Quadrant III describes exactly the opposite of Quadrant II. A situation of low pedagogical control
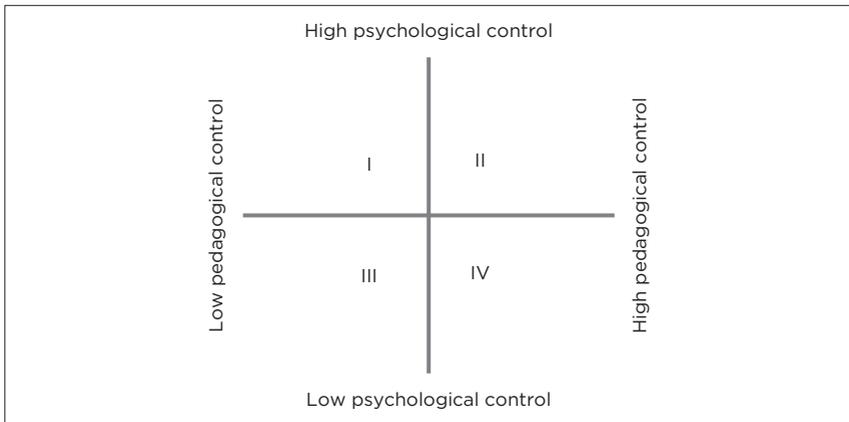
Source: Recreated from Long (1989:3).
FIGURE 1.1: Long's model for SDL.

and low psychological control is also an incompatible learning style, as a student who demonstrates low self-directedness will not be able to perform optimally if he or she is allowed by the facilitator to control the learning situation without any peer or facilitator support. Lastly, Quadrant IV refers to high pedagogical control and low psychological control. It describes a situation where the student has little self-directedness and the facilitator provides a greater amount of support. Thus, Quadrants I and IV provide the best matches for a learning situation, while Quadrants II and III illustrate areas of conflict. Quadrant I represents the environment where SDL can occur optimally.

◼ Candy's self-directed learning model (1991)

In 1991, Candy proposed a model of two interacting dimensions of SDL. According to Candy (1991), one dimension is the amount of control within an institutional setting. In this dimension, at one end of the continuum, the educator has total control over how the content is to be presented, what is to be studied and what outcomes are expected from the students. The opposite end of

this continuum represents a state in which the student has total control over the learning experience. The second dimension of SDL is student control in situations outside the formal institutional setting. Candy refers to this as 'autodidaxy'. In this dimension, the student decides what is to be learnt, how learning activities would occur, when learning would take place, where learning activities would be conducted and how learning outcomes would be evaluated. The continuum of the autodidactic domain represents the amount of assistance the student has in making decisions about the learning experience, if any (Candy 1991).

As seen in Figure 1.2, Candy (1991:22–23) further states that 'self-direction actually embraces dimensions of process and product (outcome), and that it refers to four distinct, but related, phenomena', namely, (1) personal autonomy, (2) self-management, (3) student control and (4) autodidaxy. Personal autonomy (independence, freedom of choice and rational reflection) is one of the main goals of education, and it refers to the personal characteristics of a student (Loyens et al. 2008). Self-management refers to 'the willingness and capacity to conduct one's
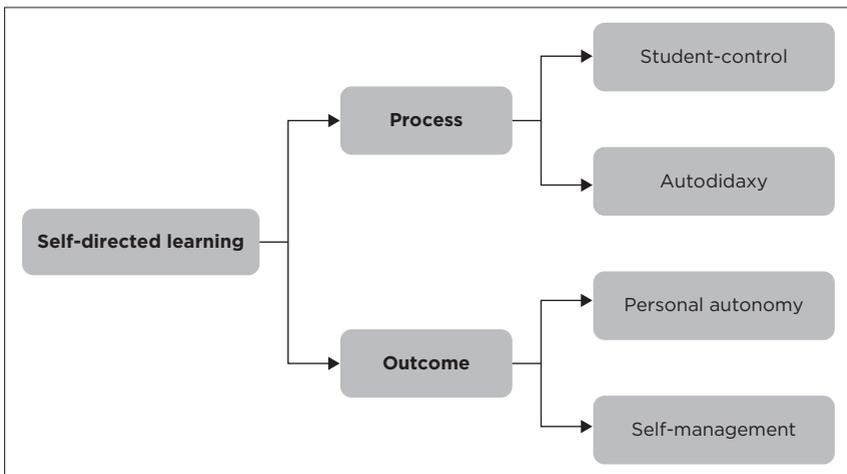
Source: Recreated from Candy (1991:22).
FIGURE 1.2: Candy's model for SDL.

own education' (Song & Hill 2007:29). Loyens et al. (2008:414–415) explain that '[a]lthough personal autonomy can be considered to be an *overall* disposition, self-management refers to the *exercise* of autonomy in learning'. Candy (1991) distinguishes between 'student control' and 'autodidaxy', where student control deals with control over aspects of the instructional situation, while autodidaxy implies learning outside formal educational settings.

Candy's model implies that a student's self-direction may be different in different content areas (Song & Hill 2007). According to Song and Hill (2007:27), Candy (1991) is of the opinion that 'learners may have a high level of self-direction in an area with which they are familiar or in areas that are similar to a prior experience'. He also discusses how SDL can be seen as an outcome or a process but asserts that the development of self-directedness in students is the goal, with a focus on helping people to develop the qualities of moral, emotional and intellectual autonomy (Candy 1991). According to Candy (1991), a student's autonomy is likely to vary in different situations. Educators should be cognisant of the fact that a student who is self-directed in one situation might need more orientation, support and guidance in other learning situations.

Although Candy follows in Long's footsteps regarding the control component of his model, their approaches are from slightly different perspectives. Long focused on psychological and pedagogical control while Candy distinguished between student control over aspects of the instructional situation and learning outside formal educational settings. Candy further recognised the importance of the learning context for SDL, and his model was the first to state that students 'may exhibit different levels of self-direction in different learning situations' (Song & Hill 2007:27) and content areas. When implementing SDL, learning context cannot be disregarded. It is important to take into consideration that if the students are enrolled for several different fields of study, their level of SDL can be influenced by their different interests and skills. Although Candy recognises this component of SDL, the 'model does not describe how SDL is relevant in different learning contexts such as classroom learning or online learning' (Song & Hill 2007:29).

The researchers relate to the fact that Candy consistently argues for a constructivist interpretation for SDL. He states that 'learning in its fullest context is [a] social activity, and the attainment of full personal autonomy – both in learning and outside it – must recognise this interdependence' (Candy 1991:22). According to Roberson (2003:29), Candy focusses on the fact that social inequalities can be eliminated with 'free learning' and the social implications thereof. 'Candy's (1991) [model] on SDL seems to [form] a bridge between the extensive SDL research in the [1980s] and the need for future direction' (Roberson 2003:28). During the same time Candy (1991) developed his model, Brockett and Hiemstra (1991) also developed their Personal Responsibility Orientation (PRO) model for SDL.

◼ Brockett and Hiemstra's Personal Responsibility Orientation model (1991)

The PRO model for SDL (Brockett & Hiemstra 1991) depicts two dimensions of SDL, namely, (1) personal responsibility in the teaching–learning process and (2) personal responsibility in one's own thoughts and actions. According to Brockett and Hiemstra (1991):

> In the first [*dimension,*] SDL is viewed as a process in which a [*student*] assumes primary responsibility for planning, implementing and evaluating the learning process. In the second [*dimension,*] SDL is referred to as a goal [*that*] focuses on 'a learner's desire or preference for assuming responsibility for learning'. (p. 29)

Brockett and Hiemstra (1991) assert that people have control over their responses even if they do not have control over the actual circumstances. Brockett and Hiemstra (1991) also emphasise that individuals do not learn in isolation and that the social aspects of learning are important as well.

Like Long (1989), Brockett and Hiemstra (1991) include the component of control, although they refer to it as 'personal responsibility' (Figure 1.3). Brockett and Hiemstra (1991) argue that personal responsibility does not always imply full control
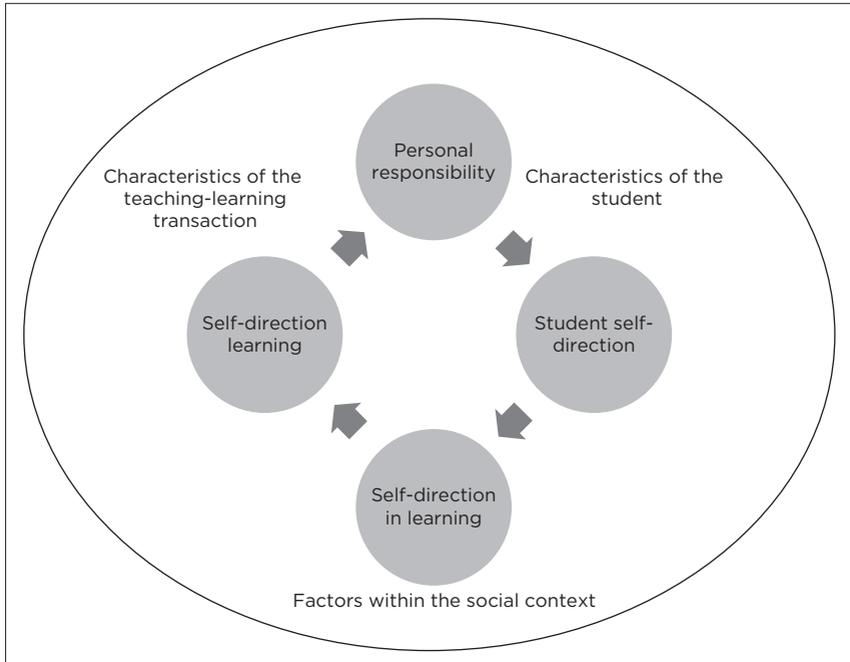
FIGURE 1.3: Brockett and Hiemstra's Personal Responsibility Orientation model for SDL.

over the learning environment. However, it implies personal control over the response to the situation. This is an important factor to consider when working with students in a formal educational setting. It is not always possible to give students full control over the learning environment, but they can take control of their own learning and their attitude towards the learning content (Brockett & Hiemstra 1991).

When referring to the component called 'Student Self-Direction', Brockett and Hiemstra (1991) suggest:

[*T*]hat optimal conditions for learning result when there is a balance or congruence between the student's level of self-direction and the extent to which an opportunity for SDL is possible in a given situation. (p. 24)

This aspect of the model must be taken into consideration when starting to develop environments conducive to the development of SDL in a classroom with a diversity of students. According to Brockett and Hiemstra (1991), if one student 'is predisposed towards a high level of self-directedness and is engaged in a learning experience where self-direction is actively facilitated, the chances for success are high'. However, there will also be students who are not as strong in self-directedness, who will, rather, find comfort in a situation where the facilitator still provides more support for SDL. The rate of success is reasonably high because the learner's experiences are in line with the expectations of the learning situation (Brockett & Hiemstra 1991). The implementation of SDL in an educational environment is a process, and it is important to balance the different types of activities while guiding and motivating students to become more self-directed. Garrison's model includes motivation as one of the dimensions, which will now be discussed.

■ Garrison's model (1997)

Grounded in a collaborative constructivist perspective, Garrison's (1997) theoretical model integrates (1) self-management, (2) self-monitoring and (3) motivational dimensions (see Figure 1.4). Garrison (1997:21) believes that although each of these dimensions 'is discussed separately, in practice, they are intimately connected'. Garrison's (1997) model of SDL 'also includes the perspectives of SDL as a personal attribute, as well as a learning process' (Singh 2010:89).

Garrison (1997) explains that 'self-management involved students taking control of the learning context to reach their learning objectives' (Song & Hill 2007:29). This form of control implies working with other people within the context and not necessarily independent learning (Garrison 1997). This includes collaborations between educator and student in managing the learning situation. Garrison (1997) believes that students should be given the freedom to choose how they would like to execute the learning process. To conclude, self-management focusses on
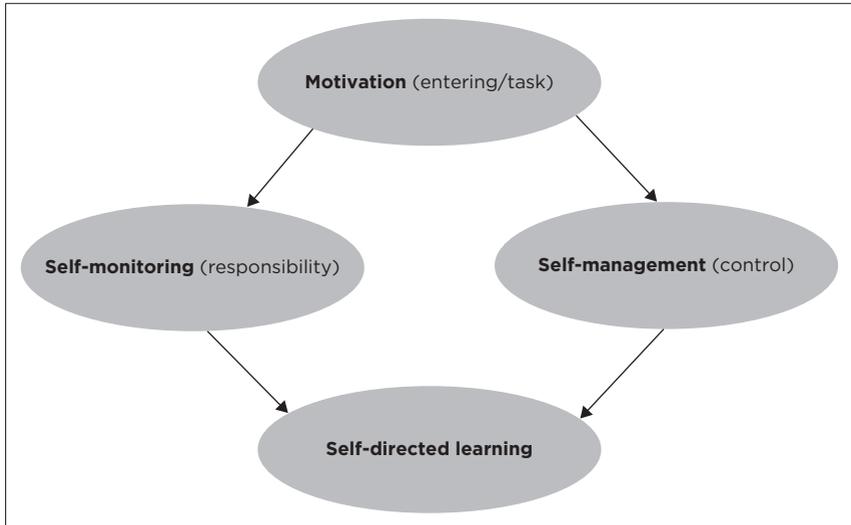
FIGURE 1.4: Garrison's model for SDL.

goal setting, the use of resources, collaboration with other people and external support for learning.

According to Garrison (1997:4), self-monitoring refers to the 'ability of students to monitor both their cognitive and meta-cognitive processes'. He emphasises the importance of integrating knowledge structures meaningfully to ensure that learning goals are being met. In order to do so, the 'self-monitoring' student should show responsibility in creating meaning through reflection and collaborative confirmation (Garrison 1997). This promotes students' self-monitoring as they integrate external feedback with their own reflection (Garrison 1997). The students should plan and adapt their thinking after which they should engage in critical reflection, assimilating new knowledge with existing knowledge.

Garrison (1997) stresses the importance of distinguishing between responsibility and control. Responsibility refers to

self-monitoring, while control refers to self-management. Educators need to understand the difficulty students face in taking responsibility for learning if they do not experience control over the learning situation (Garrison 1997). Sharing control, choice and collaboration promotes students assuming responsibility for their learning. According to Garrison (1997), effort towards learning is only possible if students are motivated. This implies that their 'perceived value and anticipated success of learning goals' is initiated. Motivation stands between control and responsibility during the learning process. In this model, motivation has two dimensions, namely, (1) entering motivation and (2) task motivation. Entering motivation compels a student to participate in the learning process, whereas task motivation keeps a student on track and persisting or persevering in the learning process (Garrison 1997). Task motivation refers to the degree to which students maintain their motivational state. Garrison (1997:n.p.) states that 'task motivation is integrally connected to task control and self-management'. Garrison (1997) asserts that intrinsic motivation leads to responsible and continuous learning. He argues that it is crucial that conditions are created to motivate students. This can be done by creating interest and aspiration to create personal meaning and common understanding.

Garrison's (1997) model was an attempt to expand the scope of SDL. He felt that most other models emphasised on the 'external control and management of learning tasks' and little attention was directed towards the learning process itself (Garrison 1997). Garrison (1997) thus decided to focus on the integration of cognitive and motivational dimensions of learning. The distinction between external control and internal cognitive responsibility in Long's (1989) model is the basis for the SDL framework and model presented by Garrison (1997). Garrison (1997:21) agrees with 'Long's (1989) [perception] that without the psychological or cognitive dimension, the focus is on teaching, not learning'. Six years after Garrison's model, Oswalt (2003) built upon previous models of SDL to develop another model for SDL.

◾ Oswalt's model (2003)

After analysing a number of SDL models, Oswalt (2003) found nine key concepts concerning SDL:

1. opportunity
2. support
3. collaboration
4. motivation
5. context
6. cognitive skills
7. skill with content
8. skill with SDL
9. willingness to control one's own learning. (p.24)

According to Oswalt (2003), various authors present a combination of some of these concepts as shown in Figure 1.5. Although some of the existing models overlap, none of the authors has integrated all of the identified components. Oswalt (2003) recognises the importance and benefits of the existing models but argues that each of these models only provides a narrow view of SDL. When all nine components are seen together, the entire process of SDL is embraced and a more complete picture of SDL is provided. In his model, Oswalt divides the identified nine SDL concepts into three major groups, namely, (1) learning situation, (2) components of learning and (c) students' attributes.

In the first group, 'learning situation', Oswalt (2003) includes 'opportunity, support and collaboration'. He (Oswalt 2003) refers to opportunity as 'the extent to which the facilitator is committed to fostering SDL [in] the learning situation'. In order for SDL to be promoted, the facilitator must be willing to give the students the opportunity and support them to direct their own learning. According to Oswalt (2003), support includes the extent to which the facilitator provides expertise, guidance and materials for the learning situation.

The last concept that has an influence on the learning situation is collaboration. Oswalt (2003) believes that collaboration is an
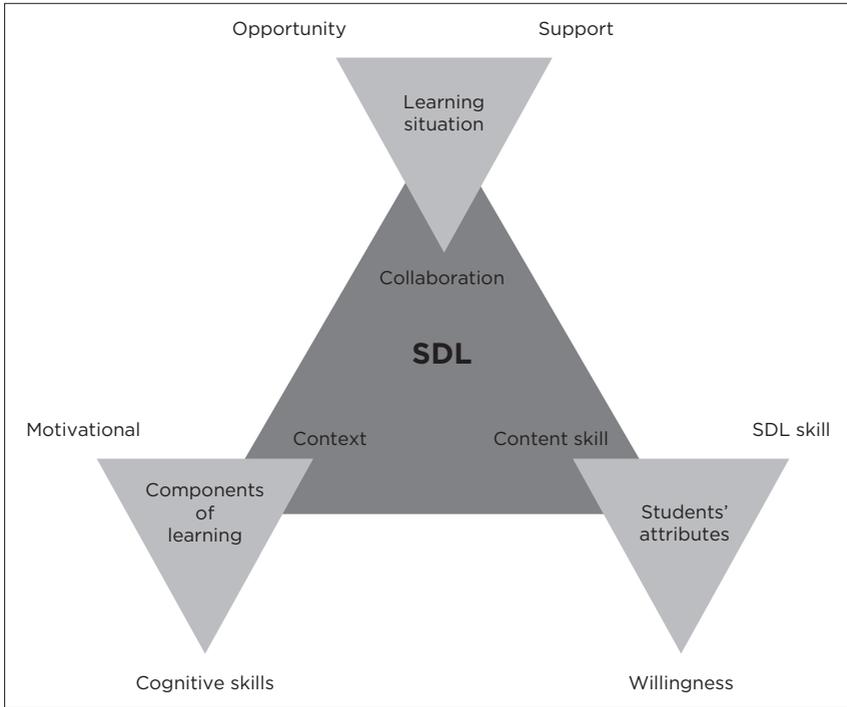
Source: Recreated from Oswalt (2003:22).
SDL, self-directed learning

FIGURE 1.5: Oswalt's model for SDL.

essential aspect in SDL, and peer-to-peer support groups or networks can encourage SDL, whether it is in a formal or a non-formal learning situation.

The second group, 'learning attributes', integrates content skill, SDL skill and 'willingness to direct one's own learning' (Oswalt 2003). Oswalt (2003) argues that the students' skill level in a content area will have a direct impact on their ability to direct their own learning within that specific content area. He further states that students will be more willing to take charge of their own learning if they have developed a prior understanding of basic concepts or mastered basic skills in a certain area. Oswalt (2003)

stresses that willingness to direct one's own learning is a personal decision and SDL can only occur successfully if the student is willing to invest time and effort in promoting his or her SDL skills.

The components of learning that Oswalt (2003) refers to in his model are the cognitive, motivational and contextual factors of learning. Cognitive factors of learning include 'critical self-reflection on [both] the individual's learning process [and] the knowledge and skill the [student is attempting] to master' (Oswalt 2003). The motivational factors include both self-efficacy and volition. Self-efficacy refers to the student's confidence (or lack thereof) in his or her ability to succeed or fail, while volition refers to the student's ability to commit to tasks despite aspects in the environment that also compete for his or her attention (Oswalt 2003). Contextual factors include resources, peers and other external factors in the learning environment over which the student has control. A student has to take responsibility for all of the factors mentioned above in order to be an effective self-directed student.

Self-directed learning is not an activity in isolation but a process of discovering personal meaning in learning processes and products with the help of others (Oswalt 2003). In the learning environment, students may probably not have much experience in terms of collaboration or efficient group work.

In short, it is therefore important for the facilitator to create a positive learning environment with an atmosphere of openness and trust that supports group activities if SDL is to be fostered. This will be possible when the facilitator encourages the students to ask meaningful questions and engage in discussions with peers, giving suggestions and sharing resources during a cooperative learning (CL) experience. All of the models discussed in the previous sections have been valuable in the understanding and implementation of SDL, but the model presented by Oswalt (2003) 'focuses on the most SDL components and provides a more comprehensive' picture of SDL. In Table 1.1, a brief summary of the discussed models, categorised according to the concepts identified by Oswalt (2003), is given.

TABLE 1.1: Synthesis of SDL models.

SDL Components		Models				
		Long (1989:3)	Candy(1991:22)	Brockett and Hiemstra (1991:33)	Garrison (1997:3)	Oswalt (2003:22)
Learning Situation	Opportunity	Educators have a responsibility to give students the opportunity for SDL	Nothing explicit	Educators have a responsibility to give students the opportunity for SDL	Educators have a responsibility to promote student control	Extent to which educators foster SDL
	Support	There should be balance between pedagogical and psychological control	Nothing explicit	Educators need to support students regardless of their personal responsibility	Nothing explicit	Expertise, guidance and materials provided by educator
	Collaboration	Possible but not necessary	Nothing explicit	Students do not learn in isolation	Collaboration with others promote control over learning context	Student–student, group and student–educator interaction
Components of Learning	Motivation	Nothing explicit	Nothing explicit	Nothing explicit	Entering motivation, task, motivation and volition	Enthusiasm or eagerness of doing something: Self-efficacy and volition
	Context	Nothing explicit	Distinguish between student control in an institutional setting and autodaxity	Defines social context as institutions of learning	Students take control of resources in the learning context	Resources, peers and external factors in the learning environment
	Cognitive	Nothing explicit	Nothing explicit	Nothing explicit	Construct own meaning. Critical thinking and reflection	Critical self-reflection

TABLE 1.1 (Continues...): Synthesis of SDL models.

SDL Components	Models				
	Long (1989:3)	Candy(1991:22)	Brockett and Hiemstra (1991:33)	Garrison (1997:3)	Oswalt (2003:22)
Students' Attributes — Content skill	Nothing explicit	Student's SDL skills may differ in different learning areas	Nothing explicit	Nothing explicit	Mastering the basic skills within the content area promotes SDL skill
SDL Skill: Level of self-directedness	High psychological control will proceed to SDL without pedagogical assistance	Level of SDL skill will be higher in familiar learning areas	Students assume responsibility for planning, implementing and evaluating the learning process	Nothing explicit	The level of self-directedness in specific learning areas is influenced by skill level in that area
Willingness: Willingness to direct own learning	Willingness to direct own learning leads to better SDL skills	Willingness and capacity to direct own learning (self-management)	Willingness and desire	Self-management and Goal setting	Personal decision to invest time and effort

Source: Tredoux (2012:29).

■ Synthesis of self-directed learning models

Table 1.1 provides a short summary of the models categorised according to the concepts identified by Oswalt (2003). In the following section, the key constructs associated with each model as well as descriptions and explanations are summarised.

Long's (1989) model is based on pedagogical SDL and focusses on the interaction of two dimensions, namely, psychological and pedagogical control. The essence of his model lies in control. He believes that the amount of control given to students will influence their SDL skills. All other aspects of his model are discussed relative to the control component. Although student control is a given in a successful SDL environment, it is not the only aspect to be taken into consideration. It is also important to remember that it is very difficult in a formal educational setting, such as a university, to give students ultimate control over their learning environment; however, educators can give students control over certain aspects of their learning, such as the choice of topics for assignments, the use of alternative learning resources and different learning strategies.

The 'variety of the constructs in Candy's model added an element of depth to our understanding of SDL' (Song & Hill 2007:29). Furthermore, 'Candy's model was the first to state that a learner's self-direction may be different in different content areas' (Song & Hill 2007:29). This is an important facet of SDL to remember when designing learning environment to foster SDL. The facilitator will have to consider the fact that there are a variety of students in the classroom who will approach their learning from a different frame of reference.

In their model, Brockett and Hiemstra (1991) combine process and personal attributes and integrate social context. According to them, the social context refers to the physical environment where learning takes place, such as tertiary institutions, libraries and/or museums. Today face-to-face settings are becoming limited owing to the exponential growth in blended and online learning.

With Garrison's (1997) focus on self-management of resources in a given context, it is clear that he also emphasises the context factor. Yet, not much attention is given to the role that context plays. In Garrison's (1997) model, the interplay between learning context and SDL received little attention. Garrison followed in Long's (1989) footsteps by also stressing the control component, but he further distinguished between control and responsibilities. These two concepts go hand in hand. The facilitator in the classroom has to give students control over certain aspects of their learning. If students, for example, can decide on their own topic for an assignment or receive an ill-structured problem to solve, they will find it easier to take responsibility for the learning process and they will be more motivated to do the assignment.

All of the models discussed in the previous sections have been valuable in the understanding and implementation of SDL, but the model presented by Oswalt (2003) 'integrates the highest number of SDL components and provides a more complete' picture of SDL. 'In most of the SDL models reviewed, context was discussed to a certain extent' (Song & Hill 2007:30). However, the fact that some of the models above 'raised awareness of the importance of context in SDL [...] has not attracted much attention to date'. Although Oswalt's (2003) model provides thorough insights into the implementation of SDL in a classroom, face-to-face instruction was still the predominant mode of delivery in all his discussions. The role of the student and the educator as facilitator of learning is essential to fostering SDL and will now be discussed.

■ The self-directed student

In traditional teacher-centred classrooms, students usually are passive recipients of information (Fisher & Sugimoto 2006). Knowledge is given to the students regardless of their diverse needs; this demotivates students and is an impediment to their learning. If students are motivated to take responsibility of their own learning and see the value of the learning content, they will actively obtain the required knowledge and skills (Fisher & Sugimoto 2006; Heikkila & Lonka 2006).

In her doctoral dissertation, Guglielmino defined a self-directed student in a way that is still as accurate today as it was a few decades ago (Guglielmino 1977):

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

Based on a survey of experts and her Delphi study, Guglielmino (1977:73) proposed the following characteristics for self-directed students:

- initiative
- independence
- persistence
- a sense of responsibility for one's own learning
- a tendency to view problems as challenges
- self-discipline
- a high degree of curiosity
- a strong desire to learn or change
- the ability to use basic study skills
- the ability to organise one's time and set an appropriate pace for learning
- self-confidence
- the ability to develop a plan for completing work
- joy in learning
- tolerance of ambiguity
- a preference for active participation in shaping educational programmes
- the ability to evaluate one's own progress
- an exploratory view of education
- above average risk-taking behaviour
- knowledge of a variety of potential learning resources and the ability to use them
- the ability to accept and use criticism

- the ability to discover new approaches for dealing with problems
- the ability to formulate learning objectives
- the ability to select and use many learning strategies
- a positive orientation to the future
- emotional security
- average or above average intelligence
- creativity
- a preference for independent study or relatively unstructured sources.

As seen in Oswalt's SDL model, students' attributes, which include a number of personality characteristics, are a key component in becoming a self-directed student. Dweck (2008) found that personality characteristics have a significant impact on one's attitude and approach to learning. Individuals can improve their learning abilities by changing their self-beliefs (Dweck 2008). Understanding the impact of self-belief in one's ability to learn and accurately relate to learning situations is an essential component of the learning process (Hutto 2009). Dweck's (2008) research indicates that personality is not necessarily fixed from birth, nor is it even carried into adulthood. There are some aspects of personality that are inherent, but for the most part, personality is 'a flexible and dynamic thing that changes over the life span and is shaped by experience'. It can be surmised that SDL personality characteristics are not fixed, but can and must be developed (Dweck 2008:392).

According to Guglielmino (2008), being a self-directed student is the natural way to learn. As an example of this inherent disposition found in everyone, Guglielmino (2008) points to the activities of a young child discovering a new object. The child instinctively examines the item and explores its properties through taste, touch, sight and sound to learn as much as possible about the object. Although people are born with a natural drive to learn, for some people that drive evaporates, and learning beyond what is required for daily living is no longer actively sought (Hutto 2009). Although self-directedness is a quality that can be diminished, it can also be

restored and further developed. The use of SDL techniques in an educational setting may be viewed as an attempt to replicate the natural way that people learn (Hutto 2009).

Students should realise the importance of their knowledge, attitudes and SDL skills in the learning process (Guglielmino et al. 2004). They have to understand that the role of the educator changes to that of a facilitator or a guide and the student can no longer depend on the educator as the only source of information (Ellis 2007; Loyens et al. 2008). All students have the potential to complete SDL projects successfully. The need remains, however, for students to be aware of the purposes and processes that are necessary to succeed in SDL (Guglielmino et al. 2004; Kicken et al. 2009). To function effectively, students must recognise the multiple components present in a learning situation (Richard 2007).

■ The educator's role in self-directed learning

In all the models discussed in the section above, the educator's role in SDL is recognised. All the authors of those models agree that the educator should guide the students to reach a higher level of self-direction in their learning. In the following sections, the role of the educator will be discussed by focusing on (1) enhancing the ability of students to be self-directed in their learning and (2) fostering transformational learning as central to SDL.

Part of the role of the educator is to help students to 'be able to plan, carry out and evaluate their own learning' (Merriam, Caffarella & Baumgartner 2007:n.p.). Merriam et al. (2007:107) recommend that educators should give students more control over learning situations by only providing 'assistance to individuals or groups of students in locating resources or mastering alternative learning strategies'. Allowing students a degree of control of the learning situation may be essential to giving students practice at being more self-directed in their learning (Francom 2009). Student control is a way of organising instruction

or instructional materials in a formal educational setting. However, fostering student self-direction 'involves more than simply reducing the amount of support and guidance given to [the] students' and increasing student control (Merriam et al. 2007:107). Active teaching–learning strategies, development of critical and creative skills and real-life problems for assignments are some examples of how SDL can be fostered.

According to Francom (2009), the ability to self-direct one's learning can be increased through certain teaching methods. Several different teaching–learning strategies, models and practices have been proposed and implemented to foster student self-direction among students, such as CL (Mentz & Van Zyl 2016, 2018), problem-based learning (PBL) (Golightly & Guglielmino 2015) and process-oriented learning (POL) (Bolhuis 2003). These methods of teaching may allow students to set their own goals independently and make plans to reach them, execute learning activities, evaluate the results and monitor their own learning processes. Each of the above-mentioned teaching methods will be briefly discussed below.

◼ Cooperative learning

According Bosch, Mentz and Reitsma (2019):

> Cooperative learning is an approach that involves a small group of students working together as a team to solve a problem, complete a task or accomplish a common goal. (p. 58)

Educators should be cognisant of the formation of groups, conflict in groups and the use of relevant assignments and assessment criteria when aiming to implement successful CL in their classes (Dyson & Strachan 2016; Zhang et al. 2015).

When using the CL strategy, the educator's role changes from an information-giving authority to that of a facilitator (Bosch 2017). According to Johnson and Johnson (2009:366), CL is based on the following principles:

1. positive interdependence
2. individual accountability

3. promotive interaction
4. the appropriate use of social skills
5. group processing.

Cooperative learning is a structured way of learning, and it is extremely important to take the above-mentioned principles into consideration while planning a lesson. Educators must bear in mind that cooperation is about empowerment. Students are being empowered 'to develop to their fullest potential through the support and confidence they gain' (Bosch & Pool 2019:54).

■ Problem-based learning

In PBL, students learn by solving problems, developing strategies, constructing knowledge and reflecting on their experiences (Golightly & Guglielmino 2015). Problem-based learning 'is well suited to [help] students become active [students] because it situates learning in real-world problems and makes students responsible for their learning' (Hmelo-Silver 2004; Savery 2015). Vijayan, Chakravarthi and Philips (2016) state that PBL is a successful teaching method to encourage student autonomy, and it cannot occur in the absence of SDL. They further believe that developing SDL skills helps students to effectively acquire knowledge and skills necessary for their professional careers. Dolmans et al. (2016:n.p.) assert that in the PBL literature, SDL refers to 'the preparedness of a student to engage in learning activities defined by him- or herself, rather than by a teacher', and this refers to being motivated and willing to participate in learning and having the skills to do so. The essential components of SDL are apparent in the PBL process, namely, (1) reviewing the scenario and generating hypotheses, (2) identifying their learning issues, (3) confirming the resources they will access, (4) performing their own information seeking and (5) applying their new learning and reflecting on the content and process of learning (Savery 2015; Vijayan et al. 2016).

◼ Process-oriented learning

According to Janssen et al. (2010:121), POL focusses 'on interaction processes, such as giving detailed and elaborated explanations', negotiating meaning, co-constructing solutions and lines of reasoning and developing and formulating arguments during collaboration. The process of knowledge construction and the student's own learning process lead to the application of POL (Ebner et al. 2010). Ebner et al. (2010:n.p.) further state that 'process orientation does not refer to a tight structuring of the learning process, but rather to the possibility of trying out a range of learning strategies' where the role of the educator changes from that of a knowledge distributor to that of a facilitator of SDL. The aim of process-oriented instruction is to foster and facilitate SDL while preparing for lifelong learning (Bolhuis 2003:338; Wang & Yu 2016). Bolhuis (2003) grouped POL into four main principles:

1. moving gradually to student regulation of the complete learning process
2. focusing on knowledge-building in the domain (subject-area)
3. paying attention to emotional aspects of learning
4. treating the learning process and results as social phenomena.

The 'important role of experiences in the social and cultural context, prior knowledge and the emotional aspects of learning are highlighted' (Bolhuis 2003:n.p.) in these principles and are related to SDL in life. Bolhuis (2003:n.p.) believes that 'teaching is not just an individual activity but a social practice with a complex power structure'. He believes that preparing students for self-directed lifelong learning should be accepted and should be an important educational goal in any educational environment.

Mezirow, as quoted by Merriam et al. (2007:n.p.), suggests that 'the key to self-directedness is becoming critically aware of what has been taken for granted about one's own learning'. The essence of this goal is that students 'need to reflect critically and have an understanding of the historical, cultural, and biographical reasons for their needs, wants and interests'

(Merriam et al. 2007:n.p.). This, however, is not possible in teacher-centred education settings where the educator is the only source of information. The role of the educator has to change from an educator to that of a facilitator or even a consultant to make room for critical thinking, problem-solving and reflection. Self-directed learning 'requires a change in approach by both students and [educators]' (Zion & Slezak 2005:876; Wang & Yu 2016). 'Instead of explaining, demonstrating and correcting, the [educator] must place more emphasis on guiding the [students'] active learning process' (Zion & Slezak 2005:876; Hammad 2018; Wang & Yu 2016). In the following sections, the researchers will discuss two models that provide guidelines on how to practically implement the changing role of the educator in the classroom.

■ Grow's model for the implementation of self-directed learning

In 1991, Grow proposed an SDL model for educators to help them foster SDL in their classrooms. His model introduces four stages, which have been inspired by four leadership styles (Grow 1991). In this model, 'the [educator's] purpose is to match the [student's] stage of self-direction and prepare the [student] to advance to higher stages' (Grow 1991:n.p.). In the following paragraphs, the stages of the model, as illustrated in Figure 1.6, as well as the role of the educator in each stage will be discussed.

According to Grow (1991), the way to approach the teaching of dependent students in stage one is through coaching. To use the coaching method, Grow (1991) suggests that educators should first establish their credibility and authority. Educators should 'prescribe clear-cut objectives and straightforward techniques' for achieving these because dependent 'students respond best to a clearly [organised,] rigorous approach to the subject' (Grow 1991:n.p.). The course should thus be designed clearly, with rigorous assignments and definite deadlines.

In stage two of the model, Grow (1991) refers to students who are interested and motivated. These students 'respond to motivational

The table in the figure reads:

Educator's changing teaching role between stages as

Expositor/ coach	Guided motivator	Facilitator	Consultant
Stage 1 (low SDL)	**Stage 2** (moderate SDL)	**Stage 3** (Intermediate SDL)	**Stage 4** (high SDL)
Passive and dependent	Interested and motivated	Involved and committed	Self-directed and initiated

Student's changing learning role between stages as

Left vertical label: Increasing educator's input and control
Right vertical label: Increasing students' empowered input

Source: Adapted from Kwan (2003:318).
FIGURE 1.6: Grow's changing roles of educators and students.

techniques [and] are willing to do assignments [of which] they can see the purpose' (Grow 1991:n.p.). The role of the educator in stage two changes from being a coach to being a guide or motivator. Grow (1991:n.p.) states that such an educator will persuade and explain 'using a directive but highly supportive approach that reinforces [student] willingness and enthusiasm'.

Students in stage three of the model (Grow 1991) see themselves as participants in their own education. Grow (1991:n.p.) believes that 'they are ready to explore a subject with a good guide [and] even explore some of it on their own'. He further states that these students have the skill and knowledge but may still need to develop more confidence and self-actualisation.

In stage four of the model, the students are called 'self-directed students'. These students 'set their own goals and standards, with or without help from experts' (Grow 1991:n.p.; Knowles 1975). Students at this stage are both able and willing to take responsibility for their learning (Bosch 2017), direction, productivity and 'exercise skills in time management, project management, goal setting, self-evaluation, peer critique, information gathering and the use of educational resources' (Grow 1991:134; Kurczewska 2016).

Grow (1991) believes that most mature stage-four students can learn from any kind of educator but mostly thrive in an atmosphere of autonomy. According to Grow (1991), 'the ultimate subject of stage [four] is the [student's] own personal empowerment as a mature creator and evaluator of knowledge or as a high-level practitioner of a skill'. Because of the 'psychological maturity of stage-four students, the instructor gradually reduces both two-way communication and external reinforcement so that the student's own efforts become the unequivocal focus' (Grow 1991:135).

Grow's model is but one idea of the role of the facilitator. Borich (2007) set some guidelines for the facilitator in striving to enhance SDL, which will now be discussed.

■ Borich's model to implement self-directed learning in the classroom

According to Borich (2007), to promote SDL in a learning environment, the educator is required to perform the following unique teaching functions (see Figure 1.7):

- Provide information on when and how to use mental strategies for learning.
- Explicitly illustrate how to use these strategies and to link the solutions to real-life problems.
- Encourage and motivate students to become actively involved in the subject matter by going beyond the information given and to restructure the new information in their own way of thinking and prior knowledge.
- Gradually shift the responsibility of learning to the students through practice exercises, dialogues and discussions that engage them in increasingly complex thinking patterns.

In an active teaching and learning environment, facilitators should allow students to make decisions about their own learning by establishing a collaborative relationship with learners and assist them to become the central figures in their own learning (Nasri 2017). According to Kwan (2003), the adoption of SDL implies that students are not expected to follow a set curriculum. Learning should be a lifelong process that occurs whenever the
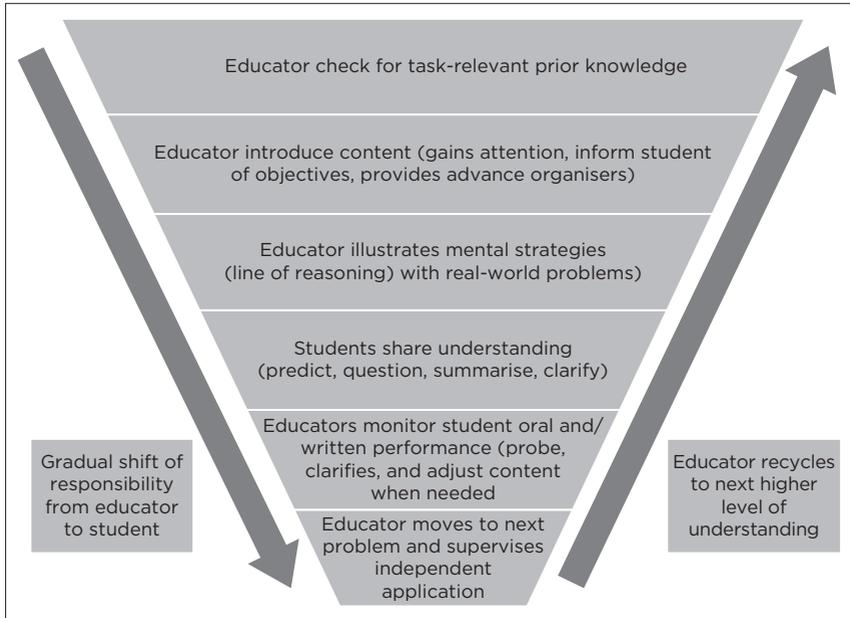
Source: Recreated from Borich (2007:348).

FIGURE 1.7: Shifting of responsibility from educator to student.

desire to do so is experienced (Kwan 2003). Students learning should be contextualised according to their personal experience (Kwan 2003; Merriam et al. 2007).

■ Guidelines on how to foster self-directed learning

Because there is 'a need [for providing] teaching and learning experiences that help students gain skills for SDL' (Francom 2010:n.p.), it is important to find specific principles and guidelines on how to do so. From a review of the literature on SDL, Francom (2009) reveals four main guidelines for fostering SDL in a formal educational environment:

1. matching the level of SDL learning required to student readiness
2. progressing from educator to student direction of learning over time

3. supporting the acquisition of subject matter knowledge and student self-direction together
4. having students practise SDL in the context of learning tasks. (pp. 10–11)

In the next sections, each of these principles, with guidelines on how to reach them, will be presented (Tredoux 2012).

■ Matching the level of self-directed learning required to student readiness

The first guideline for fostering 'SDL involves matching the level of SDL required in learning activities to student readiness' (Francom 2009:n.p.). Students who have more subject matter knowledge and a more advanced SDL experience will 'be more ready to self-direct their own learning than [students with a] lack [of] this [knowledge or] experience' (Francom 2011:2; Kurczewska 2016). As seen in Grow's (1991) model, the educator should determine the SDL readiness level of the student and match his or her teaching role and strategies accordingly. Boyer et al. (2014) assert that competence in SDL 'needs to be developed. Students need practice to learn how to be better [students.] Therefore, teaching should move gradually towards student' self-direction (Bolhuis 2003; Boyer et al. 2014; Grow 1991).

■ Progressing from educator to student direction of learning over time

The second guideline focusses on 'progressing from [educator] to student direction of learning over time' (Francom 2009). After the students' current level of self-direction is determined, the educator has to guide them towards a more student-centred approach (Andrzejewski et al. 2016; Grow 1991). As the 'students progress in gaining [subject matter] knowledge and experience, they [should] be given more opportunities to self-direct their learning' (Francom 2009:n.p.; Grow 1991). This will be possible if

students are given the opportunity to set their own goals, choose what they want to learn and choose learning resources. According to Broadbent and Poon (2015), it is necessary not only to allow students to self-monitor their learning process but also to self-assess their progress. By being actively involved in the identification of expected outcomes and the determination of assessment methods, the responsibility of the student is being increased, his or her level of self-directedness will increase over time and the learning process is no longer only teacher-directed (Loyens et al. 2008). The educator should motivate students to be more self-regulated (Andrzejewski et al. 2016).

■ Supporting the acquisition of subject matter knowledge and student self-direction together

The third guideline for fostering student self-direction involves supporting the acquisition of subject matter knowledge along with student self-direction. Francom (2009) suggests that because there is a relationship between the two, both should be taught together. According to Guglielmino (2013), students should be involved in selecting their own learning material. By doing this, students can identify their own needs, select preferable learning experiences, decide on the structure of the learning environment and choose learning materials from a variety of sources. The educator should, therefore, act as a support system (Guglielmino 2013). According to Van Zyl and Mentz (2015), engagement in a variety of real-life learning situations is essential, where students can decide for themselves the learning strategy to use and which steps to follow for a specific learning task given to them by the educator. Students want to know if the knowledge and skills they gain are relevant in their everyday lives (Andrzejewski et al. 2016).

Researchers agree that learning is not always transferable to all subject matter. For this reason, it is important to teach subject knowledge and SDL skills together in all the different content

areas (Francom 2009). 'Cognitive strategies, such as those required for SDL, [may] require the use of intellectual skills', which require basic knowledge of subject matter (Francom 2009:n.p.). 'Knowledge domains have their own networks of meaning: problem statements, concepts and rules, [which are] expressed in a partly domain-specific language' (Bolhuis 2003:330; Brockett & Hiemstra 1991; Oswalt 2003). Bolhuis (2003:330) asserts that students' learning 'depends on [their] expertise in the learning domain in three ways':

1. being knowledgeable of the problem statements and procedures of knowledge acquisition (knowing what and how to learn) in the domain
2. having access to a relevant knowledge base to build on
3. being motivated to learn in the domain.

These three ways connect well with Oswalt's SDL model concept of components of learning (motivation, context and cognition).

◼ Practising self-directed learning in the context of learning tasks

Learning tasks can provide an excellent context in which students are required to find, evaluate and apply information (Francom 2009). Practising 'SDL in the context of [learning] tasks may foster [student] self-direction while increasing the relevance and usefulness of learning activities' (Francom 2011:35). Guglielmino (2013) proposes a few guidelines on how to incorporate SDL into learning tasks and help students to plan, carry out and evaluate their own learning, namely:

- involving students in planning, which may include having students develop questions for a lesson or assist the educator in identifying topics that need to be included in a specific lesson
- having students complete a project instead of a paper for an assignment and allowing them to make choices regarding the way in which they demonstrate learning
- scheduling time for students to select activities that they wish to do

- using individual and group projects with planning guidelines
- presenting problem situations and having students discuss how they would go about solving the problem and where they would obtain information
- having students describe how they have learnt to apply specific skills
- encouraging exploration and discovery in order for students to make valuable connections
- discussing the importance of SDL in all facets of life, including at school, in the workplace and at home
- teaching goal-setting skills and having students use learning contracts or develop task lists. (p. 4)

'For students to develop into self-directed [students, educators] must [guide them to] proceed along a continuum from dependence to independence' (Guglielmino 2006:3).

■ Conclusion

Self-directed learning is a challenging goal for both educators and students, as it requires the role-players to change, take risks and develop a plan in order to be a success. Improving students' self-directedness requires modifying some of the longstanding views about the roles of educators and students. The proper role of the educator is to establish an environment where students will have the opportunity to take responsibility of their own learning. The implication thereof is that educators should give more freedom to students and trust them to fulfil certain responsibilities. The implementation of SDL in the classroom takes time and requires planning. It is important that the educator provides students with choices in the use of resources, learning strategies and even learning objectives. The educator should encourage students to move out of their comfort zone by providing new challenges and unfamiliar learning conditions and creating problem-solving situations. It is the role of the educator to provide feedback and help students evaluate their learning in order to promote critical thinking. Educators must be able to create an environment of openness and trust so that students will have the confidence to ask questions and take part in group

activities and discussions. Lastly, the educator has to motivate students so that they will have a positive attitude, a feeling of independence and a willingness to learn and improve their SDL skills.

Students enter learning situations with different experiences and different levels of SDL skills. Their willingness to participate and direct their own learning depends on how they view the SDL experience. The fact that students may demonstrate SDL skills in one situation does not necessarily mean that they can or want to be self-directed in another learning situation. In different learning situations, some students require more guidance than others. A student's SDL readiness can be influenced by the familiarity with the areas in which SDL is encouraged, the nature of the task and the personality of the student. Self-directed learning tasks should be set in such a way that they can encourage students of varying readiness and willingness to direct their own learning. They should encourage students to believe in their own abilities and inspire them to move to a higher level of SDL.

■ Acknowledgements

The impact of cooperative learning on self-directed learning

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■ Abstract

Self-directed learning means students defining their own goals (representing a realistic and challenging level of aspiration) and defining the path or means to achieve the said goal. Self-directed

learning is not an individual endeavour where students work in isolation, with only their own resources to help them. Typically, SDL is a social endeavour where students work in cooperative groups with the resources of all group members available to assist and help them. While SDL assumes students select their own learning goals, in most organizations goals are imposed. Students, therefore, must be influenced to internalize imposed goals and make them personal goals. The ownership of the goals has to shift from teachers and the school to the students, usually through dialogue and discussions with the teacher and classmates. It should be noted that most students pursue multiple goals simultaneously. These goals may be academic (such as learning to read), social (such as making friends) and developmental (such as adopting more complex patterns of thought and analysis).

Two of the theories underlying the nature of CL are Structure–Process–Outcome theory and Social Interdependence theory. These two theories have the same underlying premise (Watson & Johnson 1972; Johnson & Johnson 1989):

> The way the goals of a situation are structured determines the process individuals engage in to achieve [*their*] goals, [*and the process*] determines the outcomes. (p. 5)

According to Social Interdependence theory, CL is 'students working together to maximize their own and each other's learning' (i.e. achieve shared learning goals). *Competitive learning* is students working against each other to achieve an academic goal such as a grade of 'A' that only one or a few students can attain. *Individualistic learning* is students working by themselves to accomplish learning goals unrelated to those of the other students (Johnson, Johnson & Smith 2006).

Cooperative learning occurs only when five basic elements are structured into the situation. The five elements are positive interdependence, individual accountability, promotive interaction, appropriate use of social skills and group processing. The resulting

outcomes not only include 'higher achievement, more positive relationships, and greater psychological health' (Johnson & Johnson 1996:n.p.) but also a number of outcomes specifically related to SDL:

• intrinsic motivation
• competence motivation
• developmental motivation
• continuing motivation
• commitment to and persistence in working to achieve a goal
• learner control
• internalizing imposed goals
• the simultaneous accomplishment of multiple goals
• creativity.

While SDL can take place when goals are structured competitively or individualistically, it is within CL situations that SDL is most facilitated and enhanced. Working cooperatively helps individuals formulate goals, makes goals more meaningful and creates the conditions in which imposed goals are internalized and made personal goals. Cooperation also provides resources to help achieve the goals and moves self-efficacy to joint efficacy. It increases awareness of what are acceptable and unacceptable means of achieving one's goals. Cooperative learning allows students to achieve multiple goals simultaneously. Finally, there are multiple outcomes resulting from CL that increase the effectiveness of SDL and enhance the quality of the learning that takes place. It is within the union of SDL and CL that students tend to benefit the most from their efforts.

■ Introduction

The purpose of this chapter is to discuss the relationship between SDL and CL. Although SDL may occur in competitive and individualistic situations, to be most effective SDL should occur in a cooperative situation. In other words, CL provides the foundation for effective SDL. Therefore, in this chapter, the nature of SDL will be reviewed, the major theories underlying CL will be

briefly presented, the nature of CL will be discussed, the essential elements needed to structure CL will be reviewed, the types of CL will be outlined and the outcomes of cooperation most relevant to SDL will be reviewed. The cooperative nature of self-defined learning will then be discussed.

■ Nature of self-directed learning

From the moment of birth, motivation to learn is largely self-directed. In order to understand SDL, it is helpful to define a few related concepts. A *goal* is an ideal state of affairs that individuals value and are working to achieve. Goals are related in one of three ways through social interdependence. When individuals have mutual goals they are in a cooperative relationship, when their goals are opposed they are in a competitive relationship, and when their goals are unrelated they are in an individualistic situation (i.e. no relationship) (D.W. Johnson & F. Johnson 2013). The *path* or means is the method or course of action by which an act can be accomplished or a goal achieved. It includes both the strategies and procedures used to accomplish the goal and the resources required (or at least helpful) to do so. The strategies and procedures include acquiring and organizing the resources needed to accomplish the goal. *Level of aspiration* is the degree of difficulty of the goal towards which the person is striving (Dembo 1931). Self-directed learning may then be defined as a situation in which (a) the individual is able to define his or her own goals, (b) the goals are related to his or her central needs or values, (c) the individual is able to define the paths (i.e., procedures, strategies, resources) to these goals, and (d) the achievement of these goals represents a realistic level of aspiration for the individual, that is, not too high or too low, but high enough to be challenging (Johnson 1970; Lewin et al. 1944; Watson & Johnson 1972). To be able to engage in SDL, a person needs enough self-responsibility and self-control to define his or her own goals and the paths taken to achieve the goals, enough commitment to persevere to achieve the goals, enough effort to achieve the goals and the utilization of

his or her more important abilities. More traditionally, SDL is commonly defined as the student taking the initiative for his or her learning (Knowles 1975). Taking the initiative may involve students diagnosing what they want to learn, formulating specific learning goals, identifying the resources needed, choosing and implementing the strategies needed, and evaluating learning outcomes.

There are several issues that need to be discussed in order to clarify the nature of SDL. The first is the failure of 'the individual assumption, [which states] that [goals] should be tailored to each student's personal aptitude, learning style, personality characteristics, motivation, and needs' (Johnson & Johnson 1996:n.p.). The ability of schools to provide an unlimited amount of goals specially tailored 'to the cognitive and affective needs of each [student,] however, is limited by' (Johnson & Johnson 1996:n.p.) the lack of understanding of how cognitive and affective needs are translated into goals. Since each student 'has multiple characteristics and traits that interact in unknown and unpredictable ways' (Johnson & Johnson 1996) to produce learning goals, instruction cannot truly adapt to the complexity of each person's learning goals. Finally, the individual assumption assumes that in SDL students will work in isolation, with only their own resources to help them.

In actual fact, SDL may largely have social origins (Johnson & Johnson 1989). While babies respond to biological needs (i.e. being hungry, being cold), they smile and try to learn language in order to build relationships with their caretakers/family. Infants internalize goals imposed by adults and accept the goals as their own (i.e. toilet training). They watch what older persons do and seek to imitate them (e.g. learning language, walking – in other words, social learning). By interacting with others, new personal goals develop (e.g. when parents read to a child, the child wants to learn to read). They seek out allies and form coalitions in order to master new skills and competencies. As individuals get older, they often learn on their own in order to contribute to later group efforts or engage in more complex interactions with others. They frequently have

social goals in mind when studying alone. They engage in interpersonal dialogues that stimulate their thinking, curiosity and creativity (Guglielmino & Guglielmino 2001). Individuals, furthermore, may seek out others with similar learning goals and form alliances to pursue their mutual learning goals. In such alliances, their discussions may clarify the nature of the goals and the resources needed to achieve them. It is from these dialogues that students engage in complex thought patterns and higher levels of understanding. Thus, it may be a fallacy to conceive of SDL as something a person does in isolation from others.

Secondly, within schools and organizations in which people are employed, goals are largely imposed. In kindergarten, students are told they have to learn to take turns, share toys and materials, do simple math, learn to recognize the letters of the alphabet, and many other goals. In high school, students are told they have to learn math and science, whether they want to or not. An important issue for all schools and other organizations is how to ensure students transform imposed goals to personal goals. Much of SDL begins with teacher-directed learning that assumes that gradually through dialogue and discussions with the teacher and classmates, students will internalize the goals and the responsibility of learning will shift to the students. When goals are imposed on a student, such as the goal of learning to read, several factors influence the extent to which the goal is internalized and adopted as one's own. The first is through identification. The more the student identifies with the person presenting the goal, the greater the likelihood the student will adopt the goal and be self-directed in trying to achieve it. The second is the social role assigned to the student. If a person accepts the role of student, then whatever the teacher imposes may be adopted and transformed into a person goal. The third is group membership. The more the student is a valued member of a group (either a CL group or the class as a whole), the more the group goals will be adopted as personal goals by the student.

Thirdly, most students pursue multiple goals simultaneously. These goals may be academic (such as learning to read), social

(such as making friends) and developmental (such as adopting more complex patterns of thought and analysis).

Fourthly, self-directed learners need to seek out the resources they need to achieve their goals. That includes forming alliances and coalitions with classmates and others who are seeking to achieve similar goals.

Fifthly, in defining the paths to be taken to achieve the goals, the values, norms, regulations and laws of one's family, friends, community and society are taken as a framework in which to develop the paths (Johnson & Johnson 2002, 2010b). Alternative strategies that involve stealing or cheating, for example, are not typically considered or adopted because they are unaccepted means of achieving one's goals.

Sixthly, in determining the importance, salience and value of the goals adopted, the benefits to oneself are considered, but so are the benefits to other members of one's family, friends, community and society, as well as the common good of all. Individuals seek employment not only to have money for themselves, for example, but also to ensure their spouse and children have food, a place to stay and a nice vacation. They even may seek to attain a certain job to make a contribution to society.

Seventhly, in order for SDL to take place, the learning situation should be structured cooperatively, not competitively or individualistically. It is primarily within cooperative situations and relationships that personal goals relevant to the person's needs and values are formulated; peers, teachers and family members recommend books to read, subjects to study, teachers to take classes from and career possibilities. The same people suggest what strategies and procedures the person should use to achieve the goals. Other relevant people may even suggest the appropriate level of aspiration, suggesting that one subject will be too hard for the person or too easy. Once the person takes action to achieve the goals, other people may frame the results as being a success or failure. Cooperation is known to heighten inducibility (Deutsch 1949a, 1962), where the person is open to being

influenced by collaborators. Openness to be influenced by collaborators includes collaborators being able to influence the person's goals and path taken to achieve the goals. In competitive situations, inducibility is very low (competitors resist being influenced by each other) and in individualistic situations, where there is no interaction, no inducibility exists.

Thus, although SDL is by definition a situation in which a person pursues his or her own goals, the origins of those goals tend to be social. Originally, many of the goals are imposed by others. A person pursues multiple goals simultaneously. Many of the resources for achieving the goals come from other people and are achieved through alliances and coalitions. Goals are defined, furthermore, 'to benefit others and the common good as well as [to benefit] oneself' (Johnson et al. 2014a:n.p.). And in defining the paths taken to achieve the goal, the norms and laws of one's social community need to be taken into account. In order for SDL to take place, therefore, goals are best structured cooperatively, not competitively or individualistically.

◼ The nature of cooperative learning

There are many theories noting the importance of cooperation (Johnson & Johnson 2015a), including cognitive development theories, social cognitive theories, and behavioral-learning theories. The most influential and foundational theories, however, are derived from Lewin's (1935) work. They are the Structure–Process–Outcome Theory and Social Interdependence Theory.

◼ Structure–Process–Outcome theory

Based on the theorizing of Kurt Lewin (1935), Goodwin Watson and David Johnson (Watson & Johnson 1972) formulated Structure–Process–Outcome Theory. They posited that the way the goals of a situation are structured determines the processes individuals engage in to achieve the goals, which in turn determines the outcomes of their efforts. The outcomes result

from the processes individuals engage in to achieve the goals, not from the goals themselves.

■ Social Interdependence Theory

■ Definitions and history

According to Johnson, Johnson and Holubec (2013:Ch. A, p. 4), Social Interdependence Theory was derived from the theorizing of Koffka, Lewin, and Deutsch. In the early 1900s, Kurt Koffka one of the founders of the Gestalt School of Psychology, stated that groups were dynamic wholes in which the interdependence among members could vary. Kurt Lewin*,* one of Koffka's colleagues, extended Koffka's notions in the 1920s by stating that the essence of a group is the common goals that create interdependence among members and results in the group being a 'dynamic whole' so that a change in the state of any member or subgroup changes the state of any other (Johnson et al. 2013:Ch. A, p. 4). Ovisankian, Lissner, Mahler, and Lewis, Lewin's students and colleagues, further extended the theory by demonstrating that it is the drive for goal accomplishment that motivates cooperative and competitive behavior (Johnson & Johnson 2015b). Morton Deutsch, one of Lewin's graduate students, in the late 1940s, used Lewin's reasoning about social interdependence to formulate a theory of cooperation and competition (Deutsch 1949a, 1962, Johnson et al. 2013:Ch. A, p. 4). Deutsch's work has been expanded primarily by one of his students, David W. Johnson and his brother Roger (Johnson & Johnson 1974, 1978, 1989, 2009a, 2010a).

Two types of social interdependence are posited by Social Interdependence Theory, namely, positive (cooperative) and negative (competitive) (Deutsch 1949b, 1962; Johnson 2003; Johnson & Johnson 1989, 2009a, 2010a). According to Johnson and Johnson (2015b):

> *Positive interdependence* (i.e. cooperation) exists when individuals perceive that they can reach their goals if and only if the other

individuals with whom they are cooperatively linked also reach their goals. *Negative interdependence* (i.e., competition) exists when individuals perceive that they can obtain their goals if and only if the other individuals with whom they are competitively linked fail to obtain their goals. *No interdependence* (i.e., individualistic efforts) exists when individuals perceive that they can reach their goal regardless of whether other individuals in the situation attain or do not attain their goals. [...]. Positive interdependence tends to result in promotive interaction (such as mutual help and assistance), negative interdependence tends to result in oppositional interaction (such as obstruction of each other's efforts), and no interdependence tends to result in the absence of interaction. The relationship between the type of social interdependence and the interaction pattern it elicits is assumed to be bidirectional. Each may cause the other. Positive interdependence, for example, tends to result in collaborators engaging in promotive interaction (i.e. helping, sharing, encouraging each other), and patterns of promotive interaction tend to result in cooperation. (p. 164)

Certain psychological processes tend to result in each type of interdependence. Positive interdependence (Johnson & Johnson 2008):

[*T*]ends to result in *substitutability* (i.e., the degree to which actions of one person substitute for the actions of another person), *inducibility* (i.e., openness to being influenced and to influencing others), and *positive cathexis* (i.e., investment of positive psychological energy in objects outside of oneself) (Deutsch 1949a; Deutsch 1962; Johnson 2003, Johnson & Johnson 1989). Negative interdependence tends to result in non-substitutability, resistance to being influenced by others, and negative cathexis. No interdependence detaches a person from others, thereby creating non-substitutability, no inducibility or resistance, and cathexis only to one's own actions. (p. 406)

■ What makes cooperation work

Assigning individuals to groups and telling them to work together does not in and of itself result in cooperative efforts. Seating students together can result in competition at close quarters (i.e., pseudo-groups) or individualistic efforts with talking (i.e., traditional learning groups). Whenever two parties interact, however, the potential for cooperation exists (Johnson et al. 2013).

Cooperation occurs when five conditions are carefully structured in the situation, namely, positive interdependence, individual accountability, promotive interaction, social skills and group processing (Johnson & Johnson 1974, 1978, 1989, 2009a, 2010a).

The first needed condition for cooperation is positive interdependence. Deutsch (1949a) and Johnson and Johnson (1992) define positive interdependence as the perception that one is linked with others in a way so that one cannot succeed unless they do (and vice versa) and, therefore, groupmates' work benefits one and one's work benefits them. The three major categories of interdependence are outcome interdependence, means interdependence and boundary interdependence (Johnson & Johnson 1989, 1992). In a cooperative or competitive situation, individuals are oriented towards a desired outcome, end state, goal, or reward. In addition, positive interdependence may be created through the means used to accomplish the outcomes, such as resource, role, and task interdependence (which are overlapping and not independent from each other). Finally, the boundaries existing among individuals and groups can define who is interdependent with whom. *Boundaries* may be created by environmental factors (different parts of the room or different rooms), similarity (all wearing the same color shirt), proximity (seated together), past history together, expectations of being grouped together, and differentiation from competing groups. Boundary interdependence thus includes outside enemy (i.e., negative interdependence with another group), identity (which binds group members together as an entity), and environmental (such as a specific work area) interdependence, all of which are overlapping and not independent from each other. (Johnson & Johnson 1989, 1992)

The second needed condition for cooperation is 'individual accountability'. *Individual accountability* exists when the performance of each individual group member is assessed and the results given back to the group and the individual. Each group member has a personal responsibility for completing one's share of

the work and facilitating the work of other group members. Group members also need to know (a) who needs more assistance, support, and encouragement and (b) that they cannot 'hitch-hike' on the work of others. The purpose of CL is to make each member a stronger individual in his or her right. Persons work together so that they can subsequently perform higher as individuals. To ensure that each member is strengthened, students are held individually accountable to complete assignments, learn what is being taught, and help other group members do the same. Individual accountability may be structured by (a) giving an individual test to each student, (b) having each student explain what they have learned to a classmate, or (c) observing each group and documenting the contributions of each member (Johnson et al. 2013:Ch. 1, p. 15).

The third needed condition for cooperation is promotive interaction (Johnson et al. 2013:Ch. 1, p. 15). Students promote each other's success by helping, assisting, supporting, encouraging and praising each other's efforts to learn. Doing so results in such cognitive processes as orally explaining how to solve problems, discussing the nature of the concepts being learned, teaching one's knowledge and skills to classmates, challenging each other's reasoning and conclusions, and connecting present with past learning. It also results in such interpersonal processes as modeling appropriate use of social skills, supporting and encouraging efforts to learn, and participating in joint celebrations of success.

Promotive interaction changes the self-efficacy of group members to joint efficacy (Johnson & Johnson 2003). Individuals can aspire to much more difficult goals when they know they have the resources of other group members to draw upon.

The fourth needed condition for cooperation 'is the appropriate use of social skills' (Johnson et al. 2013:Ch. 1, p. 15). Social skills are required for contributing to the success of a cooperative effort. Examples of such social skills are leadership, decision-making, trust-building, communication, and conflict management skills. Procedures and strategies for teaching social skills may be found in Johnson and Johnson (2014) and Johnson and F. Johnson (2017).

The fifth needed condition for cooperation is *group processing* (Johnson et al. 2013:Ch. 1, p. 15). Group members need to focus periodically on the continuous improvement of the quality of the processes they are using to achieve their goals. They do so by describing what member actions are helpful and unhelpful in ensuring that all group members are achieving and effective working relationships are being maintained, and make decisions about what behaviors to continue or change. Group processing may result in (a) streamlining the learning process to make it simpler (reducing complexity), (b) eliminating unskilled and inappropriate actions (error-proofing the process), (c) improving continuously group members' skills in working as part of a team, and (d) celebrating hard work and success.

These five needed conditions, furthermore, are the basis for cooperation in family, community, organizational, societal, and global settings. At every level in which cooperation occurs, these five needed conditions need to be systematically structured.

■ Types of cooperative learning

There are four types of CL that may be used to promote self-directed leaning (Johnson et al. 2013; Johnson, Johnson & Smith 2006), namely, formal CL, informal CL, cooperative base groups, and constructive controversy. *Formal CL* consists of students working together, for one class period to several weeks, to achieve shared learning goals and complete jointly specific tasks and assignments (such as problem-solving, completing a curriculum unit, writing a report, conducting an experiment, or having a dialogue about an assigned task) (Johnson et al. 2013:Ch. 1, p. 8). In formal CL, teachers (Johnson, et al. 2013):

- *Make a number of pre-instructional decisions.* An instructor decides on the academic and social skills objectives of the lesson, size of groups, the procedure for assigning students to groups, the roles assigned to students, the materials needed to conduct the lesson, and the arrangement of the room.

- *Explain the task and the positive interdependence.* An instructor clearly defines the assignment, teaches the required concepts and strategies, specifies the positive interdependence and individual accountability, defines the criteria for success, and explains the expected social skills to be engaged in.
- *Monitor students' learning and intervene within the groups to provide task assistance or to increase students' interpersonal and group skills.* An instructor systematically observes and collects data on each group as it works. The instructor intervenes to assist students in completing the task accurately and in working together effectively when it is needed.
- *Evaluate students' learning and help students process how well their groups functioned. Instructors carefully assess s*tudents' learning and sometimes evaluate their performances. Members of the cooperative groups then process how effectively they have been working together. (Ch. 2, p. 3)

Informal CL consists of having students work together to achieve a joint learning goal in temporary, ad-hoc groups that last from a few minutes to one class period (Johnson et al. 2013:Ch. 1, p. 8, Ch. 3, p. 12). Students engage in short dialogues or activities in temporary, ad-hoc groups in response to a small number of questions about what is being learned. The brief discussions or activities may be used to focus student attention on the material to be learned, set a mood conducive to learning, help set expectations as to what will be covered in a class session, ensure that students cognitively process the material being taught, and provide closure to an instructional session. Informal CL groups are often organized so that students engage in three-to-five minute *focused discussions* before and after a lecture and two-to-three minute *turn-to-your-partner* discussions interspersed every ten to fifteen minutes throughout a lecture.

Cooperative base groups are long-term, heterogeneous CL groups with stable membership whose primary responsibilities are to provide support, encouragement, and assistance to make academic progress and develop cognitively and socially in healthy ways as well as holding each other accountable for striving to learn (Johnson et al. 2013:Ch. 1, p. 8, Ch. 4, p. 4).

Typically, cooperative base groups (1) last for the duration of the semester, year or until all members have graduated, (2) are heterogeneous in membership and (3) meet regularly (e.g. daily or biweekly). Instructors assign students to base groups of three to four members, have them meet at the beginning and end of each class session (or week) to complete academic tasks such as checking each members' homework, routine tasks such as taking attendance, and personal support tasks such as listening sympathetically to personal problems or providing guidance for writing a paper. (Johnson et al. 2013:Ch. 1, p. 8, Ch. 4, p. 4). *Constructive controversy* exists when one student's ideas, information, conclusions, theories, and opinions are incompatible with those of another, and the two seek to reach an agreement (Johnson & Johnson 1979, 1995, 2007, 2009b; D.W. Johnson & F. Johnson 2013). Instructors create academic controversies (Johnson et al. 2013:Ch. 2, p. 21) by choosing an academic issue, assigning students to groups of four, dividing the group into two pairs, and assigning one pair the pro position and the other pair a con position. Instructors implement the five step controversy procedure of having students (1) prepare the best case possible for their assigned position, (2) persuasively present the best case possible for their position to the opposing pair, (3) engage in an open discussion in which the two sides argue forcefully and persuasively for their position while subjecting the opposing position to critical analysis, (4) reverse perspectives, and (5) drop all advocacy and come to a consensus as to their best reasoned judgment about the issue.

The four types of CL may be used in an integrated way (Johnson et al. 2013:Ch. 5, p. 1). A typical class session may begin with a base group meeting, followed by a short lecture in which informal CL is used. The lecture is followed by a formal CL or a constructive controversy lesson. Near the end of the class session another short lecture may be delivered with the use of informal CL. The class ends with a base group meeting.

■ Outcomes of cooperation

Cooperative efforts have numerous outcomes that may be subsumed within three broad categories, namely, effort to achieve, positive interpersonal relationships and psychological adjustment (Johnson & Johnson 1974, 1978, 1989, 2009a, 2010a). The research on social interdependence has considerable generalizability because research participants have varied as to economic class, age, sex, and cultural background, because a wide variety of research tasks and measures of the dependent variables have been used, and because the research has been conducted by many different researchers with markedly different orientations working in different settings and in different decades (Johnson et al. 2013:Ch. A, p. 10).

☐ Effort to achieve

The most frequently discussed outcomes of CL are 'effort to achieve, positive interpersonal relationships, and psychological health' (Johnson & Johnson 1974, 1978, 1989, 2009a, 2010a). Working cooperatively to achieve a common goal tends to produce higher achievement and greater productivity than does working competitively or individualistically (Johnson & Johnson 2014). There is so much research confirming this finding (Johnson & Johnson 2018:7) 'that it stands as one of the strongest principles of social and organizational psychology. Cooperation also tends to result in more frequent generation of new ideas and solutions' (i.e. *process gain*), greater transfer of what is learned within one situation to another (i.e. *group to individual transfer*) and more higher-level reasoning than competitive or individualistic learning efforts. Cooperative learning tends to promote more critical thinking (Smith et al. 2005), and critical thinking tends to help students be better able to communicate their ideas, synthesize information and weigh evidence from a variety of sources, all of which help students become more self-directed (Justice et al. 2007).

According to (Johnson et al. 2013:Ch. A, pp. 14–16), the superiority of cooperative over competitive and individualistic efforts increased as the task was more conceptual, the more

problem-solving was required, the more desirable was higher-level reasoning and critical thinking, the more creative the answers needed to be, the more long-term retention was desired, and the greater the application required of what was previously learned.

☐ Positive interpersonal relationships

There is no reason to believe that SDL occurs only in academic achievement situations. Much of human effort is spent in building and maintaining positive relationships with others. This is especially relevant to SDL, as there is evidence that the more positive the relationships among classmates, the harder and more successfully students will work to achieve academically (Roseth et al. 2008). In working to achieve challenging goals, furthermore, students often need both academic support to help them reach the goal and personal support to encourage them to persist and keep trying.

Overall, individuals care more about each other and are more committed to each other's success and well-being when they work together cooperatively than when they compete to see who is best or work independently from each other (Johnson et al. 2013:Ch. A, p. 17). This is true when individuals are homogeneous, and it is also true when individuals are heterogeneous in ethnic membership, culture, handicapping conditions, intellectual ability, social class and gender. 'When individuals are heterogeneous, cooperating on a task results in more realistic and positive views of each other' (Johnson & Johnson 2014:843). Cooperative learning has been shown to be an essential component for successful ethnic integration and inclusion of handicapped peers (Johnson & Johnson 1974, 1978, 1989, 2009a, 2010a, 2014:843; Johnson, Johnson & Maruyama 1983). According to Johnson and Johnson (1989, 2014:843; D.W. Johnson & F. Johnson 2013) and Watson and Johnson (1972) as relationships become more positive, many positive outcomes result, such as reductions in absenteeism and turnover of membership, increases in satisfaction and morale, increases in member commitment to organizational goals, increases in

feelings of personal responsibility to the organization, willingness to take on difficult tasks, increases in motivation and persistence in working towards goal achievement, increases in willingness to endure pain and frustration on behalf of the organization, increases in willingness to defend the organization against external criticism or attack, increases in willingness to listen to and be influenced by colleagues, increases in commitment to each other's professional growth and success, and increases in productivity. Cooperating on a task also results in more task-oriented and personal social support than do competitive or individualistic efforts (Johnson & Johnson 2014:843).

☐ Psychological health

The more healthy and well-adjusted students are psychologically, the more effective they are in working to achieve goals. Being part of a cooperative group, 'and valuing cooperation, results in greater psychological health and higher self-esteem than does competing with peers or working independently' (Johnson et al. 2013:Ch. A, pp. 18–19). Cooperative efforts with caring people, who are committed to each other's success and well-being, and who respect each other as separate and unique individuals, tends to promote personal ego-strength, self-confidence, independence and autonomy. When individuals work together to complete tasks, they interact (mastering social skills and competencies), they promote each other's success (gaining self-worth) and they form personal as well as professional relationships (creating the basis for healthy social development). Working cooperatively with others tends to result in individuals seeing themselves as worthwhile and as having value, being more productive, being more accepting and supportive of others, and being more autonomous and independent. Cooperative experiences are not a luxury. They are an absolute necessity for the healthy development of individuals who can function independently.

In addition to these three outcomes, there are a number of outcomes that specifically relate to SDL. They are intrinsic

motivation, competence motivation, developmental motivation, continuing motivation, commitment to and persistence in achieving goals, creativity in achieving goals, learner control, simultaneous accomplishment of multiple goals, and benefits from helping others achieve their goals.

☐ Intrinsic motivation

Intrinsic motivation may be defined as motivation that is inherent in the activity and its perceived meaning (Johnson 1970; Watson & Johnson 1972). It is interest in and enjoyment of an activity for its own sake (Deci & Ryan 1985). Learning for the joy of it, to enhance one's competence, to benefit others, and as the result of meaningful feedback is intrinsic to learning activities. *Extrinsic motivation* may be defined as motivation for outcomes separate from and following the activity (Johnson & Johnson 2003). Winning and performing up to external criteria are examples.

Three of the factors that create intrinsic motivation in cooperative situations are as follows. Firstly, intrinsic motives seem to evolve when achieving is also aimed at benefiting others. Weisieltier (cited in D.W. Johnson & R.T. Johnson 2013:n.p.) studied medical students and 'found more intrinsic motivation among [those] who wished to help cure cancer patients than among [those] who wanted a high income'. The study of medicine seemed 'inherently worthwhile to the former but not to the latter. When individuals see their own achievement as of possible service to others there tends to be intrinsic motivation' (D.W. Johnson & R.T. Johnson 2013). Secondly, cooperation also 'involves striving to reach mastery goals. There is evidence that mastery goals promote' (Johnson & Johnson 2003) seeking challenging tasks, being absorbed in tasks, being self-determined and feeling autonomous (factors facilitative of intrinsic interest and enjoyment) (Butler 1987; Deci & Ryan 1985; Dweck 1991). According to Johnson and Johnson (2003:164), 'Rawsthorne and Elliot (1999) found in a meta-analysis of intrinsic motivation studies that the pursuit of mastery goals produced significantly

more free-choice persistence at the task (ES = 0.17) and self-report interest and enjoyment (ES = 0.36) than did the pursuit of performance goals'. Thirdly, working cooperatively with others tends to expand the emotions experienced while working on a task. Group enjoyment of an activity, for example, is more powerful than individual enjoyment (else people would always play and work alone) (Johnson & Johnson 2003).

'The oppositional interaction resulting from a competitive goal structure tends to result in extrinsic motivation based on winning and benefiting at the expense of others'. [...] 'the more competitive individuals' attitudes are, the more they see themselves as being extrinsically motivated' (Johnson & Johnson 2003:165). In competition, for example, performing a task well is less important than winning (Ames 1984; Johnson & Johnson 1999; Levine 1983) and individuals' attend more to their own ability to perform and winning than to 'how' to do the task (Nicholls 1989). Pritchard, Campbell and Campbell (1977 in D.W. Johnson & F. Johnson 2013) found that competition decreased intrinsic motivation and Deci and Ryan (1985, cited in Johnson & Johnson 2003) found that:

> [*F*]ace-to-face competition decrease subjects' intrinsic motivation and increase their extrinsic motivation even when there were no rewards involved. There is evidence, furthermore, that competition is a negative incentive, not unlike electric shock, so that individuals may learn to escape from or terminate competition through instrumental responses. (p. 165)

According to Johnson and Johnson (2003):

> Individualistic efforts may result in either intrinsic or extrinsic motivation. Like [*cooperation,*] individualistic efforts may be based on mastery goals, which tend to promote intrinsic motivation. Most often in educational and career settings, however, individuals engage in individualistic activities for instrumental or other reasons, such as receiving a reward. Individualistic efforts are promoted by external reward systems, such as programmed instruction, behaviour modification, [*or piece-rate compensation*]. (p. 166)

External reward systems create extrinsic motivation. The absence of the interpersonal influences, furthermore, eliminates many of the sources of intrinsic motivation.

☐ Competence motivation

Perhaps at no age is SDL more apparent than in infants and young children. One of the most powerful intrinsic motivators is *competence motivation*, the drive to increase one's fitness or ability to carry on those transactions with the environment that result in maintaining oneself, growing and flourishing (White 1959, 1963). Generally, humans initiate action to achieve goals. Infants work hard in communicating with the people around them, smiling and trying to talk. Young children explore novel objects and places, grasp, crawl, walk, attend and perceive, speak, think, manipulate their surroundings and alter their environment. All these behaviors are part of how children learn to interact effectively with their environment rather than passively allow the environment to act upon them. When they are successful, they are likely to be pleased with themselves and positive about their abilities. This confidence motivates them to further explore the world and attempt to manipulate the environment.

■ Personal causation theory

Richard DeCharms (1968, 1976) extended White's work by developing a systematic programme for teachers to encourage competence motivation in students. Four major concepts in his program are personal causation, agency, origin and pawn. *Personal causation* is doing something intentionally to produce a change. *Agency* is the reasonable use of knowledge and learned habits to produce desirable changes. When agency is successful, and the student causes a desired change, the student believes he or she was the *origin* of the change. When agency fails or the student is blocked from success by some person or event, the student feels like a *pawn*. An origin causes things to happen by exercising free choice in selecting goals, acting by choice and being the master of his or her fate. A pawn is controlled by other people and external circumstances by having goals imposed on him or her, being coerced into taking specified actions and having little or no control over his or her fate. Generally, students treated

as origins like academic tasks better, work harder and are more involved in the completed product than students treated as pawns (DeCharms 1968). Teachers taught students to behave as origins by:

- knowing their own strengths and weaknesses
- choosing personal goals based on their capabilities and situational realities
- determining concrete actions they could take now to help them reach their goals
- learning how to tell whether their actions were having the desired effects.

☐ Developmental motivation

Piaget's (1950) theory of cognitive development posits that children are inherently motivated to improve the quality of their reasoning, moving from pre-operational to operational to formal levels of reasoning. This motivation is not imposed on them by adults, the children themselves self-direct their learning as their level of reasoning increases. Both Piaget (1948) and Kohlberg (1967) posited that the same SDL is behind the development of moral reasoning. Both Piaget and Kohlberg noted that cognitive and moral development take place when children work cooperatively, not competitively or individualistically. There is considerable evidence, furthermore, that the transition to higher levels of cognitive and moral reasoning take place in cooperative, not competitive or individualistic, learning situations (Johnson & Johnson, 1989, 2009a, 2010a).

☐ Continuing motivation

Most schools hope to produce graduates who continue to be motivated to expand their skills and knowledge throughout their lives. Students hopefully develop the internal motivation to venture into new areas of learning and skill development after they have finished their formal education. '*Continuing motivation* is motivation to seek further information in the future about the

topic being studied. Allen (1979) found that science students who worked in cooperative learning groups' (D.W. Johnson & F. Johnson 2013) compared to students who were taught with a lecture-competition format (Johnson & Johnson 2003) demonstrated more continuing motivation. Gunderson and Johnson (1980) in D.W. Johnson and F. Johnson (2013:n.p.) also 'found cooperative learning experiences to be related to increases in continuing motivation'. A major cause of continuing motivation, furthermore, is interpersonal 'academic disagreements and conflicts among ideas, conclusions, and theories' (Johnson & Johnson 1979:n.p., 1989, 2007, 2009b). Within a cooperative situation, constructive controversy, tends to lead to uncertainty, epistemic curiosity, and a re-evaluation of one's conclusions (Johnson & Johnson 2003). According to Johnson and Johnson (2003):

> Within a competitive situation, such academic conflicts tend to result in uncertainty, a closed-minded justification of one's own conclusions, and a derogation of opposing points of view. Within an individualistic situation, [...] initial conclusions are not challenged and fixation on initial impressions is common [*as there is no opportunity for disagreement and intellectual challenge*]. (p. 167)

☐ Commitment to and persevering in achieving goals

Commitment to goal achievement tends to increase in cooperative efforts (Johnson & Johnson, 1974, 1989, 2009a, 2010a). According to Johnson and Johnson (2003):

> *Commitment to goal achievement* is reflected in a cluster of variables including willingness to exert effort to achieve the goal, belief in the value of the goal, liking for the task, liking for the experience of working on the task, involvement in the task, believing success is important, spending time on the task, and persisting in trying to achieve the goal. (p. 168)

Cooperative experiences, compared with competitive and individualistic ones, tend to promote more positive attitudes towards the task being worked on and the experience of doing

so (effect sizes = 0.57 and 0.42 respectively) (Johnson & Johnson 1989). Most individuals tend to prefer cooperative over competitive and individualistic experiences (Johnson & Johnson 1989). Cooperation, compared with competitive and individualistic efforts, tends to promote more involvement in activities and tasks (Deutsch 1949b; Haines & McKeachie 1967; Johnson & Johnson 2003), 'greater importance of success, and more on-task behaviour and less apathetic, off-task, disruptive behaviours' (Johnson & Johnson 2003:168). The more oriented a person is towards cooperation, the greater the perseverance the person shows in achieving goals (Johnson et al. 1978). The classic studies by Kurt Lewin and his associates (Johnson & Johnson 2003) showed that public commitment to the group's goals in discussions in cooperative groups result in greater goal achievement than did individualistic interventions.

In addition, the more group aspirations as well as personal aspirations are reflected in the goals, the more significant the goals will (Johnson & Johnson 2003) seem to the group members and the more committed group members will be to achieving them. 'Members of groups that are evaluated as a unit become more highly motivated than do groups in which individuals are evaluated as individuals' (Johnson & Johnson 2003:153; Berkowitz 1957; Berkowitz & Levy 1956). Being motivated to 'achieve for the sake of the group is a well-known phenomenon' (Johnson & Johnson 2003:149; Hertiz-Lazarowitz, Kirdus & Miller 1992). 'Overall, these results indicate that individuals tend to be more committed to goals when they work co-operatively than when they work competitively or individualistically' (Johnson & Johnson 2003:168).

☐ Creativity in achieving goals

When self-directed learners challenge themselves, creative thinking is often required to determine how best to complete an assignment or solve a problem. Cooperation, especially when it includes constructive controversy promotes creative insight by influencing individuals to view an issue from different

perspectives and reformulate it in ways that allow the emergence of new orientations to achieving the goals. There is evidence that cooperation increased the number of ideas, quality of ideas, feelings of stimulation and enjoyment, and originality of expression in creative problem-solving (Johnson & Johnson, 1989). Being confronted with credible alternative views tends to increase the number of novel solutions (Nemeth & Wachtler 1983), the use of more varied strategies (Nemeth & Kwan 1985) and the generation of more original ideas (Nemeth & Kwan 1987). According to Johnson and Johnson (2015):

> These studies further demonstrated that controversy encouraged group members to dig into a problem, raise issues, and settle them in ways that showed the benefits of a wide range of ideas being used, as well as resulting in a high degree of emotional involvement in and commitment to solving problems [*the group was working on*]. (p. 101)

☐ Learner control

Self-directed learning assumes that a person can control his or her efforts to learn. Cooperative learning tends to give students more control over their learning than competitive or individualistic learning. Hooper and his associates (Hooper 1992; Hooper, Temiyakarn & Williams 1993) note that three forms of lesson control may be used in the design of instruction, namely, learner, linear and adaptive control. *Learner control* involves giving learners power to determine how much they want to learn, what help they need, what difficulty level or content density of material they wish to study and in what sequence they wish to learn material. '*Linear control* prescribes an identical instructional sequence for all students regardless of interest, ability, or need' (Johnson & Johnson 1996:n.p.). This is the traditional and most widespread type of lesson control, often seen in lecturing each class session with a midterm and final exam. According to Snow (1980), Tobias (1987), and Tennyson, Christensen, and Park (1984), *adaptive control* modifies lesson features according to student aptitude, prior performance, or ongoing lesson needs. Linear control lower learners' motivation by imposing an inappropriate lesson sequence

on learners, and adaptive instruction may promote learner dependence (Hannafin & Rieber 1989). Instructional effectiveness and efficiency increases as learner control increases (Reigeluth & Stein 1983) as also do learner independence, efficiency, mental effort, and motivation (Federico 1980; Johnson & Johnson 1996; Salomon 1983, 1985; Steinberg 1984).

Cooperative learning tends to increase the effectiveness of learner control. When students work alone, in isolation from their peers, their productive control over the learning situation tends to decrease (Johnson & Johnson 1996). They may, for example, make 'ineffective instructional decisions' and leave instructional tasks prematurely (Carrier 1984; Hannafin 1984; Johnson & Johnson 1996; Milheim & Martin 1991; Steinberg 1977, 1984). Carrier and Sales (1987) demonstrated that students working cooperatively, compared to working alone tended to motivate each other to seek elaborative feedback to their responses to practice items during learning control, and to seek more frequently a greater variety of feedback types. Cooperative pairs spent longer times inspecting information on the computer screen as they discussed which level of feedback they needed and what the answers were to practice items. Students in the learner-controlled or CL condition compared to students in the learner-controlled/individual learning condition selected more options during the lesson, and spent more time interacting with the tutorial (Johnson & Johnson 1996).

Taken together, these studies imply that CL improves the effectiveness of learner-controlled lessons.

☐ Imposed goals transformed to personal goals

Membership in a group powerfully influences what goals are adopted and how committed members are to achieve them (Johnson & Johnson 2003):

> Solomon Asch (1952) [*examined*] how new needs or goals came into existence and became part of the person. He posited that new goals became internalized through social processes such as membership

of a group. He believed that subordinating one's own interests to the interests of the group or community was as intrinsic to humans and as powerful as acting on self-interests. He stated that selfishness (i.e., the total focus on self-benefit while ignoring the well-being of others) has a low survival value [*as*] in a society each individual is dependent on others for the most basic [*needs,*] such as food, water, shelter, clothes, transportation, and communication (not to mention love and caring). [*In order*] to meet his or her own needs each individual must cooperate with others and form a community. To promote one's own well-being*,* the individual needs to be a member of the group, to be valued by other group members, to engage in joint enterprises with others, to count in their lives, and to be an object of significance for others. A person's happiness and well-being thus become intertwined with the happiness and well-being of others, and one's self-interests thereby include the interests of others (such as spouse and children) and the community as a whole. Thus, the striving for cooperation and community are among the most powerful motives in humans and result in the emergence of new social needs and goals that include the well-being of others and the common good. (p. 141)

☐ Simultaneous accomplishment of multiple goals

Cooperative efforts result in the simultaneous increases in achievement, more positive interpersonal relationships, higher self-esteem, greater psychological health and greater social support (Johnson & Johnson 1974, 1989, 2009a, 2010a). Thus, in addition to higher achievement, every cooperative lesson is also a lesson in how to improve the relationships among students (reducing alienation and loneliness) and social skills. The use of CL makes the class a therapeutic milieu, where social support is present for both the person and for academic achievement. Students tend to adopt democratic, equalitarian and pluralistic values. When students are working cooperatively with classmates, a wide range of goals are being accomplished simultaneously.

Competitive efforts, on the other hand, focuses attention on achieving one goal (i.e. winning) and may involve social costs such as making friends and social support. Being motivated for differential benefit tends to result in negative interpersonal relationships.

'The desire to be accepted by and friends with one's peers tends to be directly opposed to consistent winning or losing' (Johnson & Johnson 2003:n.p.). In addition, competition tends to generate a contingent self-esteem where winning results in feeling worthwhile and losing results in feeling worthless. The need to maintain contingent self-esteem may increase motivation for those individuals who perceive they have a chance to win. Those who believe they cannot win may experience low self-esteem, which in turn may lead to depression and other psychological problems including a lack of motivation to set and achieve goals.

Individualistic efforts involve working alone to accomplish an academic goal. Doing so eliminates the accomplishment of other goals. In individualistic situations, for example, academic and social goals 'tend to be contradictory and operate against each other' (Johnson & Johnson 2003:n.p.).

☐ Benefits from helping others achieve their goals

Finally, it should be noted that in helping group members achieve their goals, a student benefits in multiple ways (Johnson & Johnson 1974, 1989, 2009a, 2010a). When students promote the success of cooperators, it increases their competencies, increases their own understanding of the material they are explaining, builds self-esteem and a view of oneself as a concerned and helpful person, increases the probability that the help will be reciprocated when they are struggling to achieve a goal, increases the mutual commitment to the relationship and offers many other benefits.

■ The cooperative nature of self-directed learning

There are three ways in which goals may be structured. Individualistically, where individuals work by themselves to achieve personal goals unrelated to the goals of others; competitively,

where individuals work in opposition to each other to achieve a goal that all wish to achieve but only one or a few can accomplish; and cooperatively, where individuals work together to achieve mutual goals. It is cooperation that is most compatible with SDL.

A person engaging in SDL firstly has to choose a goal to accomplish. In defining one's goals, the origins of the goals tend to be the social community in which one lives. Many of the goals are first imposed and recommended by one's family, friends, community and society, and are then internalized and adopted as one's own. Others are internalized through identification with and imitation of admired people, adopting social roles (such as student, friend, citizen) and adopting the norms and values of the groups one belongs to.

In order for SDL to take place, the goal chosen to be accomplished must be meaningful. Meaning is derived from knowing that accomplishing the goal will contribute to (a) one's own well-being, (b) the well-being of others (family, friends, community, and society) and (c) the common good. It helps, furthermore, if the paths to accomplish the goal are as interesting and desirable as the goal itself. When fellow cooperators promote one's efforts to accomplish one's goals, they should support and approve the actions one is taking. In defining the paths to be taken to achieve goals, in other words, the values, norms, regulations and laws of one's family, friends, community and society are taken as a framework in which to develop the paths. Finally, the level of aspiration should reflect not only what 'I' am capable of, but also what 'we' (members of one's cooperative group) are capable of. Joint efficacy opens far more opportunities for SDL than does self-efficacy (Johnson & Johnson 1989, 2002).

In SDL, most students pursue multiple goals simultaneously. These goals may be academic (such as learning math), social (such as making friends) and developmental (such as adopting more sophisticated strategies of critical thinking). Within CL situations, multiple goals may be pursued simultaneously with each goal enhancing the achievement of the other goals.

■ Conclusion

Finally, it should be noted that in order to maximize the achievement of learning, social and developmental goals, SDL efforts in a cooperative group will be more effective than will SDL efforts in a competitive or individualistic situation. The combined use of SDL and CL, compared with competitive and individualistic learning, will tend to produce (to name just a few) greater intrinsic motivation, competence motivation, developmental motivation, continuing motivation, commitment to and persistence in achieving goals, creativity in achieving goals, more effective learner control, more effective transformation of imposed goals to personal goals, the simultaneous accomplishment of multiple goals and, in addition, attain all the benefits from helping others learn.

■ Acknowledgements

Moving to deeper self-directed learning as an essential competency for the 21st century

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■ Abstract

Research indicates that SDL should be fostered in education to prepare students for a changing world. Industry claims that graduates lack competencies, such as critical thinking, collaboration and creativity, when entering the 21st-century workforce. Transfer of

Knowledge has been mentioned as a growing requirement for the 21st century, and the concept of deeper learning is gaining momentum. A literature review was performed to obtain an understanding of SDL, as well as deeper learning. The review indicated that SDL remains an important factor in preparing learners for the 21st century, but that competency to transfer knowledge from a known situation to a new situation continues to be lacking. The focus has been on putting the *self* in learning, and less focus has been placed on *learning*. It is therefore suggested that *deeper self-directed learning* (DSDL) must be developed among students in order to foster knowledge transfer. The aim of the chapter is to define DSDL as an essential competency for the 21st century. Cognitive load theory and social constructivist theory were identified as suitable foundations to build the theory of DSDL. Accordingly, instruction can be informed to develop DSDL among students so that they can take responsibility for their learning in such a way that transfer of knowledge can occur.

■ Introduction and problem statement

Competencies, such as critical thinking, creativity, problem-solving, communication and collaboration, determine readiness for working in 21st-century environments (National Research Council [NRC] 2012). The International Engineering Alliance (2013:4) specifically refers to in-depth knowledge, comprehension and wide application of knowledge, lifelong learning, communication and teamwork as required competencies of graduates. Research, however, expresses the concern that higher education lacks development of 21st-century competencies in students (Nelson Laird et al. 2014; Taylor 2016). Owing to the rate at which new information is appearing (Guglielmino 2013), and the complexity and the dynamics of required competencies (Figueiredo et al. 2017), employees cannot merely rely on their existing knowledge. They need competencies to evaluate their current knowledge, obtain new knowledge and transfer knowledge to new contexts.

In recent years, a growing movement to foster SDL globally has gained momentum. Self-directed learners take responsibility for their own learning and are lifelong learners (Knowles 1975), as SDL is described as 'both the beginning and the end of lifelong learning' (Candy 1991:425). The focus of SDL research has mostly been on putting the self in learning, by determining and developing characteristics and competencies to enhance SDL, and by determining learners' SDL readiness (Ayyildiz & Tarhan 2015; Guglielmino 1977; Williamson 2007). Less emphasis has been placed on the *learning* in SDL, especially on knowledge transfer.

The NRC of the United States launched a study to gain insights into required 21st-century competencies (NRC 2012). Deeper learning (DL) was defined as a direct result of this study. The conclusion was made that DL is the process of developing transferable knowledge and competencies (NRC 2012). Twenty-first-century learners should have appropriate competencies and should be capable of transferring knowledge to the world beyond the classroom (Kuh 2016).

In literature, suggestions are made from different paradigms for learning in the 21st century. As indicated above, SDL and DL are both seen as being essential. It is, however, necessary to combine suggestions from different paradigms and to incorporate them in practice. In this chapter, it will therefore be argued that in order for learners to become lifelong learners in the 21st century, they need to be self-directed learners (Knowles 1975), and they need to connect what they are learning to life outside the classroom (Kuh 2016), to transfer knowledge to new contexts and to face new challenges. We thus need students who can take responsibility for their own learning (SDL) in such a way that they can transfer knowledge (DL). Transfer to new contexts is, however, 'difficult to achieve' (Goldstone & Day 2012:149), and compared to the vast body of research on SDL, little mention has been made of transfer of knowledge within SDL.

In this chapter, we aim to define DSDL as an essential competency for the 21st century and to propose a theoretical

foundation for DSDL. In the remainder of this chapter, the method of investigation will be discussed, followed by a discussion of SDL and DL and a proposal for a theoretical framework. Lastly, DSDL as an essential competency for the 21st century will be explained.

■ Method of investigation

A literature review was conducted on DL, transfer, SDL and relevant learning theories. The review initially focused on DL, based on the research of the NRC (2012), on 21st-century skills or competencies, on approaches to learning, on learning transfer and on transfer of knowledge. Relevant learning theories were then reviewed. Self-directed learning was also identified as a crucial aspect of learning for the 21st century, and it was thus included in the review.

A comparison of skills required for DL and SDL was done in order to determine commonalities between DL and SDL. Although some authors distinguish between the words 'skills' and 'competencies' (Ananiadou & Claro 2009), the two terms are used interchangeably. In this chapter, the term 'competency' will mainly be used.

The processes of DL and SDL were then further reviewed, in order to define the process of DSDL and to postulate a suitable foundational theory for DSDL.

In the following section, SDL and DL will be defined. A conceptual and theoretical framework will then be provided and, lastly, DSDL will be defined.

■ Defining self-directed learning

The concept of SDL emerged from studies on adult learning (Merriam, Cafarella & Baumgartner 2007). Tough's (1971) and Knowles' (1975) investigations of adult education, and their definitions of SDL, prompted a growing body of research on SDL, and they had a ripple effect on numerous educational landscapes

(Conner et al. 2009). Self-directed learning is regarded as one of the most researched educational areas (Guglielmino 2013), and research in this area has expanded to include all ages of learners and all levels of education (Merriam et al. 2007). In what is regarded as the most-cited publication on SDL, surpassed only by that of Tough (1971) (Conner et al. 2009), Knowles (1975) defined SDL by saying:

> In its broadest meaning, 'self-directed learning' describes a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating their learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes. (p. 18)

According to the above definition by Knowles (1975), learners, or students, in practice should take responsibility for their own learning. They should be able to identify what their learning goals are and what knowledge they lack to achieve their goals. Furthermore, they should be able to identify and use appropriate resources to assist them in acquiring the necessary knowledge, whether these resources be teachers, peers, books or online resources. During the learning process, they should reflect on their learning, they should be able to assess whether they have achieved their learning goals and they should persist with learning and overcome obstacles until their goals have been reached. During this whole process, the educator is in the background, helping to create a need for learning, facilitating and encouraging the learner.

Since Knowles' (1975) definition, numerous researchers have built on his definition to further understand and conceptualise SDL (Long 2000). According to Long (2000), self-direction is the conscious controlling of a process by an individual. He views learning as a combination of psychological and neurological processes, resulting in changes on both psychological and physical levels (Long 2000). According to Long (2000), SDL is driven by primary and secondary internal processes, and effective SDL will not be possible without these processes. In addition to intrinsic motivation (Knowles 1975), Long (2000) adds metacognition and

self-regulation as the primary dimensions that drive SDL (Gavriel 2015). These dimensions will now be elaborated on.

Motivation is widely mentioned as an important intrapersonal competency to develop when fostering SDL (Du Toit-Brits & Van Zyl 2017; Gavriel 2015:15; Payne, Rocks & Schaffner 2014). Motivation is furthermore 'highly valued' (Ryan & Deci 2000b:69) in all aspects of life, because it is seen as the internal dimension that 'produces' (Ryan & Deci 2000b:69), or the dimension that 'moves people to act, think and develop' (Deci & Ryan 2008:14). Long (2000:16) defines motivation as the 'energy, drive, or desire that encourages, impels, or sustains an individual to accomplish a goal or task'. Motivation is also considered to be at the core of cognitive and social development and regulation (Ryan & Deci 2000b). According to Deci and Ryan (2008:14), motivation is a contributing factor, especially when learning complex tasks, when something has to be discovered or where 'deep information processing or creativity' (Deci & Ryan 2008:14) is involved.

In general, there are two categories of motivation, namely, intrinsic motivation and extrinsic motivation (Long 2000; Ryan & Deci 2000a) – these are generally seen as opposing concepts (Deci & Ryan 2008:15). An individual can also be described as being a-motivated, meaning that he or she has neither intrinsic nor extrinsic motivation (Deci & Ryan 2008:15). An operational definition of being intrinsically motivated would be 'doing something because it is inherently interesting or enjoyable' (Ryan & Deci 2000a:55). In contrast, being extrinsically motivated can be defined as doing something 'because it leads to some separate consequence' (Deci & Ryan 2008:15).

According to Ryan and Deci (2000b:70), intrinsic motivation can be considered as the single phenomenon that reflects the 'positive potential of human nature'. As individuals are also seen to have a natural disposition towards mastery and curiosity, intrinsic motivation will influence learning, exploring, discovering and the seeking of new challenges, and it will move individuals beyond their capacities (Ryan & Deci 2000b). Intrinsic motivation

is furthermore often associated with curiosity and a desire for challenge (Long 2000; Ryan & Deci 2000a), both of which are characteristics of highly self-directed learners (Edmondson, Boyer & Artis 2012; Guglielmino 1977).

Researchers often pose the question as to whether intrinsic motivation can be stimulated by applying extrinsic motivational strategies (Deci & Ryan 2008). A meta-analysis of this question has mostly confirmed that by using extrinsic motivational strategies, intrinsic motivation will most probably be undermined, and learners will lose interest (Deci, Koestner & Ryan 1999). Deci and Ryan (2008:15) accordingly argue that intrinsic motivation leads to a sense of autonomy, but that external motivation, such as rewards, threats, deadlines and even evaluation, diminishes the feeling of autonomy, as individuals tend to feel pressurised and controlled.

Metacognition can simply be defined as 'thinking about thinking' (Long 2000:18), thus monitoring one's own thinking and being conscious of what one is thinking (Long 2000). According to Zimmerman (2013:137), the use of strategies to organise or transform information can be described as metacognitive activities. Long (2000:18) defines the term 'executive control' as when learners monitor and are alert to their state of thinking. Research has indicated a correlation between SDL and metacognition (Long 2000; Mariano & Batchelor 2018; Shannon 2008; Van der Walt 2014). According to Long (2000:18), SDL can be enhanced when a learner engages executive control and metacognitive processes. Metacognition has even been called 'the engine that drives self-directed learning' (Shannon 2008:18). Highly self-directed learners will thus be aware of the cognitive processes they apply in learning, and they will be able to reflect on personal failures and successes (Long 2000). Therefore, when engaging in problem-solving, metacognition will be displayed by learners who evaluate and adjust strategies during problem-solving (Long 2000). It has, however, been suggested that educators should aim to enhance learners' metacognitive awareness, by applying appropriate

strategies to explicitly develop learners' metacognitive skills (Breed 2013:14), and that this will consequently enhance their SDL (Shannon 2008:26).

Long (2000:19) states that *self-regulation* is a critical element of SDL and is a natural outflowing of metacognition; Self-regulated Learning (SRL) is therefore often mentioned when discussing SDL (Van Deur 2018). Because both the words 'self' and 'learning' are included in the concepts of SDL and SRL, these two concepts are intertwined and are 'often used interchangeably' (Bolhuis 2003:335).

Zimmerman (2013:137) defines SRL as 'the degree to which students are metacognitively, motivationally, and behaviourally active participants in their own learning processes'. According to Shi and Witte (2018:113), self-regulating learners take control of personal, behavioural and environmental matters to achieve their academic goals. When comparing SRL with Knowles' (1975) definition of SDL, overlapping sub-processes are identified, namely, goal setting, task analysis, selecting strategies and self-evaluation (Long 2000:20; Loyens, Magda & Rikers 2008). Furthermore, both SRL and SDL focus on student control, both activate metacognitive skills and both view intrinsic motivation as important (Loyens et al. 2008). Self-directed learning is, however, viewed as a broader concept than SRL (Loyens et al. 2008), as SDL is also premised on giving students the opportunity to select 'what will be learnt' (Loyens et al. 2008:418), to define and initiate the learning task and to evaluate the selected learning materials critically.

Long (2000) also describes four secondary dimensions of SDL, namely, choice, competence, control and confidence. These dimensions are closely connected, and when students are allowed to make *choices* in learning, their awareness of *control* will consequently also be affected (Long 2000). Similarly, when their need for *competence* is met, their motivation will be enhanced (Deci & Ryan 2008). It is thus unlikely that a learner will be self-directed in an area where they feel incompetent (Long 2000). Furthermore, when students have *confidence* in their ability to

do something, they can, in turn, initiate effort (Long 2000). Self-directed learners will consequently experience more feelings of competence and confidence, which should help them to initiate more effort (Long 2000). Conversely, for learners to apply their skills and abilities and to become more self-directed, they should have confidence and believe in their abilities.

Apart from the primary and secondary dimensions described above, SDL can also be studied in terms of other characteristics or competencies (Merriam et al. 2007). These are consequently used to determine learners' self-directed readiness (Guglielmino 2013). Having good SDL competencies is regarded as essential for students to develop their full learning potential (Williamson 2007) and be lifelong learners who take responsibility for their learning (Guglielmino et al. 2009). Candy (1991) associated high SDL with deep approaches to learning. However, discussions on SDL have not focused much on deep approaches to learning and competencies to transfer knowledge. In the following section, DL will be defined, after which competencies required for SDL and DL will be compared, to align SDL and DL.

■ Defining deeper learning

According to Biggs and Tang (2007), learning research originated with Marton and Säljo's study of deep and surface approaches to learning in 1976. Recently a need for 21st-century learning (Voogt et al. 2013) and DL has emerged from the literature (Alliance for Excellent Education 2018; Bellanca 2015; NRC 2012). Deeper learning is described as an essential process for developing 21st-century knowledge and competencies, where the aim is to transfer what has been learnt to new situations (NRC 2012). The application of transferable knowledge as a product of DL again supports the process of DL 'in a recursive, mutually reinforcing cycle' (NRC 2012:99). Deeper learning can thus be explained as an infinite process, where the specific aim is to develop 21st-century competencies and to obtain transfer of knowledge and competencies.

Research generally refers to deep or surface approaches to learning (Candy 1991; Varunki, Katajavuori & Postareff 2017). To foster DL, students should follow a deep approach to learning, where they try to understand the principles of what they are learning (Candy 1991) and to be academically committed to and interested in their studies (Biggs & Tang 2007). They should be able to seek and grasp key concepts, understand their work in a broader context, concentrate on analysing and relating ideas (Parpala et al. 2013), integrate new information with prior knowledge, apply knowledge to real-world situations and transfer ideas (Varunki et al. 2017) to new situations. Thus, a challenge of teaching for DL is to encourage students to adopt deep approaches (Nelson Laird et al. 2014).

This section focused on the '*how*' of learning, but DL also has implications for *what* must be learnt (Voogt et al. 2013) – the types of knowledge and competencies required for DL. According to Mishra and Kereluik (2011), three key areas of knowledge should be addressed in the 21st century:

1. foundational knowledge – core content knowledge, information literacy and cross-disciplinary knowledge
2. meta knowledge – acting on foundational knowledge, problem-solving, critical thinking, communication, collaboration, creativity and innovation
3. humanistic knowledge – what we value, knowledge of life, cultural competence and ethical and emotional awareness.

Collaboration, communication, digital literacy, citizenship, problem-solving, critical thinking, creativity and productivity are seen as the more essential 21st-century competencies (Voogt et al. 2013). Although these competencies are not exclusive to the 21st century (Tulgan 2015), they are becoming increasingly important (Voogt et al. 2013). The Alliance for Excellent Education (2018) describes DL as a set of six interrelated competencies:

1. deep content knowledge
2. critical thinking and complex problem-solving
3. collaborative work

4. effective communication
5. SDL
6. developing an academic mindset (believing in one's ability to grow).

These should, however, only be mentioned as a starter list of competencies for DL (Bellanca 2015), as naming only six competencies would be too simplistic, not taking into account the complexity of learning. It would be more appropriate to provide a classification of three domains of competencies – cognitive, intrapersonal and interpersonal (NRC 2012). This classification is consistent with the suggestion of Smith, Douglas and Cox (2009) that education should be renewed by focusing on an apprenticeship of the head (cognitive development), an apprenticeship of the hand (communication and teamwork) and an apprenticeship of the heart (attitudes and values).

When reviewing competencies required for DL and characteristics required for SDL, it was evident that DL and SDL correspond in all three of the cognitive, intrapersonal and interpersonal domains. Listing all competencies in all domains would be an onerous task, and for the purpose of this chapter, only key competencies in each domain will be discussed.

■ Domains of competencies for deeper learning and self-directed learning

The NRC (2012) describes the cognitive domain as consisting of cognitive processes and strategies, such as critical thinking, problem-solving, analysis, reasoning, knowledge (including procedural knowledge), creativity and innovation. Zimmerman (2013) also includes activities such as planning and goal setting. Critical thinking is widely seen as an essential cognitive skill (Nelson Laird et al. 2014) for success in the 21st century (Bailey & Mentz 2015). Learners should be able to evaluate and criticise information and make informed judgements (Bailey & Mentz 2015).

Critical thinking also includes the ability to interpret, analyse and make conclusions on the basis of evidence and reasoning (Facione 1990). Other competencies that are classified under the cognitive domain are active listening, information and technological literacy, productivity, creativity and innovation (NRC 2012; Voogt et al. 2013), which feature strongly in DL and also link with the characteristics of a self-directed learner (Guglielmino 2013). Both SDL and DL are positively related to creativity, critical thinking and problem-solving (Edmondson et al. 2012; Guglielmino 1977).

Competencies in the intrapersonal domain are those that provide psychological and moral grounding for a person's actions (Denhardt 2001). Such competencies will build self-esteem and will consequently provide students with the confidence to apply what has been learnt (Denhardt 2001). They are therefore not only closely linked to the ability to transfer knowledge (which relates to DL) but also to the ability to take responsibility for own learning (which relates to SDL). Intrapersonal competencies further include complex attitudes and a desire to learn (Guglielmino 2014). According to Guglielmino (1977), highly self-directed learners are self-confident and display initiative and independence. They enjoy learning, are able to apply basic study competencies, are goal-oriented, have the ability to plan and pace their studies and consequently to complete tasks in due time (Guglielmino 2013). Although being goal-oriented and having the ability to plan are not explicitly mentioned as competencies required for DL, directing one's own learning and being self-directed are also mentioned as DL competencies (Alliance for Excellent Education 2018). Therefore, the ability to plan and being goal-oriented are also seen as DL competencies.

Although Nelson Laird et al. (2014) identified the need for cognition and positive attitudes towards literacy as cognitive dimensions in DL, these attributes are rather categorised within the intrapersonal domain in this chapter. The need for cognition is associated with enjoyment of learning and can be described as 'the tendency to engage in and enjoy effortful cognitive activity'

(Nelson Laird et al. 2014:407). Positive attitudes towards literacy refer to 'reading widely and enjoying the learning process' (Nelson Laird et al. 2014:407). Self-directed learners are also described as having positive attitudes towards learning (Guglielmino 2014), and such characteristics would therefore also fall within the intrapersonal domain. Self-directed learners are furthermore intrinsically motivated, will continuously monitor their learning progress, will identify their shortfalls, will make conscious efforts towards self-improvement and are responsible, self-disciplined individuals (Williamson 2007). A positive relationship between SDL and life satisfaction and curiosity has also been indicated (Edmondson et al. 2012; Guglielmino 1977). Intrapersonal characteristics are further considered to be a driving force for innovation, and will consequently encourage learners to persist in finding solutions to problems (Guglielmino et al. 2009).

In the interpersonal domain, competencies such as communication, collaboration and responsible behaviour take on new dimensions in the 21st century (Voogt et al. 2013). Increasing economic, technological and environmental global interdependence requires increased cooperation between individuals and systems (Johnson & Johnson 2014). Required interpersonal competencies include teamwork, leadership, decision-making, trust-building and conflict management skills (Johnson & Johnson 2014; NRC 2012). Knowles (1975) indicates several characteristics that emphasise collaboration. He states that self-directed learners seek collaboration and assistance from other people, including peers (Knowles 1975:71). They should be able to explain to others, see peers as resources, give help to others and be able to receive help (Knowles 1975). Guglielmino et al. (2009:24) argue that self-directed learners should not be labelled as 'non-social' learners interested in promoting 'individualistic or materialistic' interests, but rather as learners willing to share knowledge with others and apply it in order to improve society.

Deeper learning accordingly also has a strong focus on interpersonal competencies in both the cluster of teamwork and

collaboration and the cluster of leadership skills (NRC 2012). Deeper learners must be able to show empathy, trust, negotiate, solve conflict and be service-oriented. They further have to show social responsibility and communicate assertively (NRC 2012).

From the above discussion, the conclusion is made that DL and SDL require overlapping competencies. There is, however, one competency that is mainly emphasised in DL, namely, the ability to transfer knowledge (NRC 2012). Self-directed learning and DL can thus be distinguished within the outcomes of the two processes. The outcome of DL as a process is to transfer knowledge to new contexts (Bellanca 2015), whereas the SDL process assumes that the learner 'grows in capacity to be self-directing' (Knowles 1975:20). To be self-directed, learners should take responsibility for their own learning and should constantly evaluate their actions in order to identify new learning goals (Knowles 1975).

In the following section, knowledge transfer as a product of DL, and factors affecting transfer, will be discussed.

■ Knowledge transfer as a product of deeper learning

Learning that does not result in transfer is described as 'unproductive and inefficient' (Goldstone & Day 2012:149). To develop a capacity for transfer is considered one of the most important aims of learning (Collard, Brédart & Bourguignon 2016; Pai, Sears & Maeda 2015). Educational programmes often assume that knowledge acquired will transfer to situations outside the classroom (Adams 1987:44), but they do not always specifically account for transfer. Application of what has been learnt is often 'left to chance' (Merriam & Leahy 2005:2). According to Norman (2009:808), students typically display a success rate of less than 30% in applying a learnt concept to a new problem. It can thus be stated that even after more than 100 years of research, transfer still remains an issue of concern (Dixon & Brown 2012) and 'a complex and dynamic process' (Blume et al. 2010:1067).

Various definitions and perspectives on transfer are found in the literature. Transfer can classically be defined as the capacity to use knowledge acquired in one context, also referred to as prior knowledge (rules, examples, strategies and constraints), to solve a dissimilar or novel problem in another context (Collard et al. 2016; Nokes-Malach & Mestre 2013; Norman 2009). Transfer is also described as an effective and continuous application of knowledge and skills gained in learning activities (Merriam & Leahy 2005). Adams (1987) describes transfer as the learning of a response in one situation that influences the response in another situation. Nokes-Malach and Mestre (2013) give a more elaborate definition of transfer as:

> A dynamic process in which the learner engages in the highly selective activation and application of knowledge to create a representation that allows him or her to make sense of the situation in order to accomplish a goal or perform some task. (p. 185)

Although many definitions of transfer can be found, the central theme emerging from the above is that transfer is a continuous process, where learning in one situation influences a student's response or problem-solving in another situation.

Apart from the mainstream cognitive definitions of transfer, researchers view transfer from different perspectives. Lobato (2012:233) defines transfer as 'the generalization of learning', which indicates that learners' prior activities have an influence on their activities in novel situations. Lobato (2012) proposes an alternative perspective on transfer, also referred to as the actor's point of view, where the student is seen as the actor and the researcher is seen as the observer. When determining transfer, the researcher does not measure transfer against predetermined cognitive outcomes or behaviours (Nokes-Malach & Mestre 2013). The researcher rather tries to determine how prior knowledge and experiences have shaped students' activities when they attempt transfer. Therefore, while from a classical transfer perspective the result of transfer would be seen as incorrect (negative transfer), this alternative perspective aims to capture the nature of a student's reasoning on transfer tasks and the

social processes that contributed to the connections that the student has built (Lobato 2012).

Herrington, Herrington and Glazer (2006) view transfer by referring to situations that are conducive to transfer. According to them, transfer implies that favourable situations for transfer must exist, where students have a choice to apply the knowledge they have learnt. They further state that when knowledge has not been transferred, the possibility exists that the environment was 'inadequate for transfer' (Herrington et al. 2006:191), hence inhibiting transfer.

According to Lobato (2012:233), research agrees that transfer occurs if the representations that students build of 'initial learning and transfer situations are identical, overlap, or can be related'. Perkins and Salomon (2012:252) accordingly state that three mental bridges must be built when transferring knowledge. These bridges are those of *detecting*, *electing* and *connecting*. Students must detect a link between a new situation and existing prior knowledge, they must elect to pursue the link and they must then make a connection. Accordingly, Herrington et al. (2006) indicate that students choose to apply their knowledge (connect), electing to pursue the link. Building the bridges of detecting, electing and connecting can occur successively or concurrently, and not necessarily in any specific order. Although the student would have elected to pursue a link that has been detected, the 'connect' bridge is regarded as the most difficult bridge to cross, and it is the final stage of transfer (Perkins & Salomon 2012).

Two broad categories of transfer can be identified. Near transfer occurs when knowledge and competencies are applied in contexts similar to the contexts in which the learning occurs (Johnson et al. 2011). Far transfer occurs when knowledge and competencies are applied to new problems in different contexts (Johnson et al. 2011). According to Merriam and Leahy (2005), the greatest interest of learning transfer is the far transfer of deep structures.

Near transfer and far transfer can be described as surface transfer and deep transfer, respectively. Deep structure transfer

and surface structure transfer are described especially in terms of problem-solving (Chi & Van Lehn 2012; Merriam & Leahy 2005). Structure refers to the similarities of a situation, which can lie on the surface or on the deep level of a scenario. Surface structure refers to the concepts, objects or context described in a transfer problem (Chi & Van Lehn 2012:178). Therefore, when similarities lie on the surface, the transfer situations are quite similar and have the same relational structure (Chi & Van Lehn 2012; Nokes 2009:3).

Schwartz, Chase and Bransford (2012) also define negative transfer and overzealous transfer. Negative transfer can be defined as transfer that has been made to an inappropriate situation, which interferes with learning and consequently hinders new learning and problem-solving (Schwartz et al. 2012:205). Overzealous transfer occurs when students have applied transfer that works well enough with respect to the task at hand, but is, in effect, suboptimal transfer, impeding new learning. Students, for example, apply complex solutions to problems, and they do not notice more efficient, simple solutions. The role of the teacher should, therefore, be mentioned when negative transfer or overzealous transfer has occurred, and facilitation should be provided so that learning is not impeded because of the type of transfer used.

Of equal importance is the ability to identify and compare similarities and differences between transfer situations correctly. Chi and Van Lehn (2012) describe the following possible transfer outcomes through the identification and comparison of surface and deep structures. Although the surface structure may seem to be the same, differences on a deep level can exist, which negates the possibility of transfer. Novices, however, are often misled by surface similarities, and they may incorrectly want to apply transfer, not recognising differences on a deep level. Similarly, although surface features may seem to differ, similarities on a deep level can exist, which means that these situations are transferable.

Similarities that lie on a deep structure refer to the rules or procedures for solving the problem (Chi & Van Lehn 2012;

Nokes 2009). The original learning situation and the transfer situation will not seem identical, making transfer difficult for novices (Perkins & Salomon 2012). Deep knowledge is thus required, which means that a deep understanding should have been developed in the original context of learning (Perkins & Salomon 2012), to transfer application of solutions between problem situations.

According to Blume et al. (2010), there is still an urgent need to find factors and strategies that can enhance transfer. In recent years, research on transfer has indicated various factors that increase the likelihood of transfer. These are discussed below.

◼ Factors influencing transfer

Research has shown that when abstract knowledge or schemas can be constructed, the likelihood of transfer increases (Nokes-Malach & Mestre 2013). Such schemas will allow students to identify similar deep structures between situations, enabling them to apply transfer in problem-solving situations (Chi & Van Lehn 2012), as explained above. A deep understanding of learning content is, therefore, emphasised as the basis of transfer (Chi & Van Lehn 2012; Perkins & Salomon 2012). Students often understand that they need to make connections, but even though they are motivated to make connections, they fail to develop connections when they cannot perceive deep-feature similarities (Chi & Van Lehn 2012).

According to Schwartz et al. (2011:770), the model of instruction used is a large contributor to transfer. They sampled articles on transfer in the fields of mathematics learning and science learning published between 2003 and 2008, and they found that 75% of the studies used a telling and practice teaching strategy for both treatment and control variables in transfer studies while they manipulated other variables (Schwartz et al. 2011). A telling and practice strategy means that students are first told about certain concepts and they then have to practise or apply them. Schwartz et al. (2011) argue that with a telling and

practice strategy, a deep structure of concepts will in most cases not be learnt. Their research indicates that when students first explore novel deep structures and are only told afterwards what experts or teachers know, transfer is improved (Schwartz et al. 2011).

Blume et al. (2010:1065) conducted a meta-analysis of 89 studies that explored the impact of factors such as 'trainee characteristics, work environment', and interventions on 'transfer of training' of employees. They found that transfer is influenced by variables 'such as cognitive ability, conscientiousness, motivation', 'learning outcomes' and 'a supportive' transfer climate (Blume et al. 2010:1065, 1070). However, when comparing studies within the same context and looking through a more precise quantitative lens, they concluded that there are only 'a limited number of strong predictor relationships with transfer' (Blume et al. 2010:1089). They found that cognitive ability had the single largest relationship with transfer, and personal characteristics, such as conscientiousness, pre-training self-efficacy and motivation to learn, had moderate relationships with transfer (Blume et al. 2010). Additional factors to be considered are the types of skills that need to be trained and the timing of the transfer measurements, as both of these will also have an influence on transfer (Blume et al. 2010). According to Blume et al. (2010:1096), there are no simple answers to transfer, as there is a lack of consistency to support specific transfer interventions. They thus recommend combining various strategies for transfer, as well as making transfer interventions longer and more impactful (Blume et al. 2010).

Belenky and Nokes-Malach (2012) describe two broad categories of goals that can motivate transfer, namely, mastery-approach goals and performance goals. Mastery-approach goals focus on developing understanding, competence and attaining of a skill, while performance goals focus on demonstrating a skill, and thus on performing better than others (Belenky & Nokes-Malach 2012; Nokes-Malach & Mestre 2013). Research by Belenky and Nokes-Malach (2013) suggests that mastery-approach goals

rather than performance goals will facilitate transfer. Research also indicates that a deep understanding of knowledge and skills, which is seen as an outcome of the mastery approach, will influence transfer (Johnson et al. 2011; Perkins & Salomon 2012).

Grossman and Salas (2011) used the research of Blume et al. (2010) as a basis and aimed to identify the individual characteristics, training design and environments that exhibited the most consistent and the strongest relationships with transfer. They identified cognitive ability, self-efficacy and motivation as having strong relationships with transfer. All these concepts relate to being a self-directed learner. Their research further indicated that when training is perceived as useful and valuable, trainees are more likely to transfer, or apply, what has been learnt (Grossman & Salas 2011). Behaviour modelling is also mentioned as an effective strategy to facilitate transfer (Grossman & Salas 2011). Transfer is especially mentioned when trainees design their own scenarios for modelling behaviours (Taylor, Russ-Eft & Chan 2005). This can also be related to SDL, where students are provided with choices in their learning, which will build confidence and competence (Long 2000). Grossman and Salas (2011) furthermore suggest that opportunities to practise skills should be provided, including error management and how to anticipate and handle problem situations in realistic, positive and negative environments. This suggestion can also be related to SDL, where students reflect on their solutions to problems and evaluate learning conditions to determine the resources needed. Regarding realistic environments, a short discussion on including authentic learning environments to foster transfer is provided below.

Transfer is also promoted when engaging in authentic learning environments (Herrington et al. 2006; Lombardi 2007). 'Authentic contexts reflect the way knowledge will be used in real life' (Teather & Moore 2011:5), giving students the opportunity to model real-world practice and gain exposure to examples of how experts perform tasks (Herrington et al. 2006). Although several views of authentic approaches to learning exist, Herrington and Herrington (2006:3) argue that cognitive authenticity rather than

physical authenticity is most important when designing authentic learning environments. They suggest that simulation of real-world situations should promote realistic problem-solving processes than similarity to physical environments (Herrington & Herrington 2006:3). Authentic activities are accordingly described by Herrington et al. (2006:4–6) as ill-defined activities and complex tasks that are relevant to the real world, which should be completed over a sustained period within collaboration settings with other students.

In the above discussion, some factors that influence transfer were discussed. Transfer is characterised by 'significant variability in findings', as stated by Blume et al. (2010:1065), and it can be described as an 'elusive phenomenon' (Nokes-Malach & Mestre 2013:184) that is difficult to obtain (Merriam & Leahy 2005; Norman 2009; Pai et al. 2015:82). The literature, however, provides some guidelines for further research to foster transfer, as described above, which should be implemented in various combinations and in extended studies. It can further be concluded that the importance of teaching for DL, to assist learners in recognising similarities in deep structures and developing SDL, is evident from the above discussion. For example, when including complex authentic tasks that are ill-defined, learners' SDL competencies are being fostered, as they need to determine their learning goals, identify resources and evaluate their learning. Deeper learning is required to determine solutions to such problems, as knowledge gained should be transferred to solve the problem.

Transfer of knowledge and learning cannot be ignored when preparing learners for the 21st century. Blume et al. (2010:1066) state that positive transfer of training to the workplace determines the effectiveness of the training. This statement can be rephrased from a DL perspective and can be applied to teaching and learning when one has to acquire certain competencies. It can thus be stated that transfer of learning will determine the depth of learning, and it can be considered the real measure of achievement in education (Eisner 2001).

In Section 3.4 to Section 3.6 above, an attempt was made to define DL by discussing approaches to learning, types of knowledge and skills required for DL, and knowledge transfer as an outcome of DL. Some definitions of and perspectives on transfer, as well as factors affecting transfer, were discussed. In the following section, a theoretical framework for DL and SDL will be proposed by discussing cognitive load theory (CLT) and social constructivist theory (SCT).

■ Conceptual and theoretical framework for deeper learning and self-directed learning

Self-directed learning is described as a process (with or without the help of others) where cognitive abilities to formulate, identify, choose, implement and evaluate are needed (Knowles 1975:18). Deeper learning is described as a twofold process that occurs within the *individual's mind* and *through social interaction* within a learning community, resulting in transfer of knowledge and skills (NRC 2012:24). These two definitions provide the basis for proposing CLT and SCT as a theoretical framework for DL and SDL, as both DL and SDL occur within the individual's mind and involve interaction with others.

■ Cognitive load theory

According to Mayer (2008:761), learning 'depends on the learner's cognitive processing during learning'. It can be explained as the learner selecting the incoming material, organising the incoming material into a mental representation and then relating the incoming material to the learner's long-term memory (LTM) (Mayer 2008:761). Cognitive load theory (Sweller 1988) relates to Mayer's (2008) description of cognitive processing during learning and is often mentioned regarding learning (Janssen et al. 2010; Kirschner, Paas & Kirschner 2009; Mason, Seton & Cooper 2016). According to Paas, Van Gog and

Sweller (2010:116), CLT has become an influential theory regarding instructional design where learning of especially complex cognitive tasks is concerned. When learning complex tasks, an overwhelmingly number of elements 'need to be processed simultaneously', which can impact meaningful learning (Paas et al. 2010:116). Cognitive load theory thus focusses on the instructional control of the 'excessively high load imposed by complex tasks' (Paas et al. 2010:116). In the following sections, CLT will be described by referring to two types of memory in the human mind, namely, LTM and working memory (WM), the interaction between LTM and WM, and the implications of CLT in transfer.

■ Long-term memory and working memory

Cognitive load theory (Sweller 1988) uses current knowledge about human cognitive architecture, and it describes the process of learning as an interaction between LTM and WM in the minds of individuals (Paas et al. 2010). Long-term memory is said to have virtually unlimited capacity (Sweller, Ayres & Kalyuga 2011), and it is used to store knowledge in the form of schemas (Mason et al. 2016). A schema is defined as a cognitive construct where multiple elements of information can be combined into a single construct and they become one element again (Chi, Glaser & Rees 1982). According to Nokes-Malach and Mestre (2013:186), a schema can also be described as a knowledge representation of a problem that captures the original or the typical elements of the problem. The different individual elements of a problem that need to be solved can thus be treated as a single element by a schema that has previously been acquired to solve the problem (Sweller et al. 2011). Such schemas can therefore render difficult problems easy to solve, as the LTM provides templates to effortlessly solve problems (Sweller et al. 2011). However, when a learner identifies an inappropriate schema to solve a problem, the problem can seem to be difficult to solve (Sweller et al. 2011). Competencies or skills can be acquired because of information

held in the LTM (Sweller et al. 2011). Advanced knowledge and skills are accordingly acquired after many cycles of forming new schemas (Paas, Renkl & Sweller 2003).

The WM is used to process and integrate information with existing schemas in the LTM. Unlike the LTM, the WM is quite limited in duration and capacity (Paas et al. 2010). According to Sweller et al. (2011:43), research by Peterson and Peterson (1959) found that almost all information in the WM is lost after approximately 20 s. Sweller et al. (2011) therefore suggest that new material should constantly be rehearsed, for it to be held in the WM indefinitely, as this will assist in transferring information to the LTM. Regarding processing capacity, research has indicated that the WM is limited to less than nine elements (Choi, Van Merriënboer & Paas 2014). Sweller et al. (2011), however, argue that no more than three items of new information can be processed by the WM at a given time because of the combinatorial number of elements that the WM should deal with.

The limitations of the WM, however, only apply to new information. As soon as content in the WM has been integrated with existing schemas in the LTM, new knowledge is stored as new schemas in the LTM, which can again be integrated with new content in the WM (Paas et al. 2010; Sweller et al. 2011). Therefore, when dealing with familiar information in the LTM, the limitations of the WM do not apply (Choi et al. 2014).

Research has shown that improving and managing WM resources and balancing the cognitive loads on WM can enhance transfer of learning (Paas & Van Gog 2006; Van Merriënboer, Kester & Paas 2006; Waris, Soveri & Laine 2015). Thus, it contributes to the argument that CLT is a sound theory on which DL can be based. According to Kalyuga (2009), deep learning for transfer depends on the interaction between the cognitive loads named as intrinsic load and germane resources. In the following section, the different types of cognitive load will be elaborated on.

◼ Types of cognitive load

During processing of instructional information and learning, the available resources in the WM will be allocated to two main types of cognitive load, namely, the intrinsic load and the extraneous load (Choi et al. 2014; Paas et al. 2010; Sweller et al. 2011). Germane cognitive load is often mentioned as a third type of cognitive load (Kirschner et al. 2009:36), but currently the term 'germane resources' is suggested (Choi et al. 2014; Kalyuga 2011; Sweller et al. 2011). Germane resources are seen as part of the intrinsic load devoted to learning.

☐ Intrinsic load

Intrinsic load (see Figure 3.1) is imposed by the nature and the structure of information, and it is affected by the difficulty of the content (Sweller et al. 2011) and the expertise of the learner (Van Merriënboer et al. 2006). Complex content that has to be learnt requires that complex schemas should be acquired, and subsequently causes a higher intrinsic load (Paas et al. 2010). Thus, if a large number of elements need to be processed simultaneously by a learner, the intrinsic load will be high, and learning will become difficult, requiring intensive resources from the WM (Choi et al. 2014). Learning material that requires low element interactivity requires less WM resources, and learning will thus be easier (Paas et al. 2010). According to Van Merriënboer et al. (2006:344), intrinsic load is also determined by the expertise of the learner. For a high-expertise learner, a problem may only consist of a few elements, while for a low-expertise learner the same problem may consist of numerous elements.

☐ Extraneous load

Extraneous load is imposed by the way in which information is presented and the activities that students are required to engage in (Sweller et al. 2011) (see Figure 3.1). The instructional design can, therefore, also impose unnecessary extraneous load on the
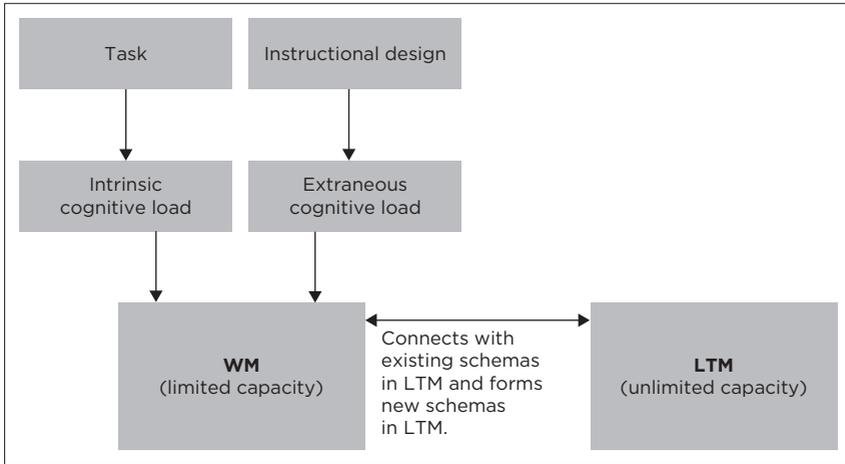
LTM, long-term memory; WM, working memory.
FIGURE 3.1: Cognitive load theory.

WM if it has not been designed to take the cognitive architecture into account (Choi et al. 2014; Sweller et al. 2011) and make extraneous load as low as possible. According to Van Merriënboer et al. (2006), extraneous load is not required for learning, and it typically results because of poorly designed instruction.

☐ Germane resources

Germane resources refer to WM resources devoted to dealing with learning (Sweller et al. 2011), and therefore with the intrinsic load (the difficulty of the content) (Choi et al. 2014). Thus, when more germane resources are available for learning, it would result in more effective processing of the WM, and learning will thus be more effective. In an ideal learning situation, where learners are optimally engaged in learning, optimal use will be made of germane WM resources (Kalyuga 2011).

☐ Balancing the cognitive load

As the WM has limited capacity and resources, the balance between the intrinsic load and the extraneous load will affect learning.

Although the extraneous load does not hamper learning when the intrinsic load is low (i.e. more WM resources are available), it hampers learning when the intrinsic load is high (Van Merriënboer & Sweller 2005). Thus, too many WM resources will be used to deal with the extraneous load, and not enough germane resources will be available to deal with the high intrinsic load and learning. Therefore, when the intrinsic load is high, the extraneous load should be reduced in order to provide more capacity for germane resources, which will result in more effective processing of the WM, and thus more effective learning (Paas et al. 2010; Van Merriënboer et al. 2006). Reducing the extraneous load will, therefore, allow interaction with schemas in the LTM, as well as updating of schemas (Janssen et al. 2010). However, although the extraneous load may be eliminated, the possibility exists that the intrinsic load may still be too heavy for the WM resources in the event of difficult learning content. The intrinsic load should, therefore, be managed by the instructional design, to allow simultaneous and balanced processing of all elements in the WM (Paas et al. 2010; Van Merriënboer et al. 2006).

Perkins and Salomon (2012:257) argue that in order to develop transfer, a change of mindset about knowing and learning is required. According to the view of CLT, the extraneous load and the intrinsic load of learning complex tasks should initially be reduced to provide for more germane resources that can be devoted to learning (Van Merriënboer et al. 2006). When executing complex tasks, the intrinsic load early in the initial learning process can be so high that little or no processing capacity is left for students to develop internal metacognitive processes and cognitive schemas (Van Merriënboer et al. 2006), thus interfering with forming the basis for transferable knowledge.

According to the view of CLT, Schwartz et al. (2012) suggest that instructional practices should focus on building a deep basic understanding of concepts by guiding students through inquiry activities first and then doing some problem-solving, instead of following a tell-first approach. It is further recommended that learners should be exposed to a variety of learning conditions

that include a variety of problems and solutions, to be practised in random order (Halpern & Hakel 2003; Van Merriënboer et al. 2006). Key ideas will then be retrieved in multiple ways, which will enhance schemas in the LTM (Halpern & Hakel 2003). Although this may result in difficult and longer initial learning, the learning and transfer gain can be significant (Halpern & Hakel 2003; Schwartz et al. 2012).

In Section 3.7 above, CLT has been described and proposed as a suitable theoretical foundation for DL and SDL. Cognitive load theory was proposed based on the first part of the definition of DL, namely, a process that occurs within an individual's mind, with knowledge transfer as the outcome. In the following section, SCT will be recommended to support learning that occurs through social interaction, as indicated in the second part of the definition of DL, and as a competency required for SDL, as indicated above.

■ Social constructivist theory

Social constructivist theory describes learning as a process that occurs through social interaction (Thomas et al. 2014). More specifically, according to Murphy et al. (2005:342), SCT as described by Vygotsky (1978) assumes that 'knowledge construction is achieved by the interaction that takes place within oneself through reflective thinking, and by the interaction that occurs in communicating and collaborating with other people'. Failing to recognise the social process and the many ways in which experienced learners can share knowledge with less experienced learners can limit the intellectual development of students, as this will exclude the possibilities that social facilitation brings to learning (John-Steiner & Souberman 1978).

Social constructivist theory should be clearly distinguished from social constructionist theory. According to Thomas et al. (2014:3), social context is at the centre in social constructionism, and the influence of culture on people is emphasised. Accordingly, a person has a definite view of the world, shaped by culture

and context. In contrast, within a social constructivist paradigm, the individual is placed at the centre of the meaning-making experience, where learning takes place because of the individual's interaction within a specific social context (Thomas et al. 2014).

The roots of SCT lie in the research of Vygotsky (1978). According to Vygotsky (1978:78), all persons have a 'zone of proximal development', defined as the 'distance between the actual development level' (that which a person can do or know at that stage) 'and the level of potential development' that can be obtained in collaboration with other more capable peers. It can thus be said that we are always maturing and we always have more potential capabilities. Therefore, what we would probably be able to do at a later stage on our own can be mastered earlier by collaborating with peers.

Damon (1984) explains the views of Piaget and Sullivan on the influence of peer interaction on intellectual development. According to Damon (1984:333), Piagetian theory states that peer interaction works as a trigger for change, as feedback from peers urges individuals to re-examine their own perspectives and justify their own beliefs, which introduces new thought patterns and intellectual reconstruction. Damon (1984) further states that according to Sullivan, peers approach each other as equals, are closely matched in knowledge and ability, and generally do not have an authority relationship. They accordingly learn from each other by sharing ideas, they compromise willingly, they make mutual plans and they are open to each other's insights (Damon 1984).

According to Murphy et al. (2005:342), learning through interaction requires that students engage actively in exchanging ideas and 'meaning negotiation by looking at and reflecting on the multiple perspectives of fellow students'. It is through such communicative interaction that students learn, by being exposed to the perspectives of their peers, which clarifies their ideas and thus fosters application of the material that has been learnt (Stearns 2017). Such application of knowledge also implies transfer of knowledge. As discussed above, one aspect that is important for

transfer of knowledge is that learners should be exposed to a variety of views or insights on a specific concept, in order for them to obtain a deeper understanding. It is within such a multiplicity of perspectives, which is a premise of social constructivist learning (Stearns 2017), that transfer of knowledge and learning is developed.

Views on SCT from a CLT perspective are worth mentioning. Collaborating with peers seems to reduce the cognitive loads, improving learning and transfer. In a collaborative learning setting, the intrinsic load is divided across the working memories of the collaborating group members (Janssen et al. 2010; Kirschner et al. 2009) (see Figure 3.2). The intrinsic loads on individual group members are thus reduced. From the CLT perspective, groups are seen as 'information processing systems' consisting of multiple collaborating working memories (Kirschner et al. 2009:36). Some concern has been raised that managing group activities such as communication and coordination between group members will add to the extraneous load of group members (Janssen et al. 2010). However, according to Kirschner et al. (2009:37), the cost
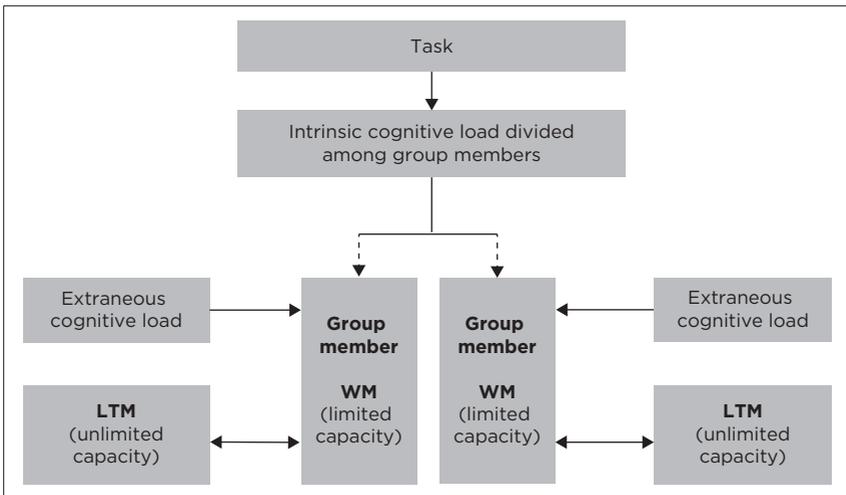
LTM, long-term memory; WM, working memory.
FIGURE 3.2: Collaborative learning in view of the CLT.

of such higher extraneous load is 'minimal compared to the gain' achieved by the division of labour. Accordingly, SCT is supported as a proposed theory, as part of the theoretical framework for DL and SDL, as it has been suggested that collaborative learning is an effective means to increase flexibility and transferability of knowledge (Kalyuga 2009).

Figure 3.2 shows how the intrinsic load of a task is shared by the working memories of two group members, thereby reducing the intrinsic load on each individual. Figure 3.2 also indicates the extraneous load added to each group member, owing to their managing of the activities of the group.

In Section 3.7, it was indicated how CLT and SCT can be aligned with DL and transfer, and it was also indicated how these theories can link with SDL. The value of deep processing skills and the implications of CLT and SCT cannot be ignored in fostering DL and SDL. From a CLT perspective, Berger and Hänze (2015) thus argue that difficult content reduces the impact of intrinsic motivation, which is regarded as crucial for SDL (Long 2000). Self-directed learners should, therefore, have the skills to integrate and connect information in the WM with information in the LTM in order to develop 'deep processing skills' (Long n.d.). Such deep processing skills may, in turn, foster enjoyment of learning, changing mindsets to view problems as challenges (Kell & Van Deursen 2002) and reducing the negative impact of difficult content on intrinsic motivation, which will set in motion the process of SDL. From an SCT perspective, the competencies required for DL and SDL in the interpersonal domain, which have been discussed above, underscore SCT, namely, that learning occurs within social interaction with others.

■ Moving to deeper self-directed learning

In the above discussion, DL and SDL were defined, the similarities between 21st-century competencies required for DL and those

required for SDL were indicated and a theoretical framework was proposed. Accordingly, Bellanca and Guglielmino (2014) describe threads that are common to DL and SDL. Firstly, when preparing learners for the 21st century, none of the processes of DL and SDL can be ignored or excluded, as each process includes distinct learning outcomes. Deeper learning focusses on transfer of knowledge, and SDL focusses on taking ownership of learning and evaluating learning outcomes. Secondly, the outcomes of these processes will not happen by chance, and teachers have to intentionally foster DL and SDL in the classroom and beyond (Bellanca & Guglielmino 2014; Van Merriënboer et al. 2006).

It is, therefore, posited that the individual processes of DL and SDL, on their own, are not sufficient for 21st-century learning and acquisition of 21st-century competencies. To effectively prepare learners for the 21st century, the focus of teaching must be on deeper DSDL, where learners take ownership of and responsibility for their learning, where the aim is to transfer knowledge to new contexts.

In Figure 3.3, the DSDL process is visually represented by means of a Fibonacci spiral, which spirals inward infinitely (Reich 2018). On the outer boundaries lie the cognitive, intrapersonal and interpersonal competencies of DL and SDL. As the forces driving DL and SDL (a driving learning need to take ownership of learning, develop 21st-century competencies and transfer knowledge) are combined, these competencies become more and more intertwined, spiralling inward towards DSDL, without reaching a saturation point on DSDL.

Figure 3.3 depicts DSDL as a process initiated by a learning need to transfer knowledge and acquire 21st-century competencies. As indicated by Hattie and Donoghue (2016:4), when there is no learning need created for transferring knowledge and acquiring 21st-century competencies but only for acquiring surface knowledge, there will also be no argument for DSDL.
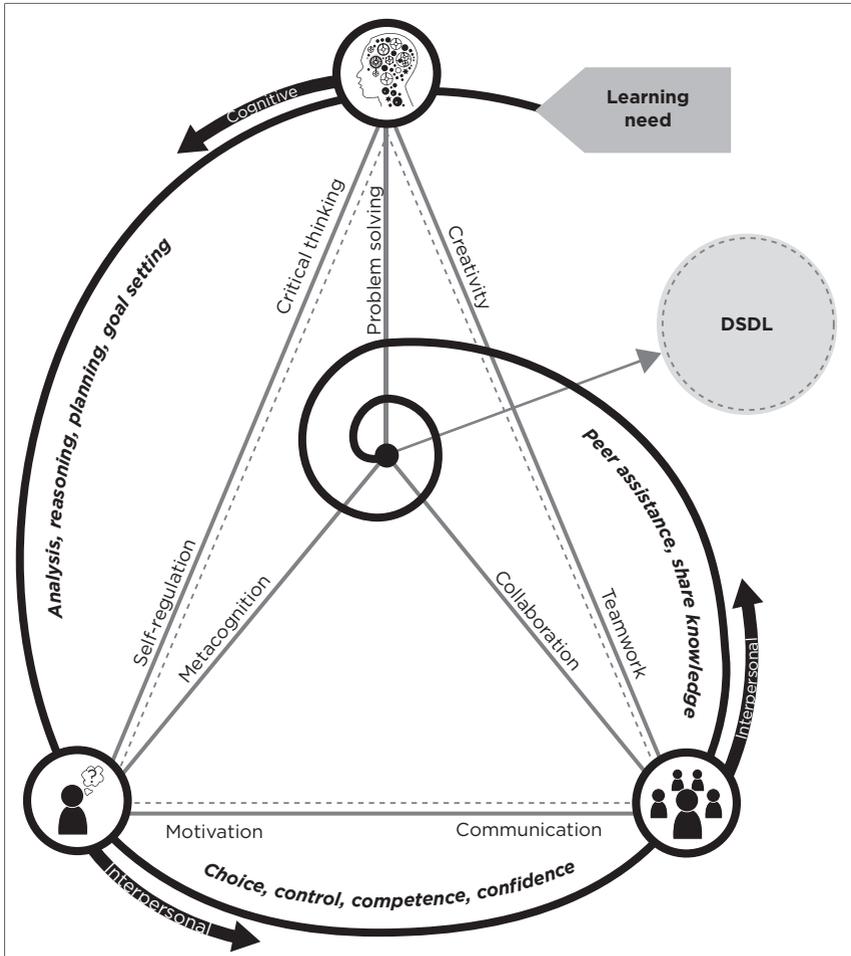
DSDL, deeper self-directed learning.
FIGURE 3.3: Deeper self-directed learning.

The spiral in Figure 3.3 indicates that the DSDL process revolves around cognitive, intrapersonal and intrapersonal competencies, driven by the primary processes of self-regulation, metacognition and motivation and the secondary processes of choice, control, competence and confidence. The ultimate aim of DSDL is far transfer – the transfer of knowledge to new contexts – and for

learners to take charge and ownership of the learning process by formulating learning goals, selecting resources, applying appropriate learning strategies and evaluating whether learning outcomes have been achieved.

Although it may seem that the inward spiral is collecting competencies linearly, starting with cognitive competencies, it should be noted that learning is not viewed as a linear process. Application of these competencies can occur concurrently, and in any order, as required by the learning need and further learning needs identified when evaluating learning outcomes. Learning needs will be deeper in the DSDL process, and they will not merely entail that learners need to successfully complete an assignment or pass an exam. Learning needs should have a lifelong learning focus – to prepare for success in the 21st century, and to reach the required outcomes.

In the cognitive domain, a deep approach to learning is required in order to make connections between concepts in the WM and the LTM and to transfer knowledge. Learners will solve problems creatively using their critical thinking skills, while analysing and reasoning. They will continuously set goals, do planning and monitor goals. Formulation of learning goals, according to the view of DSDL, should include the essence of transfer. Learning should aim to transfer the competencies gained to areas in the current context, to other contexts and to real-life situations.

Moving to the intrapersonal domain, learners need to be intrinsically motivated and metacognitively involved in the learning process. They need to evaluate their learning and determine whether learning goals have been met, while continuously regulating their learning. While monitoring their goals, learners should identify their learning needs, to determine what knowledge they are lacking to reach their goals, and they should accordingly apply SDL abilities to reach their goals. Appropriate learning strategies should be selected and applied, and appropriate resources should be located, in order to meet the identified learning needs and goals.

When regulating their own learning, learners will focus on the activities required to move towards their learning goals. Learners should be allowed to have choices in their learning and control over information that they are exposed to. The experience of a sense of choice and control should enhance learners' intrinsic motivation, building their confidence. As learners acquire more confidence in their learning and work towards their learning goals, their feeling of competence and their belief in their ability will improve, encouraging them to initiate more effort and increasing their self-direction.

Competencies in the interpersonal domain will provide support to the cognitive and intrapersonal domains and will enhance competencies in these domains. While collaborating and communicating, learners' perspectives on tasks, content and solutions to problems will broaden, which will foster transfer. Their critical thinking will improve as they share knowledge and discuss and debate issues with their peers. Consequently, learners will be able to present more creative solutions to problems, and they will develop transferable knowledge. Teamwork, support from peers and encouraging each other will build confidence and will foster intrinsic motivation, thereby enhancing SDL.

Deeper self-directed learning will, therefore, aim at instilling a lifelong learning mindset in self-directed learners (Bellanca & Guglielmino 2014), who apply appropriate strategies, develop 21st-century competencies and continuously transfer competencies in and out of the class to successfully face the challenges of the 21st century.

The DSDL process is further seen as being developed and fostered by appropriate teaching–learning strategies that incorporate CLT and SCT. The instructional environment should accordingly be designed to reduce cognitive loads on the WM and to encourage connections with knowledge in the LTM. Learning should occur within a social environment, where learners work in supportive groups to construct knowledge, execute tasks and solve problems.

■ Conclusion

Learning in the 21st century requires that students be deeper learners and self-directed learners who can take ownership of their learning, can transfer knowledge and who have a multitude of 21st-century competencies in the cognitive, intrapersonal and interpersonal domains. In this chapter, it was argued that none of the processes of SDL and DL can be excluded when teaching and learning in the 21st century. It was further stated that DSDL can meet the requirements of 21st-century learning. When DSDL is incorporated into teaching and learning strategies, students will take responsibility for their learning, with the aim of transferring their knowledge to new and unknown situations. Students will view their learning needs in terms of such transferable knowledge, will formulate their goals accordingly, will identify resources and collaborate with others, will apply critical thinking, will solve problems, will evaluate whether appropriate learning goals and transfer of knowledge have been achieved and they will persist in their learning until their goals have been met.

Deeper self-directed learning teaching–learning strategies will accordingly aim at instilling lifelong learning and developing deeper self-directed learners, who can successfully face the challenges of the 21st century. Further research on teaching–learning strategies to foster DSDL, by incorporating CLT and SCT, and on assessment strategies to develop DSDL, is therefore recommended.

■ Acknowledgements

The importance of context for self-directed learning

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■ Abstract

This chapter explores the importance of context for SDL. The Person–Process–Context (PPC) model for SDL is used as a framework, and context as a *sine qua non* for SDL is explored. Context is explored in terms of the context of the person, as well as of the process. Several authors in the field of SDL have stressed that this learning is embedded within social contexts and that this aspect is under-researched and not well represented in the SDL literature. The literature overview provided in this chapter gives a more universal focus on the role of context in fostering SDL, whereas the research reported on in this chapter focusses on

South African data. Two data sets emerging from two independent studies carried out by the author are reported on. The first data set looks at the SDL of the holders of indigenous knowledge (thus emphasising autodidactism) using the construct of the ethnobotanical knowledge index. The second data set deals with the role of context in fostering SDL among Life Sciences teachers participating in Short Learning Programmes (SLPs) on indigenous knowledge. Both data sets emphasise the role of context in SDL. This chapter concludes with a discussion on why context is so important in science education in South Africa.

Research shows that there is a notable difference in the 'pedagogical orientations of [science] teachers in township and suburban schools in South Africa' (Ramnarain & Schuster 2014:n.p.). This establishes classroom contexts that can either enhance or impede SDL. Unfortunately, research indicates that it is often the marginalised learners in township schools whose development as self-directed learners is impeded by contexts that are not motivational. Furthermore, research shows that teachers who are reluctant to abandon positions of authority could negatively influence SDL. This raises issues of social justice and flags the necessity for research in the field of SDL and the role of conducive contexts.

■ The role of context in fostering self-directed learning

The research question that guided this research was, 'what is the role of context in self-directed learning?' In order to answer this question, two data sets were analysed. Several authors (Candy 1991; Greveson & Spencer 2005; Merriam & Caffarella 1999) have stated that the ability and motivation needed for SDL varies with the context of learning. These authors, therefore, advocate for a stronger focus on how contextual factors contribute to SDL. Candy (1991:311) states that '[the] term self-direction has misled many into elevating the individual above the collective – but the nature of knowledge and learning inherently puts learners in relationship with others'. Candy argues that self-direction is the

result of the interaction between a person and a situation. It is a 'person-situation variable; that is; it is not a quality that inheres in the person independent of the situation or in the situation independent of the person' (Candy 1991:312).

Garrison (1997:18) states that 'the ideology of autonomy surrounding SDL has restricted its conceptualization and created imbalances when implementing it in an educational setting'. Dornan et al. (2005) have shown that learning is both a private individual process and the product of the interaction between the learner and the environment.

■ The Person–Process–Context model for self-directed learning

The PPC model of Hiemstra and Brockett (2012) is a rhizomic development from their earlier PRO model for SDL. The PPC model posits that three elements –person, process and context – should be seen as equally important in SDL. Hiemstra and Brockett (2012:158) list the following characteristics for each of these three elements:

- person: creativity, critical reflection, enthusiasm, life experience, life satisfaction, motivation, previous education, resilience and self-concept of the individual
- process: the teaching–learning activities, facilitation, learning skills, learning styles, teaching and learning styles, planning and organisation, evaluating abilities and technological skills
- context: the environmental and socio-political climate, such as culture, power, learning environment, finances, gender, learning climate, organisational policies, political milieu, sexual orientation and race.

The authors of the PPC model state that SDL can be best realised when these three elements (person, process and context) are in balance. Such balance would entail that (Hiemstra & Brockett 2012):

> [*T*]he learners are highly self-directed, the teaching–learning process is set up in a way that encourages learners to take control of their own learning, and the socio-political context and the learning environment support the climate for SDL. (p. 159)

The authors of the PPC model are of the opinion that the greatest potential of the model, 'to guide future SDL research, [occurs] at the intersection between the personal and contextual elements' (Hiemstra & Brockett 2012:159). In the words of Hiemstra and Brockett (2012):

> [O]ne of the most contested aspects of [*SDL*] over the years has been that it focuses on the individual learner without considering the impact of the [*socio-political*] context in which such learning takes place. (p. 159)

Several authors in the SDL field are of the opinion that more emphasis should be placed on research into the role of context (Andruske 2000; Hiemstra & Brockett 2012).
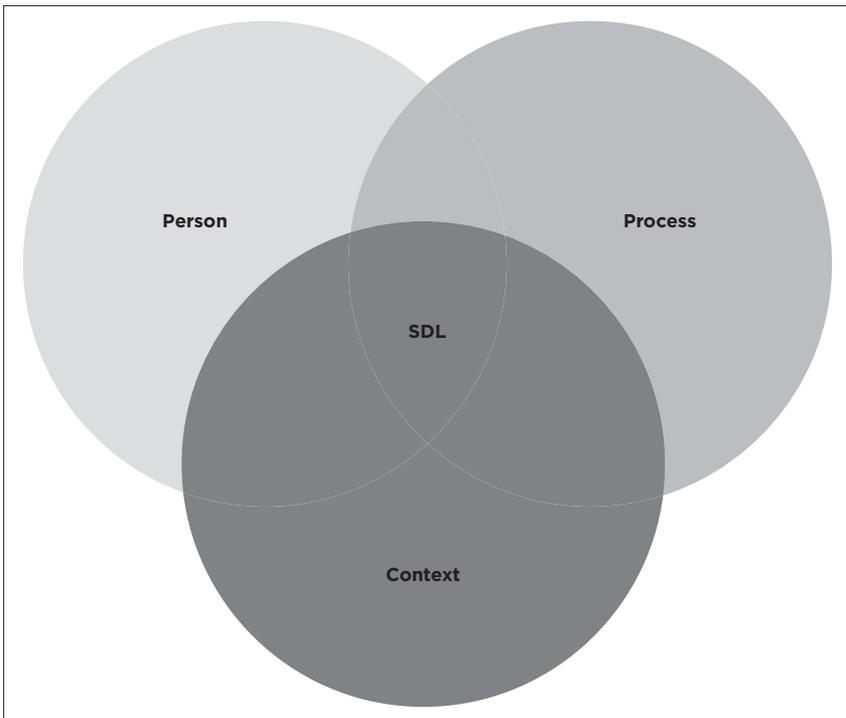
Source: Hiemstra and Brockett (2012:158)
SDL, self-directed learning.
FIGURE 4.1: The Person–Process–Context model.

◼ Self-directed learning in autodidactic contexts

Candy (1991:21) identifies four distinct but related constructs that are embraced by self-direction:

- self-direction as a personal attribute (personal autonomy)
- self-direction as a willingness and capacity to conduct own education (self-management)
- self-direction as a mode of organising instruction in formal settings (learner control)
- self-direction as a quest for learning opportunities in the 'natural societal setting' (autodidaxy).

Brookfield (1994) and Andruske (2000) advocate for expanding the definition of SDL to include marginalised groups. In such a context, issues such as the political milieu, power and race should be considered. Andruske (2000:n.p.), reporting on research conducted in Canada among women on welfare grants, showed that these women were 'self-directed learners [who engaged] in a variety of learning projects' to improve their livelihoods. She emphasised that SDL 'is often political [because] power and control are catalysts' for SDL (Andruske 2000:1). Brookfield (1993:225) holds a similar view that 'instead of being equated with atomistic self-gratification, self-direction can be interpreted as part of a cultural tradition that emphasises the individual's standing against repressive interests'. During their SDL, the women became political change agents as they steered their own learning in an attempt to move away from being dependent on welfare grants towards paid employment. Francis, Suandi and Uli (2008) shared similar findings from a study on aboriginal people (the Temuan people) in Malaysia. Similar views were also expressed by De Beer and Mentz (2017:546) from the findings of a study on Khoi-San 'holders of indigenous knowledge [...] and [how they] are self-directed learners'. This research is shared in Section 4.2.1.

Satiene (2017) conducted a study on post-retirement age individuals who clearly provided evidence of SDL pursuits.

The four themes that emerged from this research are worth taking note of (Satiene 2017:7–14):

- The participants engaged in SDL in generativity-based contexts (they were driven by a need to contribute to the social context, and to leave something [legacy] behind).
- They engaged in learning in interest-based contexts, and also in contexts that challenged them (the need to solve authentic problems).
- Older adults used SDL in social networks, learning from knowledgeable friends.
- Older adults adapted their learning to age-related changes and individual circumstances.

These insights dovetail with research findings, which will be shared later in this chapter, on Khoi-San people in the Hantam region and their learning about useful plants (data set 1). I will show how their learning was guided by their interests, the need to solve authentic problems and also age-related needs (e.g. older individuals who had a need for knowledge regarding medicinal plants).

In the school and higher education context, it is necessary to focus on the junction between 'person', 'process' and 'context' in terms of teacher- or lecturer authority and SDL. Nasri (2017) paints a picture of education in Malaysia that reminds very much of the South African situation. In Malaysia, like in most countries in the world, there is a strong drive to replace passive learning approaches with more active learning strategies. Guided by two research questions – namely, (1) 'how do teacher educators view their role as adult educators in the context of SDL?' and (2) 'how do teacher educators empower their students to take responsibility for their learning?' (Nasri 2017:1) – the research findings showed that many of the research participants did not accept 'their role as facilitators of learning, as they were [unwilling] to abandon [their] authority positions'. This, Nasri (2017) claims, should be viewed in terms of the Malaysian cultural context, and a:

> [F]ailure to acknowledge local context could lead to the deterioration in the process of introducing SDL approaches because, within Malaysia's current context and culture, like many other Asian countries, power and authority are prime considerations. (p. 2)

Educators in Malaysia are seen as respected role models with the responsibility to transmit knowledge, and learners are seen as the knowledge receivers required to listen carefully during lectures (Nasri 2017). This power relationship, which characterises many Malaysian classrooms, might hinder the interaction between learners and teachers/lecturers, and might obstruct SDL.

Grow's (1991) Staged Self-Directed Learning (SSDL) model provides a critical lens to look at the fostering of SDL in Malaysia. According to Grow, the educator should facilitate learning, across the Vygotskyan zone of proximal development, towards more SDL. Grow (1991:n.p.) emphasises that the 'instructional design should be intellectually challenging, but within the learner's zone of proximal development'. Of crucial importance is that the teaching and learning activities should be matched with the learners' readiness for and ability in SDL (Nasri 2017). Learners should be guided, and learning should be facilitated, in such a way that it will result in a transition 'from a dependent learner (stage 1), to an interested learner (stage 2), an involved learner (stage 3), and eventually a self-directed learner (stage 4)' (Grow 1991:n.p.; Nasri 2017; Revelo & Loui 2016). Breaking the cycle of transmission-mode teaching and learning will, therefore, not happen overnight. In the Malaysian context, the traditional role of the educator as a knowledge expert results in educators being comfortable with one-way knowledge transmission (Nasri 2017). Nasri emphasises the need to establish positive and collaborative relationships with learners, and to engage in teaching and learning approaches that could enhance the development of SDL skills.

Literature shows that a similar problem exists in many South African schools. Muthivhi and Broom (2008:115), who studied teaching and learning practices in Venda schools, showed that 'classroom practices fostered rote and memory-based forms of learning, failing to generate deep learning'. A central reason for this is the predominant teacher-centred approach and the power relationships that play out in the classroom. Mokhele (2006), who conducted a study in seven government schools in the Pretoria region, also highlighted the authoritarian teaching

strategies that characterise many classrooms, which encourage learners to rely heavily on teachers. This tendency does not assist learners to become independent learners who are in control of their own learning, rather than being dependent on the facilitator (Grow 1991), to refer back to the SSDL model of Grow.

It is clear that SDL is dependent on more than merely personal characteristics. Guglielmino (1978) provided us with a useful operational definition of a self-directed learner through her Delphi survey:

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

Such a learner will excel, even in learning environments that might not be conducive to enhancing SDL. However, researchers such as Hiemstra and Brockett (2012) and De Klerk and Fourie (2017) show that learning processes and their design, and the learning context, have a role to play in promoting SDL.

■ Research methodology

This chapter draws on two interdependent research studies. The role of context underpins both these research studies, as explained below.

■ Data set 1: Self-directed learning among holders of indigenous knowledge

Firstly, this chapter considers SDL among descendants of the Khoi-San people in the Northern Cape province, drawing on

the ethnobotanical knowledge index (EKI) (De Beer & Van Wyk 2011) as interpreted by De Beer and Mentz (2017). De Beer and Van Wyk (2011) developed this matrix method for ethnobotanical surveys. They also developed two indices – the EKI and the species popularity index. For the context of this chapter, the EKI is of relevance. The EKI is a quantification of the knowledge that the holders of indigenous knowledge have of the dominant plants in a region (De Beer & Van Wyk 2011). The EKI indicates a person's knowledge of the names of indigenous plants and their uses. A total of 64 plants were shown to the participants (in the form of herbarium voucher specimens – see Figure 4.2 and Figure 4.3), and a simple questionnaire (De Beer & Van Wyk 2011:743) was used to record answers to three questions:

1. Do you know the plant?
2. Can you recall any names for the plant?
3. Name any uses of the plant.

A total score (out of a possible maximum of six) was recorded in a matrix for each of the participants. The EKI was calculated
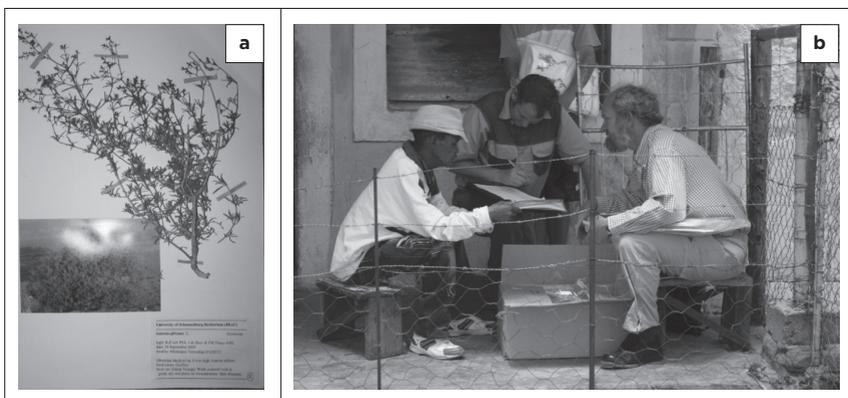
FIGURE 4.2: (a) Example of a herbarium voucher specimen shown to participants; (b) individual interviews were conducted with 16 participants.

Species	Adults		Young children	
	JB	CB	GS	AT*
Anisodontea triloba	123**6**	123**6**	0000	0000
Artemisia afra	123**6**	123**6**	0000	0000
Microloma sagittatum	123**6**	123**6**	123**6**	123**6**
EKI**	0.93	0.82	0.27	0.27

Note: For each of the 64 plant species, the scores for each of the 16 participants were recorded in a Matrix.
*, In the case of Andreas (AT), he could recognise Microloma (bokhorinkie, an edible plant) (1), he
had a name for it (2), and he knew that it is edible (the pods) (3), thus securing a score of 6 (in bold);
**, Based on 64 herbarium voucher specimens (only an excerpt shown here), the EKI is calculated for each
participant.

FIGURE 4.3: Scores for each of the 16 participants.

by adding the score for each participant for each of the 64 plants and dividing the figure by 384 (64 × 6). The EKI is a figure on a scale that varies between 0 (no knowledge) and 1 (a profound knowledge of the plants of a region). The matrix is explained in Figure 4.2 and Figure 4.3. Validity and reliability of the instrument, data and findings were ensured by having an expert (Ben-Erik van Wyk) involved in the data collection. As a seasoned ethnobotanist, he could easily establish whether participants were knowledgeable on local plant use (De Beer & Van Wyk 2011). The sample included 16 participants of different age groups from the Hantam area of the Northern Cape. Context here refers to autodidaxy (Candy 1991) and SDL within a specific cultural context in the Namakwa district. The dominant economic activity in the region is sheep farming, and most of the participants in the study, all of Khoi-San descent, were farm labourers (or the children of farm labourers). The poor socio-economic context is the backdrop against which their SDL should be considered.

Ethics clearance for Cycle 1 was obtained from the University of Johannesburg, which subscribes to the Code of Ethics of the International Society of Ethnobiology.

■ Data set 2: Design-based research of a short learning programme on infusing indigenous knowledge into curriculum themes for science teachers

The second data set focusses on Design-based Research (DBR) related to a SLP, developed and presented by North-West University (NWU), to science teachers on how to infuse indigenous knowledge into their teaching of curriculum themes. In true DBR tradition, data set 2 relies on two cycles. During Cycle 1 (Figure 4.4), the insights gained during the research in the Hantam (data set 1) informed the design of the SLP from which data set 2 emerged. The analysis of the data obtained from Cycle 1 (the SLP for Limpopo teachers) led to new design principles for Cycle 2 (the SLP for Namakwa teachers in the Northern Cape). In Cycle 1, a total of 62 Life Sciences teachers participated in the SLP. The SLP was presented in Polokwane, Limpopo, over a period of 3 days. Cycle 2 was presented in Calvinia (in the Namakwa district of the Northern Cape) over a period of 3 days and included a total of 37 Life Sciences teachers. Data were collected from teacher portfolios, post-intervention questionnaires and personal (individual) interviews with a selected group of teachers. Saldaña's (2009) coding technique was used. Codes were identified, similar codes were grouped into categories and from the categories a number of themes emerged.

For data set 2, ethics clearance was obtained from the NWU. Teachers were informed that their (voluntary) participation in the
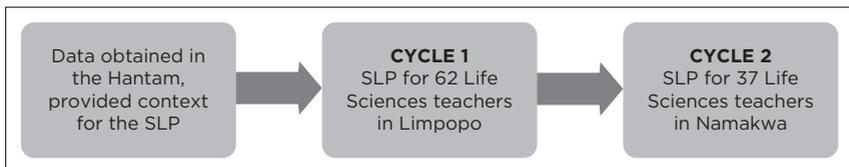
SLP, short learning programme.

FIGURE 4.4: The DBR methodology used in the research presented in this chapter.

research was not a requirement for participating in the SLP and that they could withdraw from the research at any stage.

The context that we refer to in data set 2 is the dovetailing between process and context in the PPC model. The SLPs focused on how the teacher could create a learning environment that would enhance SDL. Emphasis was placed on methods such as PBL and CL, which are regarded as methods that could potentially enhance SDL (the 'process' in Hiemstra & Brockett's [2012] model). Several researchers, for example, Garrison (1997) and Barrows (1996), have indicated that PBL can enhance SDL. Garrison (1997:30) states that 'SDL is consistent with a collaborative constructivist view of learning that encourages students to approach learning in a deep and meaningful manner'.

■ Findings of the research in terms of the role of context to support self-directed learning

■ Data set 1: The holders of indigenous knowledge as self-directed learners

Battiste (2002) makes the following statement, which is of utmost importance for the context of the research reported on in this section:

> As a concept, indigenous knowledge benchmarks the limitations of Eurocentric theory – its methodology, evidence and conclusions – and reconceptualizes the resilience and self-reliance of indigenous knowledge. Knowledge is not a commodity that can be possessed or controlled by educational institutions, but it is a living process to be absorbed and understood. Indigenous pedagogy values a person's ability to learn independently by observing, listening and participating with minimum intervention or instruction. (p. 5)

The Hantam area in the Northern Cape province, as mentioned in the methodology section, is home to a relatively large group of people of Khoi-San descent (De Beer & Van Wyk 2011). These descendants (mainly Afrikaans-speaking) of the Khoi-San still

possess a vast knowledge concerning the use of indigenous plants. Their exact ancestry (Nama, Griqua and *!Xam*) is not known (De Beer 2012). De Beer and Mentz (2017) analysed the EKIs of 16 participants in the Hantam region of the Northern Cape province. These researchers identified an interesting pattern among participants of different age groups. Young children had a good knowledge of edible plants in the region, but not of medicinal plants. Older people had a good knowledge of medicinal plants. For this reason, De Beer and Mentz (2017) concluded that people of the Hantam learn about plants based on their own needs. For children, who mostly live in socio-economically deprived environments, knowledge of edible plants has value for their everyday lives. By eating veld food (indigenous plants of the region), they were able to supplement their often inadequate diets. As children grow older, they start to learn about medicinal plants and their uses. Many adults, especially the elderly in the community, have a good knowledge of medicinal plants, which are used to treat the ailments that they develop as they age. De Beer and Mentz (2017) report that young children (9–10 years old) had an EKI of around 0.27, while older children (13 years old) had a higher EKI of 0.37. Adults and more elderly people had EKI values ranging between 0.43 and 0.93. An excerpt from De Beer and Van Wyk's (2011) matrix is shown in Figure 4.3. For example, Jan (JB), an adult, had an EKI of 0.93, whereas Gert (GS) and Andreas (AT), two young boys, had a much lower EKI of 0.27. Based on the EKI values, these authors claim that the holders of indigenous knowledge are often self-directed learners, and their learning is dependent on context. This is in line with views of Andruske (2000) and Brookfield (1993), that SDL can also be interpreted as a repudiation of oppressive regimes. The farm labourers, generally in poor socio-economic circumstances, do not have the financial resources nor the access (owing to the geographical isolation of many of the farms and the lack of available transport) to buy medicines from pharmacies. In this context, individuals set their learning goals to enhance the quality of their lives, for example, by learning about edible and medicinal plants.

De Beer and Mentz (2017) showed that SDL was promoted based on the needs of people in this marginalised community. For children it was a need for food. For the elderly it was a need for medicinal plants. (Refer to Satiene [2017]) who showed that learning adapts to age-related changes.) If one uses Knowles's (1975) classic definition as a yardstick, SDL is clearly displayed. Knowles (1975) describes SDL as:

> [A] process by which individuals take the initiative, with or without the assistance 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 outcomes. (p. 18)

The social constructivist nature of Knowles's (1975) classic definition is, therefore, important in the context of ethnobotanical learning. Vygotsky (1962, 1966) stated that:

> [A]ny function in the child's development appears on the stage twice, on two planes. First on the social plane and then on the psychological, first among people as an inter-mental category and then within the child as an intra-mental category. (p. 44)

Khoi-San children learn at an early age about plants from their parents, grandparents and other holders of indigenous knowledge. They observe these holders of indigenous knowledge and set goals for their own learning, for example, in terms of ecology (what type of habitat would a particular plant occupy, and what are the growth needs of individual species?), morphology (what are the dominant anatomical and morphological characteristics of a plant species?), pharmacology (how can extracts from the plants be used for medicinal reasons?) and conservation (how can plant material be harvested sustainably?). There is strong PBL displayed here. Barrows (1996) makes a convincing argument that PBL, in the right context, could enhance SDL. Satiene (2017:10) highlights the importance of the learner being confronted with a challenge. Francis et al. (2008) also highlight how PBL is found among aboriginal people in Malaysia. This socially constructed knowledge is eventually internalised.

De Beer and Mentz (2017) express concern that this essential characteristic of indigenous knowledge holders' SDL – namely that the learning stems from experiencing authentic and often life-threatening problems – is not centre-staged in the school classroom. So, often, in school science, answers are given to questions that the learners have not yet asked. Indigenous knowledge, therefore, holds affordances for the enhancement of SDL in the classroom.

■ Data set 2: The short learning programme (teacher professional development) in terms of epistemological border-crossing between science and indigenous knowledge

Based on the insights gained from working with the holders of indigenous knowledge, the NWU developed a SLP to assist teachers with facilitating 'epistemological border-crossing between western science and indigenous knowledge' (Jautse, Thambe & De Beer 2016:442).

☐ Data set 2.1: The short learning programme in Limpopo (Cycle 1)

The 3-day SLP was first offered to teachers in Limpopo. Based on the insights gained in the Hantam, working with the Khoi-San holders of indigenous knowledge, attention was given to context when processes were considered (refer to the PPC model in Figure 4.1). The course designers developed activities that drew on the inherent qualities of learning in indigenous knowledge systems. Firstly, problem-based activities were included, for example, an adapted Kirby–Bauer technique to test anti-microbial properties of medicinal (muthi) plants (De Beer & Whitlock 2009). De Beer and Mentz (2017) and Francis et al. (2008) make it clear that PBL is prominent in indigenous knowledge systems, and Barrows (1996) shows how PBL can enhance SDL. Secondly, CL methods were used in the SLP.

Jautse et al. (2016) indicate that CL is a hallmark of indigenous knowledge systems. These authors show how young *Bakgatla* men coming back from initiation schools [*bogwera*] have a collective responsibility to complete certain learning tasks, which resonates strongly with Johnson and Johnson's (2014) element of social interdependence in CL. The same applies to Khoi-San cultures in the Northern Cape (De Beer 2012). During the SLP in Cycle 1, the teachers engaged in CL methods, such as De Bono's thinking hats and the jigsaw method.

Despite the fact that the SLP took context into consideration in terms of the findings of SDL among Khoi-San indigenous knowledge holders, that is, by emphasising problem-based learning and CL, the data obtained during Cycle 1 were disappointing. In the post-questionnaire after the SLP, teachers indicated that they gained knowledge from the SLP and could see the value of incorporating indigenous knowledge into the teaching of curriculum themes, as well as the affordances of problem-based learning and CL in the science classroom. However, the portfolios teachers submitted after the SLP (including, among others, lesson plans) were generally disappointing, and only 24 out of 62 teachers (39%) met the SLP outcomes. Seven of the 24 portfolios provided good evidence of authentic PBL and CL. Eleven of the portfolios provided evidence that it is difficult to change teachers' habits and teaching methods, and these portfolios fell into the category of what Zeichner and Tabachnick (1981:7) describe as the 'wash-out effect'. Despite the focus on problem-based learning and CL during the SLP, teachers regressed to mostly transmission-mode (lecture-type) lessons. Table 4.1 presents an abstract from a lesson plan provided in one of the portfolios, and this teacher-centred approach dominated many of the portfolios.

During a personal interview with one of the teachers, it became clear that the focus in terms of context during the SLP was purely on *process* in the PPC model (Figure 4.1), that is, contextualising

the learning activities in terms of problem-based learning and CL, and not on the *person*:

> Although it was interesting to learn about Khoi-San people in the course, I do not have such learners in my classroom. My learners are mostly Batswana and Vhavenda learners, and I do not know much about this indigenous knowledge. (Life Sciences teacher, female, teaching in a rural school outside Polokwane)

One of the teacher reflections (which was a portfolio requirement) showed how we missed golden opportunities to contextualise

TABLE 4.1: Excerpt from a Limpopo lesson plan.

Subject: Life Sciences	Grade 11	Topic: Biodiversity of plants and reproduction	Duration: 60 min
Lesson topic	Grouping gymnosperms into indigenous plants (Researcher's note: A peculiar formulation. There are indigenous and exotic gymnosperms, which illustrate the teacher's lack of content knowledge.)		
Teaching methods	Lecture method and discussion method (Researcher's note: Despite the SLP, a relapse to transmission-mode teaching was observed, at the expense of PBL.)		
Activities:	**Time allocation**	**Teaching activities**	**Learner's activities**
Lesson introduction	10 min	Teacher *explains** what angiosperms and gymnosperms are; Brief *explanations** on what type of plants fall under above categories.	Learners *listen*** and *take notes***. Learners give examples of indigenous species.
Lesson presentation	45 min	The *teacher explains* the characteristics of gymnosperms. Teacher *informs* learners to give examples of plants.	Learners discuss in groups the characteristics of gymnosperms.***
Lesson conclusion	5 min	The teacher *checks* learners' work and *summarises* what was taught during the lesson.	Learners *pay attention* and *give answers* to questions raised.****

Source: One of the teachers' submitted portfolio.
Note: The teacher provided written consent that her portfolios may be used for research purposes. However, because of ethical principles, the name of the teacher cannot be revealed. This female Life Sciences teacher from a rural school just outside Polokwane provided a lesson plan that was typical of many of the lesson plans.
* *Researcher's emphasis:* note the teacher-centred approach; ** Researcher's note: Learners are rather passive; *** Researcher's note: Despite the fact that learners engage in discussions (a poor attempt to incorporate CL), there is little evidence of inquiry learning, or authentic reference to indigenous knowledge; ****Researcher's note: The focus is on the regurgitation of content and not on PBL.

the SLP in terms of the Limpopo milieu (excerpt from Limpopo portfolio – Table 4.1):

> The lesson I presented gave me an idea that learners always come to the classroom with pre-knowledge that need to be drawn into perspective. Such kind of knowledge provides a foundation on which new information can be built. There are, however, misconceptions that learners bring to the classroom that I need to address, such as (1) Using parts of Albino people as muthi by some African healers, (2) Lightning strikes owing to the powers of witches, and (3) A call of an owl that is thought to precede death.
>
> We were briefly told during the course how learners can engage in ethnobotanical surveys. Learners can interview elderly people in the district, to find out which plants are used as food, and as medicines. However, I am scared to give my learners such an assignment. I do not know the plants of the region. I will not be able to tell my learner, 'yes, it's correct, this plant can indeed be used to lower blood pressure'. I am sure learners will enjoy it, but I will rather not do it, as it will be too stressful for me. Learners might doubt my expertise. (Neophyte teacher, male, teaching in an under-resourced school in the vicinity of the Turfloop campus of the University of Limpopo)

In this case, the opportunity for learners to engage in authentic project-based learning, which holds the opportunity to enhance SDL, was inhibited by a lack of content knowledge on the part of the teacher – an aspect that we could have addressed in the SLP. If the SLP facilitators paid more attention to local context, and used local plants to demonstrate ethnobotanical surveys (rather than simply referring to Khoi-San plant examples), this teacher might have experimented with more learner-centred approaches, such as ethnobotanical surveys. Firstly, the position of authority that Nasri (2017) referred to is also evident here. The teacher expressed his own vulnerability and reluctance to abandon a position of authority. Secondly, this example clearly illustrates a lack of SDL on the part of the teacher; he could have identified the learning need to come to a better understanding of ethnobotanical practices in the Limpopo province. He could have identified learning resources and decided on a learning strategy to become well-versed in such ethnobotanical practices. However, he did not, and rather avoided a pedagogy that could have benefited his learners. One should be reminded of the research of Rogan and Grayson (2003), which suggested that there

should be a 'zone of feasible innovation' that should guide teacher professional development. (This should be seen in the parlance of the 'zone of proximal development'). Rogan and Grayson suggested a profile of implementation for teacher professional development, where teachers' knowledge and skills are classified in terms of their classroom practice, and teaching and assessment practices on various levels (1–4). Level 1 indicates a basic compliance, whereas level 4 indicates sophistication and a nuanced, well-developed Pedagogical Content Knowledge (PCK). Teacher professional development should occur in manageable steps. These researchers argue that it is naïve to think that a teacher on a low level (e.g. level 1, where a teacher lectures to a learner and promotes rote learning in terms of assessment practices) can, within a short period of time (like attending an SLP), advance to level 4 (where learners take responsibility for their own learning and design their own open investigations). This is aligned with the premise of the SSDL model of Grow (1991) mentioned earlier.

The misconceptions that the teacher mentioned in his portfolio reflection (see above) brought about the realisation that we should have engaged teachers in a discussion on science and pseudo-science, and the difference between them. These misconceptions provide an excellent vehicle for learners to interrogate the tenets of science and indigenous knowledge. Researchers in the field of indigenous knowledge systems show that such knowledge is often characterised by the use of metaphors (Gorelick 2014), and Dugmore and Van Wyk (2008) again explain that birds in African mythology are often used to describe fever. (There is a very logical reason for this, which is that birds have a body temperature of about 40 °C compared to the human temperature of 37 °C.) Associating birds with fever and death, such in the teacher's reflection, is a common characteristic of African mythology. It is a pity that this was not addressed in the Limpopo SLP, as such African folklore is common in this area of the Limpopo province. Discussing these 'misconceptions' as metaphors typical of African indigenous knowledge could have provided learners with a more nuanced understanding of the holistic nature of indigenous knowledge,

and that this is a distinct difference between science and indigenous knowledge. However, in the design of the SLP, these contextual factors were not considered.

From this analysis, it is clear that a consideration of *context* (see the PPC model in Figure 4.1) should focus on the intersection of *context* with both *person* and *process*. In conceptualising the intervention in Cycle 1, the SLP was aligned with the teaching–learning activities (the *process*) that characterise learning within indigenous knowledge systems (e.g. an emphasis on problem-based learning and CL). However, the context of the *person* (e.g. the predominant Bapedi, Batswana and Vhavenda cultures among the Limpopo teachers) was not adequately considered. Teachers were exposed to medicinal plants of the Khoi-San people of the Northern Cape. A far better approach would have been to refer to Limpopo plants, with which the teachers (and learners) would be more familiar.

☐ Data set 2.2. The short learning programme in Calvinia (Namakwa) (Cycle 2)

The Khoi-San examples and insights gained during the study in the Hantam, although not very relevant for teachers in Limpopo (Cycle 1), proved to be highly relevant to teachers in Calvinia (Cycle 2). Most of the 37 teachers who participated in Cycle 2 were of Khoi-San descent and had a good knowledge of the plants that were used as examples during the course. The portfolios submitted in Cycle 2 provided evidence of lesson plans embedded in authentic (indigenous knowledge) problems, and more frequent use of inquiry approaches, as can be seen in Table 4.2.

In her reflection on the above lesson, the teacher stated, 'I was pleased to see that the learners enjoyed the lessons. The role of science in our everyday lives was emphasised in the lessons' (Life Sciences teacher, female, from the Calvinia district; translated from Afrikaans by the author).

TABLE 4.2: Excerpt from a Namakwa lesson plan (a series of two lessons).

Life Sciences Grade 11: Lesson topic: (LESSON A) Loss of biodiversity (indigenous knowledge systems and the sustainable use of the environment)	
Duration	**60 min**
Teacher's activities	**Learners' activities**
Introduction	
I will divide the class into smaller groups of four learners and give the groups a number of questions (related to the loss of biodiversity) to discuss.	Learners will discuss the loss of biodiversity, and especially focus on the sustainable use of plants such as devil's claw, *Hoodia* and the African Potato (examples in the Curriculum and Assessment Policy Statement [CAPS]), which I will extend to the most important plants in Calvinia, such as the cancer bush and ballerja.
After I have asked for brief feedback by the groups, I will instruct the groups to formulate two questions for the classroom guest (a local traditional healer).	After the groups have given feedback, they have to formulate two questions to ask the guest.
	(Researcher's note: It is good to see that the teacher goes beyond the listed species in the CAPS and also focusses on local examples.)
Lesson presentation	
I have invited a traditional healer to the classroom, and have asked him to bring samples along of the most important and useful plants in the district. However, the lesson will take place in the form of an interview. Every group will be given the chance to pose a question to the traditional healer.	Every group will be able to pose at least one question, which the traditional healer will answer. Learners should record important answers, to use this as data in their posters.
Summary/Conclusion	
After I have thanked the traditional healer, I will ask the students in their groups to plan and develop a poster on the sustainable use of useful plants, which will be displayed in the school.	Students plan and make posters.
LESSON B: Testing the efficacy of medicinal plants	
Duration	**60 min × 2 (observation the next day)**
Introduction	
I will ask students to plan an experiment to test if *Sutherlandia* (the cancer bush) will be effective to treat a sore throat.	Learners, in their small groups, will be given 15 min to plan an experimental setup.
(Researcher's note: This is an extension to the CAPS (not prescribed), with big value as in providing learners with a more nuanced understanding of the nature of science.)	

TABLE 4.2 (Continues...): Excerpt from a Namakwa lesson plan (a series of two lessons).

Lesson presentation	
I will ask groups to provide feedback and will note all positive aspects of experimental designs.	Groups provide feedback on their experimental designs.
I will then provide students with guidelines for a simplified Kirby–Bauer technique, like we did during the short course.	Groups engage in Kirby–Bauer technique. Agar plates were prepared beforehand.
Observations (next day)	
I will provide learners with a worksheet to record their observations. Learners should come to conclusions. Learners are instructed to write a short laboratory report.	Learners make observations and write a lab report.

Source: Excerpt from the portfolio of a female Life Sciences teacher from Calvinia, after attending the SLP.
Note: The teacher provided written consent that her portfolio may be used for research purposes. However, because of ethical principles, the name of the teacher cannot be revealed. Translated from Afrikaans by the author.

Another teacher reflected as follows:

> I was motivated by the course, and I started to read more about the ethnobotany of our region, and its applications in both science and in our daily lives. It was a steep learning curve, but there were people in the community and in the museum who assisted me in my journey. (Life Sciences teacher, female, from the Calvinia district; translated from Afrikaans by the author)

In the latter case, there is clear evidence of SDL. The SLP in Cycle 2, unlike in Cycle 1, focused on the intersection of *context* with both *person* (immersing Khoi-San teachers into a familiar ethnobotanical context) and *process* (problem-based learning and CL) as in the PPC model of Hiemstra and Brockett (2012).

■ The importance of context for self-directed learning: The South African conundrum

In the PPC model (Figure 4.1), the interlinking and balance between three elements – person, process and context – are emphasised. As mentioned, personal attributes in this model for SDL include

enthusiasm and motivation. This again is often fuelled by processes (e.g. the teaching and learning activities) and the classroom context.

Schulze and Van Heerden's (2015) research highlighted that the science classroom is the most important factor in motivating learners (the *person* element) to engage with science. Learners involved in their research completed the Student Motivation to Learn Science questionnaire (Tuan, Chin & Shieh 2005). From their findings, it seems that many South African classrooms fail the grade, as the learning environments in many science classrooms have little motivational value in terms of learners' affective experiences. The teacher plays a pivotal role in creating motivational learning spaces. It is therefore essential that science teachers rethink the teaching methods they use, the learning environments they create (Schulze & Van Heerden 2015:7) and whether these environments can contribute to the enhancement of SDL.

Ramnarain and Schuster (2014) researched the pedagogical orientations of science teachers in the metropolitan area of Johannesburg. Their mixed methods study used the Pedagogy of Science Teaching Test (POSTT) instrument (Schuster et al. 2007) and personal interviews. Pedagogical orientation is a component of PCK, and Ramnarain and Schuster (2014:632) describe science teachers' pedagogical orientations as shown in Table 4.3.

TABLE 4.3: The pedagogical orientations of science teachers.

Pedagogical orientation	Description
Didactic direct	The teacher presents the science content or principle directly and explains it. The teacher might illustrate the concept with an example or demonstration. No student activities, but teacher answers student questions.
Active direct	Same as the direct exposition explained above, but this is followed by a student activity, for example, hands-on practical verification of the law.
Guided inquiry	Topics are approached by student exploration, with the teacher guiding them towards the desired science concept or principle. Questions are dealt with by discussion.
Open inquiry	Minimally guided by the teacher, students are free to explore a phenomenon or idea of their choice and devise ways of doing so. Teacher facilitates but does not prescribe. The inquiry process is considered pivotal. Students present what they did and discovered.

Source: Ramnarain and Schuster (2014:632)

Ramnarain and Schuster's (2014:627) findings revealed a disturbing pattern, which is very relevant to the focus of this chapter on the role of context for SDL. Science teachers in 'township schools [had] a strong active direct teaching orientation overall' (Ramnarain & Schuster 2014:n.p.). They preferred the use of transmission-mode teaching approaches such as the lecture method, occasionally following it up with confirmatory practical work. 'On the other hand, teachers [at] suburban schools [displayed] a [stronger] guided-inquiry' orientation (Ramnarain & Schuster 2014:n.p.), as shown in Table 4.4.

The interviews that followed the POSTT instruments are of particular importance to the discussion on the role of context for SDL. When the township teachers were asked why they favoured the 'active direct' orientation and why 'open inquiry' was marginalised, the following clarifications were provided:

- The township teachers indicated that they lack the confidence to facilitate inquiry learning (Ramnarain & Schuster 2014).
- According to the teachers, school management places a high premium on producing good results in summative assessments. This made it difficult to engage in inquiry-based learning experiences (Ramnarain & Schuster 2014).
- The township teachers alluded to the fact 'that parents had [expectations] for their children to get high marks in science' (Ramnarain & Schuster 2014:n.p.), putting pressure on them to 'teach to the test'.

TABLE 4.4: The pedagogical orientations of township and suburban schoolteachers.

School context	Didactic direct (%)	Active direct (%)	Guided inquiry (%)	Open inquiry (%)
Township ($n = 44$)	22.27	48.41	26.36	2.95
Suburban ($n = 47$)	1.06	16.60	58.30	24.04
Overall ($n = 91$)	11.32	31.98	42.86	13.85

Source: Ramnarain and Schuster (2014:640)

The school context clearly has an influence on the science teachers' pedagogical orientations. Ramnarain and Schuster (2014) concluded that:

> The culture of the school and parental expectations played a role in shaping the pedagogical orientation of the teachers. The generally poor performance in national science examinations of students at township schools had led to a strong teaching focus towards preparing for high-stakes summative examinations. (p. 648)

Although these teachers might appreciate the value of more student-centred approaches and inquiry learning, the 'mania for assessment' (Mbembe 2016:31) and pressure from school management and parents tend towards 'chalk-and-talk' approaches.

Such a township science classroom, characterised by transmission-mode teaching, is not a motivating learning space. Learners in such classrooms receive minimal exposure to PBL and effective CL, and this might negatively influence SDL. Garrison (1997:30) holds the opinion that 'self-direction is contradictory to the transmission of the text from teacher to students without interpretation and construction of deep meaning'.

Of course, very self-directed learners might maintain themselves well in such an uninspiring environment. However, many learners who might have developed as self-directed learners, in more favourable and motivating classroom conditions, are deprived of this opportunity.

It is these insights that catalysed the conceptualisation of the SLP described earlier (data set 2). As mentioned, the SLP was predominantly built around PBL and CL, and better conceptualising the curriculum by making use of indigenous knowledge. Many teachers hold a common misconception that PBL and CL are more time-consuming and that a lecture method is more effective in preparing learners for a test or examination (Ramnarain & Schuster 2014). The SLP aimed to provide the opportunity for teachers to rethink this assumption and realise that these more engaging student-centred approaches were not necessarily more time-consuming. During the SLP, teachers were also alerted to

the affective benefits of these teaching methods, and how these methods could better facilitate cognitive change and deep learning (as compared to 'chalk-and-talk' approaches).

■ Discussion and conclusion

In this chapter, it has been shown that several researchers (Candy 1991; Greveson & Spencer 2005; Merriam & Caffarella 1999) agree that the ability and motivation to be self-directed in learning varies with the context of learning. Merriam (2001) makes a strong argument that context should receive more emphasis in andragogy and SDL when she states that:

> Knowles's version of andragogy presents the individual learner as one who is autonomous, free and growth-oriented. Critics have pointed out that there is little or no acknowledgement that every person has been shaped by his or her culture and society, that every person has a history, and that social institutions and structures define, to a large extent, the learning transaction irrespective of the individual learner [...] and even though Knowles promoted andragogy [...], he never considered the organizational and social impediments to adult learning; he never painted the big picture.

> Merriam continues by citing Grace (1996:386) who comments that Knowles 'chose the mechanistic over the meaningful [...] (and) reduced the adult learner to a technically proficient droid, operating in a world where formulaic [...] SDL mantras are the order of the day'. (p. 7)

Hiemstra and Brockett's (2012) PPC model of SDL provides a more nuanced understanding. In the PPC model, context overlaps with both the process (which includes the teaching–learning activities) and the person (and his or her attributes). In this chapter, a definition has been given for the context in terms of both the person (the cultural background of the individual; Khoi-San, Batswana, etc.) and the process (e.g. context influencing teaching–learning activities and facilitation). Self-directed learning could also be seen as a political act, a deliberate standing of an individual against a repressive political context – as in the case of marginalised Khoi-San people in the Northern Cape province.

In this chapter, indigenous knowledge has also been discussed as a tool with which to contextualise a Western curriculum for diverse learners. Learners come to the science classroom with cultural knowledge, and this context could be effectively used to provide better access to curriculum content. However, this might be a daunting task in a multicultural classroom, as the question arises of *whose* indigenous knowledge should be the focus? My view is that *all* learners' indigenous knowledge should be considered. This requires the science teachers to have the necessary PCK to facilitate such border-crossing and to use CL strategies in the classroom. Another concern that is often raised is the lack of resources (e.g. textbooks) to assist teachers in this task. The past decade saw the publication of several textbooks that could be used in the classroom. Teachers could also make use of the considerable biological and ethnic diversity of the country.

Self-directed learning should, in my opinion, also be seen as an issue of social justice, and it is essential to prepare learners for a complex 21st Century. The research of Ramnarain and Schuster (2014) shows that it is the marginalised learners in township schools who are most often subjected to transmission-mode teaching, which does not promote SDL. The questions that need to be asked are, 'are such learners in a jeopardised position when they have to carve out a living for themselves in a complex 21st Century, either in the formal job market, or as creative entrepreneurs?' and 'are students of privilege – who attend more affluent schools that better foster SDL (according to Ramnarain and Schuster's research) – in a better position to secure jobs, or to succeed as entrepreneurs, over their peers from rural and township schools?'

Finally, I would like to conclude with a few recommendations in terms of future research.

The role of context should receive more attention from scholars working in the field of SDL. Many school contexts in South Africa are characterised by what Mbembe (2016:31) calls the 'mania for assessment', which might not be conducive to SDL.

Ramnarain and Schuster (2014) have shown that there is pressure on teachers to 'teach to the test', which promotes transmission-mode teaching and learning. This often leads to the marginalisation of both PBL and SDL. How can this culture in schools be changed? How can learning environments that nurture SDL be established in schools?

Andruske (2000) suggests that research into SDL should be widened to include marginalised individuals, as opposed to the professional middle-class. Such exploration would propel SDL into a more political realm, and would also consider SDL from a social justice perspective. The SDL research unit at the NWU could, through research that focusses on marginalised people (such as the Khoi-San in data set 1 in this chapter), provide guidance to the South African government on addressing many of the socio-economic and educational problems that the country faces. In the context of her research on women dependent on welfare projects in British Columbia, Andruske (2000) states that:

> [*S*]taff from government training programmes [*should*] understand that women on welfare have greater skills and need more than just life skills or budgeting in their programmes … women on welfare through their actions are political agents seeking to regain control and power over their lives as they navigate social spaces and social structures in their everyday worlds. (p. 4)

Through the enhancement of SDL in South Africa, many people dependent on support from the government could become successful entrepreneurs.

Indigenous knowledge holds affordances to enhance both SDL and the achievement of affective learning outcomes. However, this epistemological border-crossing between the Western curriculum and indigenous knowledge needs to be further researched. Whereas Cronje, De Beer and Ankiewicz (2015) emphasise that Western science and indigenous knowledge share many tenets (e.g. both are empirical, tentative and inferential) and that learners could benefit from such

border-crossing, other researchers warn that the metaphysical aspects that also characterise indigenous knowledge could result in pseudo-science. Another research agenda that should be pursued is to look at implications for teacher education. The work reported on in this chapter (data set 2) is limited to in-service teacher education. How should training for such epistemological border-crossing be done in preservice teacher education? Do teacher educators have the necessary knowledge and skills to perform this task?

More research on conceptual change is needed in the South African context. Vosniadou (2008) reminds us that students come to the classroom with various pre-conceptions, misconceptions and alternative beliefs, and very often these beliefs are persistent and robust, and difficult to change. From an indigenous knowledge perspective, the naïve understanding that many learners may hold could conflict with scientific theories. In such a case, radical conceptual change might be needed.

In data set 1, I have referred to research that was conducted to determine the EKI of people. However, this research is, thus far, restricted to descendants of the Khoi-San and Venda people. Research among other cultural groups is also needed. Furthermore, it would be interesting to assess the EKI of people in metropolitan areas, especially in more affluent areas.

■ Acknowledgements

In pursuit of accomplished teacher development through praxis in a South African distance learning programme

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■ Abstract

Distance learning professional development programmes are often the only means of improving the teaching competence of practising teachers in South Africa. However, these programmes are criticised for having little, if any, impact on transforming the poor education

standards in schools through improved teaching practice. There is a strong case in the literature for praxis, a reflective application of theory in practice, as a requisite stratagem to develop teachers' applied competence and ultimately transform education. Higher education institutions are, therefore, challenged to employ strategies that combine action and reflection. To address this issue, a practical component, including a work-integrated learning portfolio and visual material, was included in a distance learning professional development programme for underqualified Foundation Phase teachers. This chapter reports on a qualitative study that formed part of a distance learning programme evaluation. Qualitative data collected from 50 teachers enrolled for a distance learning professional programme were analysed for evidence of the manner in which this practical component provides for praxis to support the development of the core features of applied competence, namely, teacher understanding, practice, motivation and vision. Evidence emerging from the data confirms the value of such a practical component in supporting praxis and improving applied competence. Recommendations include a need for greater recognition of teaching context and social learning principles by the design of distance learning professional development programmes to further strengthen sustainable improved teaching competence.

■ Introduction

South Africa, like most sub-Saharan African countries, is plagued by a low standard of education attributed to, among other factors, a shortage in qualified teachers. Teachers without the minimum required qualifications are being employed to offset teacher shortages, not only in rural areas but also in urban and suburban areas. To meet the demand for qualified teachers and, consequently, raise the quality of education, the national government enrols thousands of underqualified practising teachers for Distance Learning Professional Development Programmes (DL-PDPs).

At the turn of the century, Hargreaves and Lo (2000:176) emphasised the role of teacher professional development

programmes in preparing teachers for a new professionalism that not only envelops good practice but also teachers' capacity for 'reflective intelligence'. Although Demirkasimoglu (2010) identifies a myriad of views on teacher professionalism found in scholarly debates, these debates do not fall within the scope of this chapter. However, a view advocated in a publication submitted by The Education Council of the Netherlands (2013), namely, that teacher professionalism should eventually develop into personal professionalism, is regarded as relevant for a focus on praxis as outcome of teacher professional development. According to this view, professionalism involves teachers scrutinising their own choices, actions and outcomes thereof to ensure that they make the most appropriate choices for their specific teaching context. Grounded in the literature, supporting the development of a critical inquisitive attitude with teachers should thus stand central to teacher professional learning. Furthermore, professional learning should be ongoing and continue as lifelong learning after a professional development programme (Sysko 2018).

Despite the many advantages of distance learning for teacher education in a developing country, including low costs, increased access to higher education and the attainment of equity (Kangai & Bukaliya 2011), there is a growing apprehension about the disappointing impact of professional development programmes (PDPs) delivered through distance learning on the quality of education in South African schools (Spaull 2013; Taylor 2013a, 2015; Welch 2004). Disparagement includes the lack of balance between theory and practice (Taylor 2013b; Welch 2008), while Kruger, De Witt and Janse van Rensburg (2015) echo the concern of Welch and Gultig (2002) about the capacity of DL-PDPs offered in South Africa to support teachers in developing a reflective disposition towards practice in order to improve their own teaching. The South African Department of Basic Education (2013) further raises questions about the impact of poor-quality in-service teacher training as well as the lack of teacher motivation to employ SDL with the

intention of keeping themselves updated after training. Knowles (1975) defines SDL as:

> A process by which individuals take initiative, with or without the assistance of others, in diagnosing their learning needs, formulating learning goals, identifying human and material sources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes. (p. 18)

Grounded in the definition of Knowles, SDL skills will support teachers' metacognition through reflection on their own professional learning needs, allowing them to identify the most appropriate sources to acquire as well as strategies to apply in order to become true professionals. In-service teacher training, including DL-PDPs, should thus do more to develop teachers' ability to diagnose their own learning needs and to set goals for their own professional development. The concern is, thus, the propensity of a DL-PDP to make an impact where it matters most, namely, supporting teachers to become self-directed learners who are able to take ownership of their continuous development as accomplished and reflective professionals who are able and willing to turn around poor education standards in a sustained way.

Poor education standards in schools affect a large proportion of the South African population. Despite the shortcomings of DL-PDPs, the South African Department of Basic Education (2011) views this as a means of empowering unqualified teachers as agents of change who are equipped to transform the poor standards of education of especially previously disadvantaged learners. In order to emerge from oppression, Freire (1990:33) advocates praxis, combining 'reflection and action upon the world in order to transform it'. The key role of praxis in the transformation of education is echoed in the literature (Farrell 2015; Korthagen, Loughran & Russell 2006; Zeichner 2008). The literature furthermore concurs that mere reflection on the practice of teachers will not guarantee such transformation and that critical reflection by teachers is necessary to ensure sustained improvement of practice (Brookfield 2017; Fook 2015; Lizzio & Wilson 2007; Mezirow 1990). There is thus pressure on DL-PDP

design to secure the development of a critically reflective approach to practice if these programmes are to deliver accomplished teachers empowered to transform the current poor education standards.

Shulman and Shulman (2004) place the process of critical reflection at the heart of their model of accomplished teacher development, from where it supports the capacity for purposeful change, through the transformation of a teacher's *vision, motivation, understanding* and *practice*. Grounded in their model, a practical component was added to a DL-PDP offered by a South African higher education institution. This component, entailing a work-integrated learning portfolio and audiovisual resources, aims to support teachers to improve their practice and to empower teachers to sustain improved practice through continuous and critical reflection on their own practice. No literature reporting on the way these design features support the development of accomplished teachers in a DL-PDP in the South African context could be found. This gap in the literature motivated an evaluation of the meaningfulness of this component as a contribution to the knowledge field of effective DL-PDPs offered in similar contexts.

A qualitative investigation was conducted to answer the research question, 'to what extent does the practical component support the development of accomplished teachers through praxis?'

In their Teacher Learning Communities Model, Shulman and Shulman (2004) define an accomplished teacher as:

> [*A*] member of a professional community who is ready, willing, and able to teach and to learn from his or her teaching experiences. Thus, the elements of the theory are: Ready (possessing vision), Willing (having motivation), Able (both knowing and being able 'to do'), Reflective (learning from experience), and Communal (acting as a member of a professional community). (p. 259)

The importance of learning and acting as part of a professional community of teachers, which is the main focus of this particular model of Shulman and Shulman, is not negated in this chapter. However, the main focus of this evaluation was the way in which

the practical component supports the fundamental competences of an accomplished teacher on the individual level of teacher learning. It is assumed that teachers who are able and motivated to learn and develop their knowledge and skills through critical reflection on their own practice, and who are willing to change their behaviour and vision of teaching as a result of their own learning (development), will also be better able to participate meaningfully as part of a community of practice. The features of accomplished teacher development on the individual level of teacher learning suggested by Shulman and Shulman (2004:259) constitute the conceptual and theoretical framework of the study, namely, teacher understanding, motivation, ability (knowledge and practice skills), vision and, at the core, critical reflection on own practice.

■ Conceptual and theoretical framework

The framework of Shulman and Shulman (2004) reverberates Dewey's (1938) theory of experiential learning. Through reflection on experiences, previous beliefs and understandings, teachers construct a new or revised understanding of their experiences, resulting in the formulation of an individualised theory of meaningful practice for a specific teaching context. Such new understandings will guide teachers' future actions. Critical reflection on practice, therefore, not only serves to *motivate* improved practice but also contributes to a new *understanding of* and a new *vision for* practice, bringing a more self-directed approach to own professional development and thereby promoting continuous and sustainable professional development (see Figure 5.1).

Shulman and Shulman (2004:259) are of the opinion that when a teacher demonstrates these characteristics, the chances are that he or she 'will be more willing to expend the energy and persistence to sustain' professional teaching competence. Kember et al. (2008:369) argue that all qualifications 'should promote reflective thinking as it is necessary to make reflective
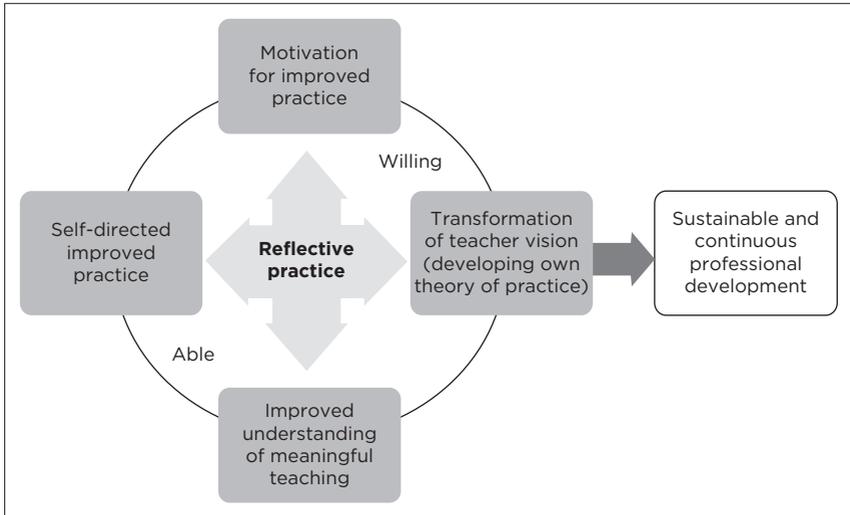
FIGURE 5.1: Core features of accomplished teacher development.

judgements to deal with ill-defined problems'. Should DL-PDPs succeed in developing these teacher competences, the teacher will be more capable to sustain improved practice, making durable changes in education standards a reality.

The central role of reflection and, more specifically, critical reflection in the development of accomplished teachers who can contribute to the transformation of education is firstly explored in related literature. Secondly, the literature on the teacher portfolio and audiovisual material is analysed in search of validation for the way these design features could serve to support accomplished teacher development.

■ The role of reflection in accomplished teacher development

Although there is general consensus on the value of reflection in teacher professional development (Çimer, Çimer & Vekli 2013;

Dewey 1933; Shulman & Shulman 2004; Valli 1997), the interpretation of reflection in the context of teacher learning is contentious (Kember et al. 2008; Larrivee 2008; Moon 2006). In agreement with Hatton and Smith (1994:7), reflection, in the context of this study, is understood as 'deliberate thinking about practice with a view to its improvement'. This view of a reflective practice relates to Freire's (1998) critical pedagogy, through which transformation is realised through praxis (Freire 1921), combining reflection and experience. In this sense, reflection includes teachers thinking about the meaningfulness of pedagogy and theory for their specific teaching context, with the aim of improving their understanding, practice and professional vision of practice.

In this study, reflection relates to the common sense dimension of reflection (Moon 2006), whereby reflection is regarded as part of the constructivist learning process, serving as a means to further develop teachers' existing knowledge and understanding. The investigation has thus acknowledged that teachers' assumptions of teaching, based on their prior knowledge and experience, will influence their reflections on their professional learning in practice. However, a change in previously held assumptions is possible through critical reflection (Mezirow 1990).

☐ Reflection and teacher understanding

Teacher understanding, as part of teacher learning from practice, is an intellectual ability to understand the relationship between subject content and pedagogy, taking into account various determinants of meaningful learning, such as the learning environment and learner background (Shulman 1987). This crucial role of teacher understanding is echoed by Sadler and Sonnert (2016) and Korthagen (2010) who caution that without supporting teacher understanding through reflection on practice, teacher education will not equip teachers to make a difference in practice. Understanding clearly implies a reflective disposition to teaching, through which teachers reflect on the implications of theory for their specific practice and thereby come to a better understanding of how to apply theory in practice.

Valli (1997) cautions, however, that reflection should develop into critical reflection, where the aim is not merely improved understanding but an understanding that should ultimately lead to enhancement of the lives of others. Such reflection demonstrating ethical awareness and an understanding of one's social responsibility is regarded as an essential criterion for critical reflection, the deepest level of reflection (Farrell 2015; Sparks-Langer et al. 1990; Valli 1997). Improved understanding through critical reflection by teachers not only has an impact on classroom practice and the academic success of their learners but can potentially enrich the lives of these learners.

☐ Reflection and teaching practice

The important role of reflection for improved practice builds on Dewey's (1916) view of reflection as an act of self-regulation, persuading a teacher to take up the responsibility for teaching and learning that could have negative consequences. Shulman (1987:19) regards reflection as imperative to learning from practice by professionals, 'when he or she looks back at the teaching and learning that has occurred, and reconstructs, reenacts, and/or recaptures the events, the emotions, and the accomplishments'. Teacher education that guides teachers in reflecting on practice is also more likely to resonate in the classrooms of teachers (Larrivee 2008; Shulman & Shulman 2004; Sparks-Langer & Colton 1991; Yasin, Rahman & Ahmad 2012).

Various researchers have warned that disregarding the central role played by teacher reflection on practice may be one of the main reasons for the poor impact of teacher education on education standards (Korthagen 2010; Shulman 1987; Shulman & Shulman 2004; Taylor 2015). Learning reflectively from practice has the potential to support the development of a more autonomous and informed approach to teaching practice (Boud, Keogh & Walker 1996; Korthagen 2010; Mezirow 1998; Schön 1983; Shulman 1987). Shulman and Shulman (2004) attest that reflective teachers will be more likely to sustain their own development with regard to their understanding, knowledge and

skills, classroom practice and vision of effective practice. This view is shared by Richards and Farrell (2011), who highlight the central role of reflection in long-term professional development.

Lampert (2010:23) describes teaching practice as 'the process of actively carrying out an idea as distinct from the process of having an idea'. Through praxis, ideas collected from theory, knowledge sharing or experience, thus need to be applied in order to improve and transform education. However, the time lapse between reflection and experience is crucial in effectuating change as a result of reflection (Loughran 2002), implying the need for continuous guidance in reflection on practice to make learning episodes meaningful. This identified need for continuous formative guidance in reflection on practice geared at the transformation of practice is difficult to uphold in DL-PDPs. Institutions offering distance learning programmes are increasingly looking to the use of learning portfolios to support a self-directed reflective approach to experiential learning. In a context where students have access to technology and where they have the necessary technological competencies, the electronic portfolio (e-Portfolio) to support student reflection on practice is trending (Brandes & Broskic 2008; Carl & Strydom 2017; Zawacki-Richter, Hanft & Baecker 2011). However, in a developing context, such as South Africa, socio-economic inequalities and the disparity in access to technology often hinder higher education institutions employing e-Portfolios to support reflection on practice in DL-PDPs for teachers (Kruger et al. 2015).

☐ Reflection and teacher motivation

Apart from the direct influence of motivation on the quality of practice (Han & Yin 2016; Karabenick & Conley 2011; Muranda et al. 2015), teacher motivation is viewed as a critical prerequisite for ongoing self-directed professional learning (Karabenick & Conley 2011; Krebera 1998; O'Farrill 2012; Zimmerman 2008). While Ahmad et al. (2013) highlight the relationship between teacher motivation and professional attitude, Han and Yin

(2016:4) have come to the conclusion that 'motivation specifies the reason why people decide to do something, how long people are willing to sustain the activity and how hard they are going to pursue the activity'. Teacher motivation has also proved to be a decisive factor in educational reform (Çimer et al. 2013; Han & Yin 2016; Kubanyiova 2006), emphasising the need for South African DL-PDPs to elevate teacher motivation.

The special kind of relationship between reflection and motivation has been the focus of numerous investigations. The role of reflection in improved motivation is well documented (Çimer et al. 2013; Shulman & Shulman 2004; Zimmerman 2008). More than two decades ago, Boud et al. (1996) described motivation as the prime mover for a reflective approach and a changed vision.

Furthermore, reflection has been shown to improve confidence (Ellis 2001; Smith 2011), which has the potential to enhance teacher motivation and competence to better deal with future challenges in practice. Kubanyiova (2006) even came to the conclusion that the absence of a reflective culture could hamper the development of a motivational teaching practice. Shulman and Shulman (2004) indicate that when critical reflection by teachers leads to a new awareness of the discrepancy between their professional vision and their actual performance, motivation to transform their practice is generated. Reflection thus enhances teacher motivation to continue innovating one's own methods of learning and ensures self-satisfaction when goals are met, which concurs with reports by educationists advocating that self-regulated skills support sustained teacher development (Korthagen et al. 2006; Shulman & Shulman 2004; Tillema 2000).

☐ Reflection and professional vision

Sherin and Van Es (2009:20) define teachers' professional vision as involving 'the ability to notice and interpret significant features of classroom interactions'. They discriminate between selective attention, by which professional vision will determine a teacher's

decisions on actions to be taken at a given moment, and knowledge-based reasoning, referring to the ways in which a teacher reasons about what is noticed based on his or her knowledge and understanding. Reflection is essential for both these dimensions of vision, supporting teachers in the development of an own practice theory grounded in a professional vision. Formulating a personal practical theory will force teachers to reflect on their own beliefs, making their implicit theory or beliefs explicit when they question their own assumptions (Maaranen et al. 2016). Although a practice theory or vision does not guarantee the realisation of good teaching, visions of possible outcomes of good education were found to have the most enduring and powerful influence on teachers (Shulman 1987). Reflecting on personal practical theories guides teachers in examining their values and starting to build a teacher identity, and increases resilience and commitment (Maaranen et al. 2016).

Providing these influences is the responsibility of teacher education programmes. Shulman and Shulman (2004) postulate that a teacher with a vision of *why, how* and *what* to teach is *ready* to teach. A professional vision drives teacher actions and serves to motivate the transformation of practice to match this vision (Kember et al. 2008; Vaughn & Faircloth 2013). Husu and Tirri (2007:394) furthermore emphasise the interrelatedness between a reflective practice, motivation and vision when they declare that 'vision can provide a sense of reach that inspires and motivates teachers, and also guides them to reflect on their work'.

A teacher's professional vision will critically determine all that happens in the classroom and is based on his or her own assumptions of what good practice entails. These assumptions are rooted in issues such as political, cultural, economic, logical or spiritual matters, as well as in prior experience of teaching (Mezirow 1998). Breaking down inappropriate assumptions or habits of mind is not easily accomplished in a DL-PDP and will require innovative pedagogy as part of the programme design.

The role of each feature, as suggested by Shulman and Shulman (2004), in accomplishing teacher development is clearly supported in the literature. The central role played by critical reflection in this

theory mirrors Mezirow's (1998) view of the role of critical reflection on one's assumptions that is necessary for transformative learning, effecting the transformation in frames of reference, leading to improved practice. Mezirow's transformative learning theory was the inspiration for various investigations with a focus on the role of reflection in teacher education (Kitchenham & Chasteauneuf 2009; Liu 2015; Schols 2012; Sifakis 2009). Kember et al. (2008) specifically emphasise the role of critical reflection in changing deep-rooted beliefs necessary for transformation.

Kubanyiova (2006) emphasises that PDPs should include activities that encourage reflection for meaningful change to occur, but notes that such activities are difficult to implement as they require SDL, which often is not part of a teacher's awareness. Shulman and Shulman (2004) also paint a bleak picture of the transformation of education should reflection on experience be left out of teacher development. Grounded in the literature, the two design features, namely, the teacher portfolio and audiovisual material on classroom practice, were added to a two-year DL-PDP for Foundation Phase (Grades 1–3) teachers. The next section expounds the literature as confirmation of the value of these features for accomplished teacher development.

■ Supporting the core features of applied competence in a distance learning professional development programme

The value of the teacher portfolio and audiovisual material for accomplished teacher development is grounded in a synthesis of theories such as the constructivist learning theory (Piaget 1964), Dewey's (1933) reflective theory and Mezirow's (1990) transformative learning theory. The underlying principles of the three theories are clear, where Zubizarreta (2004:2) describes a learning portfolio as a 'reflexive, evidence-based process that combines reflection and documentation', while at the same time 'engaging students in an ongoing, reflective, and collaborative analysis of learning'.

Portfolio tasks that guide teachers in the reflective application of new knowledge in practice not only support knowledge construction but also reflection as a learning principle driving the improvement of practice, a principle of Mezirow's transformative learning theory. Yasin et al. (2012:3839) emphasise the dual value of a portfolio in focusing 'on purposeful, selective outcomes for both improving and assessing learning'. Perhaps, the most powerful argument for the use of a portfolio as a tool for reflective learning is captured in the definition by Zubizarreta (2008):

> The intrinsic merit of learning portfolios is that they involve students in the power of reflection, the critically challenging act of thinking about their learning, and constructing (and communicating) a sense of the learning experience as a coherent, unified, developmental process. (p. 2)

A portfolio serves as a framework to aid knowledge construction through which new knowledge is either assimilated or accommodated to form part of the existing knowledge network (Piaget 1964) through reflection on their own practice. Moreover, the reflective use of audiovisual material has the potential to provide relevant exposure to real examples of good classroom teaching by which teachers can link theory with practice (Newhouse, Lane & Brown 2007). At the same time, reflection evolving from the portfolio compilation and viewing of the audiovisual material can motivate a new vision for and transformation of own practice. Boud and Walker (1992) further accentuate that active reflective activities, including learning portfolios and guided reflection following experience-based classroom activities, develop students' reflective skills.

Although the list in Table 5.1 is by no means extensive, it serves as a confirmation of the literature strengthening the surmise that a portfolio and audiovisual material have the potential to support the core features of accomplished teacher development as identified by Shulman and Shulman (2004). Strong support of the way these two design features can serve to strengthen the sustainability of learning outcomes was also found in the literature. Therefore, Table 5.1 also refers to literature that highlights this crucial benefit of the two design features.

TABLE 5.1: Validation from the literature of the value of the portfolio and audiovisual material in supporting core features of accomplished teacher development.

Core features of accomplished teacher development	Literature on the value of the two components	
	Teacher portfolio	**Audiovisual material**
Teacher reflection	Lyons (2010) Yasin et al. (2012) Wade and Yarbrough (1996)	Cherrington and Loveridge (2014) Newhouse et al. (2007) Zhang et al. (2011)
Understanding	Shulman (2005) Shulman and Shulman (2004) Yasin et al. (2012)	Cherrington and Loveridge (2014) Newhouse et al. (2007)
Practice	Shulman (2005) Yasin et al. (2012)	Cherrington and Loveridge (2014) Newhouse et al. (2007) Zhang et al. (2011)
Motivation	Klenowski, Askew and Carnell (2006) Shulman (2005) Chang (2008)	Borko et al. (2008) Kleinknecht and Schneider (2013)
Vision/professional vision	Lyons (1998) Shulman (1998)	Sherin and Van Es (2009) Zhang et al. (2011)
Sustainable learning outcomes	Brown (2001) Klenowski et al. (2006) Darling-Hammond and Snyder (2000)	Cherrington and Loveridge (2014) Masats and Dooly (2011)

Based on Shulman and Shulman's motivation of the special relationship between these core features in the development of competent teachers, an investigation of the way the practical component had supported the development of these core features was viewed as crucial for future DL-PDPs implemented in a country troubled by low educational standards. Although the value of deep critical reflection for the transformation of practice is acknowledged, grading or evaluating the level of teacher reflection was not the focus of the investigation. The practical component rather aimed to foster praxis in order to support the development of accomplished teachers. The investigation thus looked for evidence of the way the practical component supported the features of accomplished teacher development.

■ The case study

The poor education standards in the Northern Cape province of South Africa are partly attributed to the large number of unqualified teachers in the province (Northern Cape Department of Education 2017). This issue motivated the Northern Cape Department of Education to enrol 260 unqualified teachers for the Advanced Certificate in Education, a PDP delivered via distance learning. The case study focused on the experiences of the first of three cohorts that consisted of 50 practising Foundation Phase teachers, enrolled in 2010 for the 3-year programme.

The regular 1-year DL-PDP, geared at the professional development of unqualified teachers of Grade 1 (6-/7-year-old learners) up to Grade 3 (10-/11-year-old learners), was delivered via distance learning by a South African higher education institution and focused mainly on summative assessment of the way teachers mastered theoretical content. In order to adhere to the requirements of the service agreement, namely, to support and assess the development of teachers' applied competence, it was necessary to revise the programme by including a practical component. Motivated by the literature (Table 5.1), the practical component contained a work-integrated learning portfolio and audiovisual material. A study guide helped teachers systematically in the study of relevant theory on core principles of teaching for each of the subject areas in the Foundation Phase and reflection on related audiovisual images of classroom practice provided on a DVD, as well as the planning, implementation and critical evaluation of various learning experiences for their specific grade. Teachers had to compile evidence of their reflective learning in and from practice in the learning portfolio.

Where the experiences of the small group of teachers were explored after the implementation of the practical component, the case study was bounded by time and activity. Although it was anticipated that the practical component would help address the concerns with regard to the way distance learning programmes support teachers' applied competence through praxis, it is

acknowledged that various factors played a role in programme outcomes.

In line with the recommendations of Dede et al. (2009), an implementation evaluation was performed specifically to provide strong explanations for theory and model building with regard to the value of such design features in a practical component in a DL-PDP to develop accomplished teachers through praxis.

■ Research orientation and design

An interpretivist epistemology allowed for the interpretation of the participants' voiced experiences of the programme component in their specific teaching contexts. This research orientation is grounded in the belief that if teachers are to be actively engaged in their own learning, their voices should be heard (Cook-Sather 2002; Walker 2008). The qualitative approach to programme evaluation allowed for a better understanding of the way the practical component supports Foundation Phase teachers to reflect on practice, with a specific focus on the way reflection relates to understanding, practice, motivation and vision as fundamental and interrelated teaching competencies (Shulman & Shulman 2004).

Ethical clearance was obtained from the research committee of the relevant university. Permission to conduct the research and use the data generated by the research was obtained from the Northern Cape Department of Education as the founder and financier of the bursary project. After the study had been explained to the study population, written consent was obtained from willing participants. They were assured that their participation was voluntary and anonymous and that participation in the study would not influence their academic results.

Data were collected from the sample of teachers through open-ended questions that formed part of a semi-structured questionnaire, as well as through individual interviews, allowing for interpretations of the world as understood by the people studied as well as the researcher's own understanding (Patton 1987).

■ Strengthening trustworthiness of the qualitative case study

Although qualitative studies can seldom be generalised to larger study populations, the evaluation of one component of a programme has the potential for greater transferability than whole-programme evaluations (Patton 2008). Stake (2005), furthermore, posits that a qualitative case study approach to programme evaluation may render more credible findings than experimental control studies. The credibility of the inquiry was enhanced by using thick description, while the data gathered through individual interviews and open-ended questionnaires provided for triangulation as the multiple methods were directed at different perspectives of the way the practical component included in the DL-PDP supported the core features of accomplished teacher education. Recording and accurate transcription of all interviews strengthened the dependability of the data collected, and conformability was enhanced by subjecting the findings to peer review by colleagues in the field. Language diversity was accommodated by simplifying the language used in the interviews and questionnaires. The participants were also motivated to substantiate their answers in light of the settings of their schools, providing the opportunity for the recognition of the specific teaching context in the data analysis.

■ Data collection, processing and analysis

After having written their final exam paper, the whole group of teachers enrolled as part of the specific cohort ($N = 50$) was invited to voluntarily complete the questionnaire at the exam centres and 48 ($n = 48$) opted to participate. As part of quality control, visits to four of the schools where the enrolled teachers were employed formed part of the service-level agreement between the higher education institution and the Department of Education. At each of the four schools visited, one enrolled teacher was asked to voluntarily participate in an individual interview ($n = 4$). A semi-structured interview schedule, synchronised with the prescribed portfolio structure, guided the four interviews, which were

conducted while paging through each interviewee's completed portfolio. Oosterbaan et al. (2010) found portfolio-based conversations to be meaningful to support reflection as part of SRL. While the interview schedule ensured that the interviews focused on matching aspects of the teachers' experiences of the practical component, paging through the portfolio provided the teachers with the opportunity to motivate the inclusion or omission of specific evidence of experiential learning. All the data were transcribed verbatim, after which ATLASti™ (v. 7.5.10), a computer-aided analysis program, was used for open, axial and selective coding.

The questionnaire items and the interview schedule did not explicitly focus on the core elements of accomplished teacher development (Shulman & Shulman 2004) but focused on the teachers' experiences with regard to the way the practical component supported them in gaining the relevant knowledge and skills required for practice. Shulman and Shulman's core elements of accomplished teacher development, however, served as the main themes for selective coding through deductive reasoning, with subthemes emerging from the data through inductive reasoning.

It is acknowledged that the questionnaires and interviews could have elicited teacher reflection on the practical programme component. The selection of quotations was, therefore, based on clear evidence of deliberate thinking about practice, with a view to its improvement (Hatton & Smith 1994). Loughran's (2002) view of effective reflective practice as framing and reframing of the practice setting so that the teacher's wisdom in action is enhanced also informed the coding of quotations as evidence of accomplished teacher development grounded in reflection *on* and *in* practice. All of the quotations adhering to this description were linked to 'reflection' as central to accomplished teacher development, after which these quotations were classified as a reflection on understanding, practice, motivation and vision as core features of accomplished teacher development (see Figure 5.1). Although the investigation did not measure reflective and non-reflective practice, quotations clearly indicating the lack of a reflective and

self-directed disposition to practice after the programme are also discussed in the findings.

Discussion of the findings

Constant comparison of quotations related to the core features has enabled the identification of the strengths of the themes and subthemes through triangulation and negative evidence in the findings (Boeije 2002). Through ATLASti™, a network of the themes with their related codes has been generated, which serves as the basis for the discussion of the findings (Figure 5.2).

The responses are reported verbatim and unedited. For anonymity, the four interviewees are referred to as Teachers A, B, C and D, while questionnaire responses are indicated according to numbers allocated to questionnaires (T1–T48).

Teaching context

An in-depth analysis of the teaching context does not fall within the scope of this chapter. However, findings with regard to the way the programme supported the development of accomplished teachers should be interpreted in light of the diverse teaching contexts in South Africa. Participant responses confirmed the poor socio-economic context of the province as reported by Jacobs et al. (2007). These circumstances clearly contributed to typical challenges that confront the South African teachers enrolling for DL-PDPs:

> So it is very difficult, especially if you have many learners who are sick and some of them are orphans. And there are many in class. Like in our situation … we have 46 … 47 in a class. (Teacher B, undisclosed gender, date unknown)

> Most in my class, their parents are unemployed … what about now the other classes? Because when we were registering the children every single parent who was there to register was just unemployed … unemployed … So I found out that 85% of the parents are not working. (Teacher D, undisclosed gender, date unknown)

Language diversity as a barrier to meaningful reflection, in a country where 11 official languages are acknowledged in the school
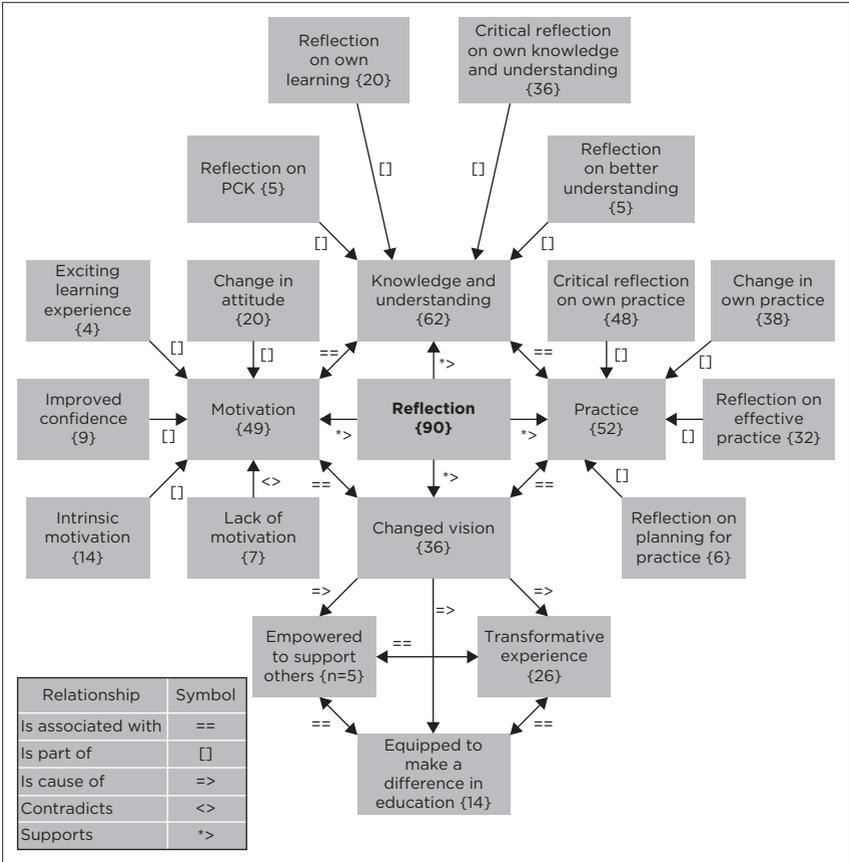
FIGURE 5.2: Network of identified codes related to interrelated core features of accomplished teacher development.

system, is also evident in the verbatim quotations. In South Africa, learners are taught in their mother tongue in the Foundation Phase (Grades R–3), which in the Northern Cape is mostly isiXhosa and Afrikaans (SouthAfrica.info 2012). As higher education institutions cannot deliver PDPs in 11 languages, teachers need to study and provide evidence of applied competence in English as the language of instruction, which is mostly not the primary language of these teachers or their learners.

Understandably, the language diversity and socio-economic challenges, together with a large teacher–learner ratio, will not only affect teacher motivation to implement newly acquired knowledge and skills in a sustainable way but will also influence teachers' visions of meaningful practice. Contextual factors may, therefore, hamper the realisation of accountable teaching grounded in reflective practice and should be accommodated in future DL-PDP design.

☐ Reflection on teacher understanding

Teacher education should not only help teachers to deeply understand a wide array of knowledge related to teaching but also to apply this understanding in practice (Darling-Hammond 2006). Informed decision-making before and during the implementation of knowledge in practice is dependent on this deep understanding. The interrelationship between understanding and theoretical knowledge, therefore, informed the coding for this theme. Apart from five quotations (*n* = 5) illustrating *better understanding*, this theme also includes quotations linked to *critical reflection on own knowledge and understanding* (*n* = 36), *reflection on own learning* (*n* = 20) and *reflection on PCK* (*n* = 5). The interrelatedness between improved knowledge, understanding and implementation is illustrated by Teacher D:

> The knowledge … They've helped me because as I've said, you work with different kinds of learners with different kinds of problems. So I didn't know how to implement, maybe a child is struggling with writing or when I went through this I thought … ooh I could have done this … (Teacher D, undisclosed gender, date unknown)

This opportunity for Teacher D to experience the connection between theoretical content and her own practice might have been lost in a distance learning programme only focusing on summative assessment of theory without requiring proof of implementation in a portfolio. Reflection on what she '*could have done*' if she had had this knowledge before is evidence of enhanced wisdom in action through the reframing of the practice setting (Loughran 2002).

Reflection on *improved PCK*, referring to a better understanding of how young learners learn, is demonstrated by Teacher B,

who clearly realised the futility of her previous teaching strategies, ignoring appropriate pedagogy:

> I didn't know most of the things, maybe I ignored them, you know, I will come in class and teach and teach to those learners but not in a way this programme helped me. (Teacher B, undisclosed gender, date unknown)

The value of a portfolio in guiding reflection on teacher knowledge was further confirmed by clear reference to the interrelatedness between improved practice, a change in teacher vision and improved motivation:

> The portfolio has opened my eyes. Now I can look at my learners with learning barriers with positive attitude because now I know how to handle and work with them. Prior [to] this programme I was very much frustrated. I even put them aside [be]cause I just didn't have the knowledge and tip of dealing with them. (Questionnaire Response T1, undisclosed participant, date unknown)

The honest confession by this teacher that she previously *'put learners with barriers aside'* makes a strong case for a more practice-based component as part of a DL-PDP.

Metacognitive reflection, through which teachers think about their own learning, including CL, is viewed by Shulman and Shulman (2004) as the key to teacher learning and development. The 20 quotations linked to *reflection on own learning* included learning to improve own practice, CL, research to improve PCK, time management and an endeavour to improve self-regulation:

> I need a lot of knowledge. I have to do research and have to sit down; this step has really brought me back. (Teacher D, undisclosed gender, date unknown)

> We don't usually read a lot. So the portfolio … it pushed us to read and to know what goes on in the school … when there is bullying, how these children should be handled. (Teacher B, undisclosed gender, date unknown)

> I think we have a problem among us of just planning together. I think we are afraid of each other… (Teacher A, undisclosed gender, date unknown)

The evident realisations of a lack of self-directed skills could serve to motivate teachers to expand their own knowledge and

understanding through inquiry, research and collaboration and, in the process, improve their teaching practice in a self-directed manner. Such thoughts about own learning from and in practice also hold potential for supporting metacognitive skills (Shulman & Shulman 2004), consequently improving one's understanding of own learning and self-regulated professional development. However, in accordance with Timperley (2008), ongoing support for critical reflection on own practice after the programme is crucial to sustain continuous professional development.

☐ Evidence of reflection on practice

The quotations illustrating reflection on practice were sorted according to four codes, namely, *reflection on effective practice* (*n* = 32), *reflection on planning for practice* (*n* = 6), *reflection on a change in practice* (*n* = 38) and *critical reflection on own practice* (*n* = 48).

Reflections on effective practice were mostly prompted by the audiovisual material on the DVD, confirming the value of visuals in encouraging a new outlook on teaching (Zhang et al. 2011). The modelling of meaningful practice through the visuals evidently changed the following teachers' perceptions about the important role of a favourable learning environment, classroom management and teaching–learning theories such as Howard Gardner's multiple intelligences:

> The graph and everything was so colourful and the children knew how to go about, and you know discipline, a lot of discipline … you have to implement also discipline. And if the children see the environment of the class is conducive, they learn more easily and everything is there … there in the corner … and the classroom arrangement … I liked the mat there … it gave really a good impression. You know … our classes are really not impressive … not conducive. (Teacher D, undisclosed gender, date unknown)

> The mathematics lesson … when we saw it there [*on the DVD*] it made you so excited that the following day we tried it and you could see that the children benefit by it. (Teacher C, undisclosed gender, date unknown)

Teacher C further stated:

> The one [*video clip*] about multiple intelligence. That got me quite thinking. (Teacher C, undisclosed gender, date unknown)

Although the literature acknowledged the potential of practice-based videos to instil a new vision for meaningful practice (Sherin & Van Es 2009), the teachers recognised the contextual differences between visuals mostly recorded in a well-resourced classroom and their own circumstances. Teacher C, who teaches in poor socio-economic circumstances, expressed a feeling of hopelessness based on the well-equipped classroom illustrated in the video:

> You know, if wishes were horses we could all wish for those … but schools in our situations… [*sigh*] (Teacher C, undisclosed gender, date unknown)

In a developing country where access to teaching and learning resources is not a given, DL-PDPs require innovative ways to guide teachers in reflection on practice, and visuals with which the teachers can relate should be considered. Illustrating costly resources in visuals to teachers working in schools that can hardly afford basic materials may be demotivating rather than motivating.

Reflection on planning for teaching is a prerequisite for effective education and applied competence. Confirmation was found of the value of the practical component in strengthening planning skills, in turn improving teacher confidence:

> I feel more confident with my planning and designing my own learning and teaching aids. (Questionnaire Response T22, undisclosed participant, date unknown)

> I like teaching, but planning can be a little bit difficult. So the portfolio made me to at least learn how to plan. Because sometimes we plan, but we do not know what we are doing. (Teacher B, undisclosed gender, date unknown)

These teachers acknowledged their prior lack of confidence to plan for teaching and learning and to highlight the need for PDPs to provide more guidance in this regard. Teachers should be motivated not only to reflect after teaching and learning but also during planning for meaningful practice.

Motivated by the literature (Goddard, Goddard & Tschannen-Moran 2007), the portfolio tasks require shared planning and reflection to enhance teacher efficacy and attitude as well as learner performance. However, a lack of cooperation among teachers was reported:

> Most of the teachers at school don't like sharing ideas. It seems as if each one is only for himself. I like sharing but sometimes it is difficult to come together and share. (Questionnaire Response T36, undisclosed participant, date unknown)

Various quotations admitted to professional shortcomings, while a relatively high number of quotations could be linked to reflection on *a change in practice* as a result of the programme. Changes made in practice, based on a changed attitude and motivation, are evident in the declaration by Teacher D:

> I have realised that I have gained that strength to go back to a class and say, let me implement this and let me have patience with this [*sic*] children. And what I did, I will never let it go down the drain. Let me use it. Let me be in my class on time. Let me teach this [*sic*] children. So I've learnt a lot of things and how to go about learning and handle the kids. A lot of patience, you know. Sometimes you shout and they can't even concentrate so I've been trying to be there for them. I've learnt a lot from this course and I really want to implement it after this. (Teacher D, undisclosed gender, date unknown)

Mere reflection does not guarantee improved applied competence (Zeichner & Wray 2001). However, acknowledging own shortcomings and considering alternative practices through *critical reflection on own practice* is viewed as an imperative first step towards change and improved practice. The 48 quotations indicating a critical reflection on own practice can be regarded as a strong indication that the programme component encouraged teachers to evaluate their current practices and consider alternatives. Sustaining this reflective approach to practice emerging from the data requires a deep-rooted motivation for improvement of own knowledge and practice. The data were, therefore, explored for reflections on the way the programme had contributed to motivate teachers to develop as professional self-directed teachers.

☐ Reflections on teacher motivation

In total, 49 quotations (*n* = 49) linked to motivation were classified according to five affective constructs related to professional enthusiasm, namely, *changed attitude towards teaching* (*n* = 20), an *exciting learning experience* (*n* = 4), *improved commitment* (*n* = 2), *intrinsic motivation* (*n* = 14) and *improved confidence* (*n* = 9).

A relationship exists between a positive attitude, teacher motivation and accomplished teaching (Ahmad et al. 2013), while a positive approach or attitude towards teaching is a prerequisite for sustained teaching effectiveness. The following quotations illustrate a changed attitude and improved commitment by the teacher:

> The portfolio has opened my eyes and now I can look at my learners with learning barriers with [*a*] positive attitude. (Questionnaire Response T1, undisclosed participant, date unknown)

> This was an amazing experience because in my life it makes me appreciate and care for learners with disabilities and make me realise the importance and to accommodate them as a teacher. (Questionnaire Response T13, undisclosed participant, date unknown)

The link between poor socio-economic background and low educational achievement is confirmed by the literature (Bayat, Louw & Rena 2014; Milner et al. 2017; Thomson 2018). Teachers working in schools situated in low socio-economic contexts need to be equipped to support the particular learning barriers that these learners may face. A lack of practice-based training in this regard may result in teachers feeling ill-equipped to support such learners. The above quotations are a strong indication that the practical component addressed these teachers' knowledge and skills gaps, contributing to an improved commitment and motivation to support learners with learning barriers.

A focus on extrinsic rewards such as better remuneration, good examination results and *making the family proud* (*n* = 3) also emerged. However, the teachers' reflections also showed improved *intrinsic motivation* for continuous professional development, as shown in the below excerpt:

> The programme helped me a lot and it encouraged me to study further. (Questionnaire Response T2, undisclosed participant, date unknown)

Such quotations were also linked to the theme 'a change in teacher vision' (see below) as the programme clearly played a role in inspiring a vision for a personal professional development plan.

Various quotations showed evidence of *improved confidence* that strongly relates to greater motivation to make a difference in practice, as expressed by the following participants:

> I am so pleased that I did this course. To me it has been the eye-opener. Last time when I did the ACE literacy I was fumbling. Now I am not scared at all. (Questionnaire Response T33, undisclosed participant, date unknown)

> I realised that I have the passion and love for teaching at heart. This programme motivated me, although it was hard, studying, working and being a mother. I persevered because it brought light not only to me, but to my learners and colleagues. (Questionnaire Response T9, undisclosed participant, date unknown)

Where a DL-PDP aims to influence the practice of teachers, improved motivation can be a primary contribution. Grounded in the model of Shulman and Shulman (2004), a teacher who is motivated (willing) to improve his or her own practice will be more inclined to apply SDL skills, critically reflect on own practice and, if necessary, find and implement lacking knowledge and skills. The conjoined role of motivation and vision in teacher professional development is further emphasised in the following section discussing reflections on teacher vision.

☐ Reflections on a change in teacher vision

Quotations illustrating reflections on a *change in teacher vision* were sorted according to three codes, namely, a *transformative experience* (*n* = 26), *empowered to support others* (*n* = 5) and *equipped to make a difference in education* (*n* = 14). These codes were also termed 'ultra-codes', as a change in vision is regarded as a strong indication of sustained change in practice (Timperley 2008).

Expressions that the programme component made a significant impact on existing teaching perspectives were linked to the code *transformative experience*:

> It was a challenge but it was … eye-opening … it was eye-opening… (Teacher A, undisclosed gender, date unknown)

Teacher D, a well-qualified teacher, voiced her changed perspective on education and own professional development as a result of the PDP:

> I took the opportunity because after doing my Teacher's Diploma, I went for Higher Diploma in Education and then I went for a BEd Honours. But I found this course … I've never had studies like this before … I know that I am going to contribute something. This course has really, really developed me. (Teacher D, undisclosed gender, date unknown)

As Teacher D has attained all of her previous qualifications through distance learning programmes, she confirms the value of the practical component of the DL-PDP, in contrast to theoretically focused programmes, in developing accountability as an accomplished teacher. This view is shared by Teacher B:

> It was a great programme! I would include more teachers, because they have the degrees but they don't have the know-how. And even how to help our learners and our parents. (Teacher B, undisclosed gender, date unknown)

The above quotation confirms the value of the practical component in accommodating praxis, and was also linked to the code *empowered to support others.* A vision for a more cooperative approach by teachers as a community of professionals was also voiced by Teacher A:

> It [*visual material*] helped me, that part, because I had to help other teachers … they were struggling with making their own big books. (Teacher A, undisclosed gender, date unknown)

Professional development includes social learning whereby teachers learn from and with others (Lieberman & Mace 2008). Teacher A's confidence to support colleagues could also be a strong indication that the practical component has instilled in her a new awareness and vision of her role as part of a community of practice.

Quotations on the way the programme has *equipped teachers to make a difference in education* typically refer to experiences of improved efficacy founded on knowledge gained through the programme as well as a change in teacher attitude:

> [*Through the programme*] I learnt to be empathetic towards the children. Because you don't understand what is happening at their homes. So you need to know them, you need to understand and to care and help them with their problems. (Teacher C, undisclosed gender, date unknown)

> I think if all are empowered through this programme, then the educators would also be able to help to improve the education of our learners. (Questionnaire Response T7, undisclosed participant, date unknown)

Teachers who believe that they have a role to play in contributing to an improved education system will have a propensity towards self-directedness, continuously reflecting critically on their own practice and that of others. The following quotation strengthens the surmise that the programme holds value to initiate change in the professional vision of teachers through critical self-reflection:

> This programme was an eye-opener for me, I had lost touch with teaching method and was redundant in my teaching, but with this Foundation Phase learning, I became closer to my learners and some of the parents, [/] was able to discuss problems with colleagues and parents. (Questionnaire Response T9, undisclosed participant, date unknown)

☐ Lack of teacher self-directedness

Although the responses mostly strengthen the case for a practical component in a DL-PDP, the data analysis also indicated a need for the development of self-directed skills of teacher-participants, such as critical reflection on own practice and self-regulation of own professional learning. Self-directed learning plays a critical role in the success of DL-PDPs in guiding teachers to a more self-regulated approach to practice and their own professional development. A *lack of reflective skills* (*n* = 10) may hinder praxis and the development of applied competence:

> [*Interviewer: Which video clips made an impression on you?*] Ooh, I'm forgetting some of the things. It's been a long time … (Teacher A, undisclosed gender, date unknown)

In total, 26 quotations demonstrated a lack of self-regulation (*n* = 26), which may inhibit professional growth through the programme. When asked why she left out required evidence in her portfolio, Teacher B acknowledged her lack of self-regulation:

> This portfolio took a lot [*of time*] and I don't know what to say because it will look as if I'm making up an excuse and there is no excuse. There is really no excuse. (Teacher B, undisclosed gender, date unknown)

These quotations confirm that not all teachers embraced SDL as was expected from them in the planning and implementation of the tasks that formed part of the practical component. The practical component specifically set out to motivate the transformation of ineffective practice, whereby teacher-participants critically reflect on their own practice and change their taken-for-granted perspectives of meaningful practice as necessary. However, Mezirow (1990) warns that such perspective transformation through critical reflection during everyday practice does not happen easily. Various researchers have also confirmed that although critical reflection is a necessary skill for professional learning, not all persons find this easy and it takes time to develop (Brookfield 2017; Kember et al. 2008; Moon 2006).

■ Conclusion and recommendations

Based on the literature, it was anticipated that the practical component will serve as a vehicle for praxis, combining reflection and practice (Freire 1921), thereby improving teachers' understanding, practice, motivation and vision. The findings strengthen the surmise that a practical component as part of a DL-PDP holds opportunity for praxis by helping teachers to link theory to practice through reflection and thereby support the development of the fundamental teacher competencies. The high frequency of quotations referring to critical reflection on own practice holds even more meaning as critical reflection is a prerequisite for sustainable change in teacher behaviour (Dewey 1916; Lobman et al. 2004; Mezirow 1990). A change in teacher perspectives and vision through critical reflection on practice will

support the development of a more sustainable self-directed practice (Kember et al. 2008; Shulman & Shulman 2004; Vaughn & Faircloth 2013).

While the value of the practical component in supporting praxis is strongly indicated in the findings, the compilation of portfolios is time-consuming and requires SRL by enrolled teachers. The distance between these teachers and the higher education institutions offering DP-PDPs, furthermore, makes it difficult for teacher educators to continuously support and motivate the teachers to implement all aspects of the practical component. To optimise the impact of such a practical component in a DL-PDP will, therefore, require collaboration between the higher education institution offering the DL-PDP and other stakeholders, such as the Department of Education and the school management. Teachers enrolled for DL-PDPs need to be convinced of the benefits of such a practical component for their practice and professional development and should be supported in practice in developing a critically reflective approach to practice.

Responses demonstrating a lack of collaboration between teachers as part of a community of teachers, furthermore, raise concern and call for an exploration of ways to effectively incorporate social learning in DL-PDPs. Measures to provide support for praxis could therefore include a rigid mentorship system, whereby a qualified mentor guides the teacher-mentee in the critically reflective application of theory in practice and motivates him or her to improve his or her practice through continuous professional learning. Initiatives to provide a supporting environment through mentorships and peer observation, including peer reflection, may further support continuous critical reflection on all aspects of teaching. This may also provide the opportunity for formative feedback directly after the implementation of learning experiences by peers who understand the particular challenges of their teaching context. Such CL strategies may also serve to develop a culture of cooperation among teachers who act as part of a community of learners, as suggested by Shulman and Shulman (2004).

The findings further show that teacher profiles and teaching contexts need to be accommodated by the DL-PDP design to ensure a sustained reflective approach to diverse teaching contexts. To ensure sustainability, adaptations to the programme may be required, such as including visuals of practice scenarios recorded in diverse teaching contexts.

The inclusion of a teacher reflective journal as part of the programme should be investigated to specifically support continuous reflection on own practice. Henderson, Napan and Monteiro (2004) suggest structured approaches to reflection in DL-PDPs to promote a better understanding of own learning processes, encourage deeper learning and develop professionals who will be lifelong learners, committed to continuous improvement in practice. Moreover, a critically reflective approach to practice by teachers will support the fundamental teacher competencies and consequently make a difference in education standards.

South Africa is in dire need of a far-reaching transformation of its education standards. Time is running out for the thousands of learners being subjected to poor-quality education. As critical reflection triggers transformative learning (Mezirow 1990), it is vital that DL-PDPs not only transfer knowledge to enrolled teachers to be summatively assessed through exams but also that these programmes explore and evaluate ways to support praxis through critical reflection on practice and theory if these programmes are to contribute to the transformation of education in South Africa.

> *By three methods we may learn wisdom: First, by reflection, which is noblest; second, by imitation, which is easiest; and third, by experience, which is the bitterest.*
>
> – Confucius

Towards a multiliteracies framework in support of self-directed learning through open educational resources

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■ Abstract

In the use of OERs, there is a need for SDL. This process of supporting SDL, however, requires specific literacies on the part of students. In this regard, the concept of multiliteracies provides an adequate approach through which a number of necessary skills and practices can be explored to support SDL through the use of OERs.

Because of technological developments, there has been a move from a singular word-based literacy to a preference for a range of multiliteracies. For the sake of this discussion, these literacies are regarded as skills and practices that are context-specific and social in nature. The so-called digital literacies are also relevant in this research. To delineate the research context, the concepts of SDL and OERs were explored and defined.

The research in this chapter took the form of a conceptual study and involved an integrative literature review as well as a document analysis of specifically identified OERs and repositories. In creating a multiliteracies framework in support of SDL through OERs, the concepts of multiliteracies pedagogy and OERs were considered. Furthermore, specific multiliteracies relevant to SDL and OERs, based on the integrative literature review and document analysis, were identified.

In conclusion, this research presents a multiliteracies framework in support of SDL through OERs, which could be used as a basis for further research and multiliteracies measurement. The framework covers foundational, technological content as well as multiliteracies specific to SDL and OERs.

∎ Introduction

There has been an increasing trend towards the extension of and increase in the use of OERs in higher education; however, such use has not been considered in terms of the multiliteracies, or multiple literacies, required by the users of OERs. The use of OERs by students requires them to be self-directed and as such the multiliteracies necessary to foster SDL should also be considered in this context. The aim of this research was to determine a framework of multiliteracies in support of SDL through OERs.

For the sake of this chapter, the concept of OERs includes open courseware (OCW) and massive open online courses (MOOCs). As stated, the emphasis is also on SDL. Garrison (1997:18) notes how 'entering competencies and contextual contingencies' have not been the focus of SDL research, and this research attempts to

contribute to this lacuna. Furthermore, the identified multiliteracies and an overview of capabilities of students in terms of these multiliteracies can give an indication of which barriers exist (cf. Van Zyl 2016:44). In this regard, Bonk and Lee (2017) observe that:

> Better understanding of the barriers and obstacles when learning from OER or a MOOC should prove highly valuable to the designers of such content as well as those creating new online education courses and degree programs from that content. (p. 50)

This chapter, hence, attends to the problem of determining which multiliteracies need to be addressed to support SDL within an OER context.

The abovementioned should be considered within a context where higher education institutions and various organisations are encouraging the use of OER because of financial and resource constraints. Caravello et al. (2015) observe that:

> With educational institutions shifting towards more open resources such as OER, OCW, and MOOCs as well as hybrid and flipped courses, there is a pressing need for secondary schools and higher education to better understand how to foster students' innate ability towards SDL and find ways to reinforce learning outside of the classroom. (p. 24)

According to Ponti (2014:154), the growth of OER has challenged the belief that lecturers are 'playing the role of subject matter authorities' and there exists a 'scarcity of resources and expertise'. These OERs, which are delivered online, require not only formal access to technology but also specific multiliteracies.

It is evident that not all South Africans have equal access to technology and the Internet (Baller, Dutta & Lanvin 2016; Bharuthram & Kies 2013; Statistics South Africa 2017), and this limited access will also have a negative impact on the computer literacy levels of the wider society. Hence, the concept of multiliteracies is explored in terms of the relevant theoretical background to also provide a reference framework and link up with existing literature regarding learner characteristics within the wider, blended learning context (cf. Bosch 2017). Furthermore, to determine the SDL-related multiliteracies, which would be intertwined with the OER-related multiliteracies, the concept of

SDL is also investigated within the context of the specific skills required from students.

The need for support regarding multiliteracies is evident from literature. Concerns about academic literacy levels have been raised in numerous publications on the South African educational context (Bharuthram 2017; Chokwe 2016; Scholtz 2016; Weideman 2013). Often, these literacy issues are the result of differing levels of proficiency in English (Carstens 2016). In addition, research shows that students within the South African context have limited information literacy skills (Chisango 2012; Esterhuizen 2015; Noll 2017; Williams 2012), which are essential for accessing any resources, whether they are curated online or not. Gruszczynska, Merchant and Pountney (2013) state that:

> The increasing use of technology for learning, including the need for a level of competency that makes the use of technology for learning possible has the potential to foster inequalities of access and opportunity. (p. 196)

The competency mentioned here forms part of the multiliteracies involved in this research, and integrating the proposed multiliteracies within classroom practice could potentially aid towards eliminating inequalities in terms of access.

Furthermore, OERs require specific multiliteracies, and in this context Robertson (2010) expresses that:

> Students need appropriate information literacy skills to assess (skills such as assessing the quality of the material, its origin, currency, and fit with the student's current learning patterns) and they introduce (or will introduce) a new set of discovery tools for students and staff to be familiar with. (p. 4)

Yet, Robertson (2010:5) also notes that this extends further as 'the skills needed to find and use OERs draw on a number of recognised skills relating to information literacy, to study skills, and the promotion of self-regulated learning'.

The empirical part of this research involved an in-depth integrative literature review and document analysis of selected multimodal documents as found in specific OER repositories.

The aim of document analysis was to determine the nature of what would be expected from students in using OER. King (2011:30) states that '[a]s technology evolves, so will the standards and classifications of literacy', and this research is a further attempt at classifying literacies within the context of SDL and OER. As such, this also implies that the identified required multiliteracies will adapt as technologies and dynamic contexts evolve. Consequently, this research proposes a framework of multiliteracies in support of SDL through OER, which would serve as specifications for any preparation for OER use or OER-related tasks, or even for possible diagnostic measurement.

■ Multiliteracies pedagogy

■ Literacy

The concept of *literacy* has traditionally been limited to reading and writing but has since been expanded in the literature on literacy to cover a number of skills as the needs of society have adapted, especially with regard to the usage of technology (Cope & Kalantzis 2015; Dawson & Siemens 2014; Gallardo-Echenique et al. 2015; Mioduser, Nachmias & Forkosh-Baruch 2008; Navehebrahim 2011). The additional focus on technology is also highly relevant in terms of increased use of OER – as is pertinent to this chapter.

Furthermore, it is important to regard technology-based literacies, according to Cooper, Lockyer and Brown (2013:94), as 'a social practice that involves learners using technology to engage with multimodal texts to construct knowledge in digital and other forms'. This aspect emphasises the role as knowledge constructor that students can fulfil. Veletsianos, Collier and Schneider (2015:579) observe that 'it appears that time and modality underpin the ways that learners engage with content' in terms of OERs and specifically MOOCs. In this regard, students need to be self-directed in scheduling and planning the use of OER and should also be flexible to work within different environments and with varying interfaces and modalities.

Literacy should also be regarded in terms of the concept of multimodality, as it functions at the level of *multimodal communication* where different modes of communication are used, as opposed to *multimodal learning or teaching* where technology and face-to-face teaching are blended or *multimodal delivery* where hybrids of contact and distance education are employed (cf. Olivier 2018a:7). In line with the research of Veletsianos et al. (2015), the focus is on the level of multimodal learning or teaching where:

> Learners engage with content in multiple modes (e.g. video, digital transcript), and they do so in unique ways based on affordances imbued in the different modalities (e.g. pausing and replaying videos, taking notes on printed transcripts). (p. 580)

Yet, effective engagement, as mentioned here, would require certain multiliteracies, depending on the profile of the students.

In addition, literacy is approached in terms of the ideological models of literacy where this phenomenon is regarded not as neutral skills but rather a set of context-specific practices (Street 2001). Yet, it is important to also consider literacy not only as an individual skill but also as a social and ideological practice (Gee 2008; Street 2017). In this research, however, the focus moves away from literacy only as social practice – where print literacy has been prominent (Perry 2012) – to multiliteracies where multimodal texts (such as online texts like OER) are taken into consideration. Ideally, OER would be providing opportunities for peer collaboration and in this manner support literacy as social practice. The different skills or practices required to support SDL through OER are central to this research.

Because of the increasing importance of the Internet in the wider education context, students' effective access to multimodal texts on this medium is essential. Certain skills are associated with the Internet as medium; in this regard, vague terms such as 'Web skills' (Navehebrahim 2011) are used. As in this research, these skills should be made more explicit to inform educational interventions and even instructional design. Burke (2002:38) observes that '[t]oo often, students – and adults, too – mistake their ability to move around the Internet for the skills that they need to navigate and read it'. Furthermore, it is not just enough to be able to access the medium,

and Burke (2002) identifies the need for students to be able to determine the accuracy, authenticity, point of view and reliability of online content. Hence, all these skills also need to be considered.

The importance of a variety of literacies to function effectively in an educational environment closely relates to the concept of multiliteracies, which is explored further in the next section.

■ Multiliteracies

The work by The New London Group has been instrumental to move the emphasis from a singular literacy to multiliteracies, specifically regarding emerging technologies and cultural and linguistic diversity (Cooper et al. 2013; Cope & Kalantzis 2000, 2015; Navehebrahim 2011; Perry 2012; Street 2017; The New London Group 1996). Furthermore, with multiliteracies, there is a move away from passively consuming texts towards having an understanding and being able to enact literacy practices (Leander & Boldt 2013; The New London Group 1996). Another important aspect of multiliteracies is having social skills (Dawson & Siemens 2014). However, there is some criticism towards the multiliteracies pedagogy and subsequent interpretations thereof, specifically in terms of its 'disciplined rationalization of youth engagement in literacies' (Leander & Boldt 2013:22). Yet, multiliteracies and the multiliteracies pedagogy provide an appropriate theoretical background for the purposes of this research.

Regarding multiliteracies, human knowledge is regarded as (The New London Group 1996):

> Initially developed as part and parcel of collaborative interactions with others of diverse skills, backgrounds, and perspectives joined together in a particular epistemic community, that is, a community of learners engaged in common practices centered around a specific (historically and socially constituted) domain of knowledge. (p. 82)

Therefore, the social aspect of multiliteracies cannot be ignored. Some related overarching concepts also need to be explored in relation to multiliteracies to place this chapter within the wider theoretical discussion of literacy.

Apart from the term *multiliteracies*, another umbrella term, *digital literacies* (cf. Lankshear & Knobel 2011; Robertson 2010), is used to refer to the 'multiplicity of literacies associated with the use of digital technologies' (Ng 2012:1066). Gruszczynska et al. (2013:197) refer to 'digital literac(ies) for openness' with a more specific emphasis on the OER context. According to Gruszczynska et al. (2013), there is a:

> [*N*]eed to re-examine digital literac(ies) for openness in the context of the debate around technology in pedagogy and in the curriculum in order that a better understanding of what is emerging (or shifting) can be achieved. (p. 204)

By placing the discourse in this chapter on multiliteracies, an attempt is made to add further dimensions to the approach of the existing digital literacies and OER discourses.

In addition, the concept of *new literacies* (cf. Lankshear & Knobel 2011) is also used and in this regard, Ng (2012) observes that:

> While 'new literacies' emphasise social practices that are shaped by emerging technologies, within educational contexts, digital literacy is a broader term that embraces technical, cognitive and social-emotional perspectives of learning with digital technologies, both online and offline. (p. 1066)

A further all-encompassing term would be *technological literacies*, which could be defined as (Lankshear & Knoebel 1997):

> Social practices in which texts (i.e. meaningful stretches of language) are constructed, transmitted, received, modified, shared (and otherwise engaged) within processes employing codes which are digitized electronically, primarily, though not exclusively, by means of (micro)computers. (p. 141)

This definition of technological literacies ties in with many of the characteristics associated with OER, and these characteristics are explored further in Section 2.6.4 on OER later in this chapter. Furthermore, the concept of *technology as literacy* (Bigum & Green 1992) is also relevant, where the focus is on literacy as a specific 'body of knowledge' (Lankshear & Knoebel 1997:140), and this implies some blurring of the lines between literacy for technology and technology as literacy.

The specific multiliteracies relevant to SDL and OER are explored under *multiliteracies in support of SDL through OER*. The next section, however, explores the concept of SDL in terms of the main theoretical issues around this phenomenon.

■ Self-directed learning

The concept of SDL is defined by Knowles (1975) as:

> A process by 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. (p. 18)

Even from this classic definition a number of multiliteracies are evident. Moreover, Gibbons (2002) explains SDL as:

> [*A*]ny increase in knowledge, skill, accomplishment, or personal development that an individual selects and brings about by his or her own efforts using any method in any circumstances at any time. (p. 2)

The parallels between the definitions by Knowles and Gibbons are evident. However, Gibbons' definition lacks emphasis on resources, although Knowles does not specifically emphasise particular aspects an individual can develop to become self-directed. Furthermore, Sze-Yeng and Hussain (2010) similarly define SDL as:

> A learner's autonomous ability to manage his or her own learning process, by perceiving oneself as the source of one's own actions and decisions as a responsibility towards one's own lifelong learning. (p. 1913)

Guglielmino and Long (2011:1) describe SDL as 'a dynamic combination of attitudes and skills, essential for dealing with the complexity individuals face in all aspects of their lives'. It is the requirements for this specific set of dynamic attitudes and skills that serve as impetus for this chapter.

Van der Walt (2016:12) notes that self-determination theory underpins SDL and observes that self-direction entails 'conscious processes such as imaging future outcomes, to account for the

wide range of volitional activity observable amongst people', and that the central issue of self-direction pertains to 'flexibility in psychological structures, flexibility that allows one's attitudes to direct action towards the effective achievement of one's aims'. Several models have been created to explain the SDL process (Bonk, Kim & Xu 2016; Van Zyl 2016). According to Bullock (2013:107), despite the allure of a linear explanation of the process of SDL, more 'interactive models' of SDL 'allow for the fact that a variety of factors, internal and external to the learner, might have an effect on the nature and quality of a [*sic*] SDL experience'.

Self-directed learning is generally regarded as a process. Bonk and Lee (2017:38) state that '[l]earner volition and inner will or purposeful striving towards some action or learning goal is at the crux or heart of self-directed learning pursuits'. Despite the focus on SDL as a process or characteristic of an individual, Bonk et al. (2016:8–9) extend SDL to the learning environment in what they describe as 'self-directed online learning environments' (SOLEs). Gibbons (2002:11) also refers to an 'SDL activity, course, or program'. However, in this chapter, SDL is viewed as a characteristic on the part of the student which is supported by specific learning environments.

Despite the study of SDL's origins in adult learning, this concept is now applied widely in terms of different levels of education at school, university and outside and for formal and informal learning (cf. Bonk et al. 2016; Bonk & Lee 2017; Bullock 2013; Caravello et al. 2015; Gibbons 2002; Guglielmino & Long 2011; Van Zyl 2016). In terms of OER, both formal and informal learning are relevant. Nasri (2017) distinguishes between SDL achieved for reasons other than academic credit (as investigated by Houle & Tough) versus SDL within a formal setting (as associated with Knowles). Similarly, Ottewill (2002) distinguishes between SDL – called 'self-directed informal learning' by Ponti (2014) – as learning achieved independently by students and *self-managed learning* as learning achieved as part of a formal course (cf. Regan 2003). Guglielmino and Guglielmino (2001), however, use these terms interchangeably. In this chapter, however, the term *SDL* is used for the sake of consistency.

Informal learning seems to be increasingly important. Waks (2016) observes the following in this regard:

> Young web natives already possess many tools for knowledge creation, collaboration, and collective action and know how to use them. Freeing up their time from a rigid normative curriculum for self-directed solo and peer learning is in itself a big step forward. Independent web-based learning will surely play a major role in new educational arrangements. (p. 128)

In educational contexts, instruction and support should not only build upon these existing tools but also cultivate multiliteracies where needed. Additionally, Bonk and Lee (2017:39) note that 'there are relatively few studies of the experiences of self-directed online learners as they move through non-formal learning channels', and although this is not the focus of this chapter, this could be a further field of future research on multiliteracies.

A distinction can also be made between formal and informal use of OER; they can be used informally through 'self-organised learning' (Ponti 2014:155) or by means of Personal Learning Environments (PLEs), or they can be more formally incorporated within a learning management system (LMS). According to Attwell (2007:1), a PLE is not software but rather an 'approach to using technologies for learning'. According to Holmes and Gardner (2006:27), LMSs 'provide shells to populate with course content and offer a variety of course delivery methods'. In essence, digital media and by implication OER blur the lines between 'formal, informal and non-formal education, and between producers and consumers of knowledge' (Ponti 2014:156).

The relevance of SDL in terms of OER is evident (cf. Bonk et al. 2016; Bonk & Lee 2017:38; Caravello et al. 2015; Horn, Anderson & Pierick 2018), and this aligns with the focus on SDL in terms of e-Learning and blended learning (Bosch 2017; Bullock 2013; Du Toit & Pool 2016; Tredoux 2012; Van der Westhuizen 2015). In addition, Bonk and Lee (2017:38) refer to 'self-directed online learning' pertaining to SDL in an online environment. To this end, Ponti (2014:166) remarks that 'the use of OER and digital media offers potential for SDL in non-formal education'. Success in using

OER and specifically MOOCs is dependent on SDL (Bonk & Lee 2017; De Barba, Kennedy & Ainley 2016; Pursel et al. 2016; Tsai et al. 2018; Veletsianos et al. 2015). As regards MOOCs, Hood, Littlejohn and Milligan (2015) found that students' current role had an impact on whether they were successful with regard to self-regulation. Self-regulation is regarded as part of the broader concept of SDL, and this is significant as the 'self-directed, non-linear nature of learning engagement in MOOCs … requires individuals to determine and structure their learning largely independently' and because MOOCs attract a 'diverse range of learners' (Robertson 2011:90). Additionally, Waks (2016:164) notes the importance of SDL within the context of open learning centres which provide spaces for the use of OER.

The concept of metacognition is highly relevant in the context of SDL (cf. Gibbons 2002:7). Flavell (1976:232) defines metacognition as 'one's knowledge concerning one's own cognitive processes and products or anything related to them'. King (2011) observes that:

> Since the goal of metacognition is to promote self-directed learning, educators function as guides who introduce the proper uses of Web 2.0 resources and create situations in which they learn about Web 2.0 with their students. (p. 30)

In this regard, Web 2.0 refers to online contexts where greater collaboration is present, and any person can act as a content creator (Ehlers 2013; King 2011). From their conception, Wikis were created to facilitate online collaboration (Leuf & Cunningham 2001) in addition to being an interface for online multimodal texts. Awareness regarding the learning process will also have an effect on how OERs are approached and used. In this regard, Tsai et al. (2018:19) found that, in terms of MOOCs, 'metacognition may impact the individual's interest in coping with learning tasks; thus, it was hypothesized that metacognition is positively related to learning interest'. However, this aspect requires further empirical research, especially with regard to multiliteracies.

Collaboration is a vital requirement of SDL (cf. Bosch 2017; Garrison 1997; Van der Westhuizen 2015). In this regard, Bonk and Lee (2017:47) state that 'any achievement from self-directed learning often requires some form of support or guidance', and

this can come from a teacher, instructor or even a peer. Technology also has some implications in this regard, as Bullock (2013:107) observes, 'SDL, particularly with the aid of digital technologies, may change the degree to which people engage in learning projects, particularly when it comes to creating new collaborative knowledge'. Therefore, collaboration should be enabled and not discouraged through the use of technology and specifically OER.

In the next section, the definition and common characteristics of OERs are provided to serve as a basis for the identified multiliteracies framework to support SDL.

◼ Open educational resources

The William and Flora Hewlett Foundation (2018) defines OER as:

> Teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. (n.p.)

Similarly, Waks (2016) defines OER as:

> Educational materials that have been licensed in a way that follows the open content philosophy and can therefore freely (at zero cost) and legally (in full compliance with copyright law) be copied, changed, and shared. (p. 110)

The term OER was first used at the *2002 UNESCO Forum on the Impact of Open Courseware for Higher Education* (UNESCO 2017) and is now widely used. Open educational resources cover several genres and vary from single unsophisticated resources such as videos or e-Books to full courses that are usually indexed and stored in online repositories. Open educational resources should also be regarded within a greater move towards open education or what Waks (2016:110) calls an 'open curriculum philosophy', which implies 'using open access tools exclusively: open source software for its virtual learning environments and its learning management system, open access textbooks' as well as the so-called 'free culture movement' (Friesen & Hopkins 2008) which focusses on individuals being free to distribute and modify written artefacts.

An essential extension of the generally accepted definitions of OER is the addition of three interrelated dimensions as proposed by Mackintosh (2011:n.p.) when he states, 'educational values: OER should be free'; 'Pedagogical utility: OER should embed the permissions of the 4Rs (reuse, revise, remix and redistribute)'; and 'Technology enablers: Technology and media choices should not restrict the permissions of the 4R framework'. The 4Rs of David Wiley mentioned by Mackintosh have since been extended to 5Rs, involving the following activities (Wiley 2018):

• Retain – 'the right to make, own and control copies of the content (e.g., download, duplicate, store, and manage)'
• Reuse – 'the right to use the content in a wide range of ways (e.g., in a class, in a study group, on a website, in a video)'
• Revise – 'the right to adapt, adjust, modify, or alter the content itself (e.g., translate the content into another language)'
• Remix – 'the right to combine the original or revised content with other material to create something new (e.g., incorporate the content into a mashup)'
• Redistribute – 'the right to share copies of the original content, your revisions, or your remixes with others (e.g., give a copy of the content to a friend)'. (n.p.)

An important aspect of OER, which is also evident from the list above, is that they should not only be considered as resources to be accessed and used but also as resources generated by students themselves. This aspect ties in with 'a more equitable, transformative pedagogy around technology through the shift *from* knowledge transmission through instruction *to* knowledge production through construction' (Kapitzke 2000:227; [*emphasis in original*]). In the same vein, Robertson (2010) states that the provision of OER:

> Is not straightforward and it accelerates the shift from understanding a university as a place where one goes to receive knowledge to understanding a university as a context for a community of learning in which students construct knowledge and a context for a student experience in which good facilities, pedagogy, and accreditation combine. (pp. 2–3)

This move from not only consuming but also producing electronic resources emphasises the importance of SDL and also poses specific literacy-related challenges in the following contexts:

- researching content
- evaluating content
- selection and manipulation of graphical content
- considering copyright issues
- setting layout
- constructing multimodal texts
- effective submission and indexing on repositories.

In terms of copyright, there is a need for creators and users of OER to understand what is allowed in terms of the use, reuse and revising of online resources. In this regard, Creative Commons licensing provides an adequate framework to clearly indicate any restrictions in the use of sources. According to the Creative Commons licences, a creator of an OER can indicate whether the resource can be used commercially or not, whether derivations of the resource are allowed and whether the resource may be shared alike or changed, adapted or built upon (Creative Commons 2018).

The generation of OER by students also relates to Mirra, Morrell and Filipiak's (2018) call for a move from digital consumption to digital invention. It extends even further, with Mirra et al. (2018) proposing a critical practice of production that:

> Extends beyond using tools to create digital versions of essays and other traditional products that would previously have been crafted with pen and paper; it involves sophisticated understanding of the specific affordances (and shortcomings) of mass media platforms and the design of learning experiences tailored to those affordances and crafted to highlight marginalized voices. (p. 16)

Through the use of digital tools, students can contribute through their own voices and even generate counter narratives (Mirra et al. 2018) – an aspect which could be highly relevant in the South African context where decolonisation of the higher education curriculum is under discussion. Despite the emphasis on linguistic diversity in terms of multiliteracies, it is evident that with OER, sufficient knowledge of English would be necessary. From the literature, one

concludes that a limited number of resources exist in other South African languages (Oates 2009; Olivier 2018a, 2018b). The use of English as default on all the researched OER repositories and even within the Wikipedia group of sites (cf. Leitch 2014:17–18) is evidence of the online hegemony of English.

For SDL as well as the use, reuse and production of OER, specific multiliteracies are required, which were explored in this research. The next section deals with the methodology followed as well as the proposed multiliteracies framework.

■ Methodology

■ Research design

This study was a conceptual study within an interpretivist paradigm (cf. Bakkabulindi 2015:22). This research was conducted as a conceptual study as it is 'largely based on secondary sources' and 'that it critically engages with the understanding of concepts, and that it aims to add to our existing body of knowledge and understanding' (Nieuwenhuis 2007:71). The empirical part of this research consisted of an integrative literature review (cf. Torraco 2016) and a document analysis of resources available in selected OER repositories. The integrative literature review involved an appraisal of literature on SDL and OER as well as a variety of sources on literacies and specifically multiliteracies.

■ Sampling

The sampling involved combing through OER catalogues and directories and selecting common OERs. This selection was fairly random but according to the number of listings can be regarded as the most prominently indexed OER repositories. Table 6.1 shows the OER repositories used in this analysis.

■ Data analysis

The data analysis involved inductive analysis of the interfaces of the OER, followed by an analysis of the types of resources

TABLE 6.1: List of open educational resource repositories consulted.

No.	OER repository	URL
1	Merlot	http://www.merlot.org/
2	OER Commons	http://www.oercommons.org/
3	AMSER	http://amser.org/
4	Open Course Library	http://opencourselibrary.org/
5	The Orange Grove	http://florida.theorangegrove.org/og/home.do
6	Khan Academy	http://www.khanacademy.org/
7	Skills Commons	http://www.skillscommons.org/
8	Curriki	http://www.curriki.org/
9	Open Stax CNX	http://cnx.org/
10	Open Learning Initiative	http://oli.cmu.edu/
11	Teaching Commons	http://teachingcommons.us/
12	Wikiversity	http://en.wikiversity.org/
13	HippoCampus	http://www.hippocampus.org/
14	Open Washington	http://www.openwa.org/
15	Humanities Commons	http://hcommons.org/core/
16	Coursera	http://www.coursera.org/
17	SOL*R	http://solr.bccampus.ca/wp/
18	Gooru	http://gooru.org/

available as well as random review of the content of different resources. Texts drawn from the OER repositories were analysed in terms of various existing multiliteracies. Similar to the approach followed by Rowland et al. (2014), elements from the multiliteracies pedagogy were employed as analysis process. In this regard, it was accepted that 'meaning-making is always purposive, multimodal, and contextually bound' (Rowland et al. 2014:140). However, it was also found that, because of the aims of this research, a more inductive approach was more sensible as no set aspects are tested in the data; rather, the framework presented here is based on a systematisation of the analysis of the data. To ensure the credibility and trustworthiness of the analysis, two cycles of coding were conducted.

An initial important observation was that the resources vary significantly in detail, scope and nature. This diversity emphasises the need for multiple multiliteracies even more. The pedagogical support in OER varies extensively, with some OER providing

lesson plans and assessments, while others may just act as storage space of resources such as videos or e-Books. From the analysis, several requirements for the use of OER were identified. In the next section, these requirements, together with the requirements for SDL, are discussed in terms of the relevant multiliteracies.

Firstly, using OER implies being able to access devices and interfaces that allow users to use these resources. This issue relates to the South African context, where both access to technology and limited computer literacy levels (Olivier 2018a) are prevalent. However, access to technology also seems to be a wider global issue (cf. Bonk & Lee 2017). The analysed OER and repositories also have different interfaces and requirements with regards to membership registration. Some of the repositories also list OERs that include videos and other interactive content which require, for example, Flash Player or the ability to play videos through the browser software. In terms of access, the use of videos might also have implications for the South African context where Internet data usage outside formal educational settings might be regarded as expensive. In terms of literacies, the identified needs pertain not only to computer literacy (Summey 2013) but also to the wider concepts of digital literacy (Eshet-Alkalai 2004; Gallardo-Echenique et al. 2015; Ng 2012; Robertson 2010; Summey 2013), ICT/IT literacy (Ng 2012) and even e-Literacy (Gallardo-Echenique et al. 2015). These concepts also tie in closely with what is described as the new literacies (Ng 2012) and imply some experimentation (Dawson & Siemens 2014) by students. Robertson (2010) even provides a list of digital literacy skills, presented as a list of questions, which are required in using OER.

Subsequently, it seemed important that users must be able to locate and access the resources (Dawson & Siemens 2014). In this regard, Horn et al. (2018:198) observe that 'selecting OERs is a time-consuming process, especially when whole programs are considered' and that '[w]hen it comes to locating learning resources, knowing where to look is important'. A certain level of

repetition exists between repositories, and no common standard exists in terms of presentation and curation. Open educational resource repositories use different search features; however, generally, limited support is provided as to how searches can be performed. The use of the 'Browse' function on Merlot and The Orange Grove, for example (or the 'Discover' function on OER Commons), can also be helpful tools towards finding appropriate OERs. Here, the need for standardised or consistent categorisation of subjects and fields seems to be apparent as repositories tend to be arranged in terms of the relevant categories to a specific country or region where the repository is based. Alternatively, it would also be sensible that these types of lists be localised towards country-specific subject names and grade levels. Regarding literacies, the importance of language is evident in locating and accessing OER, and hence functional literacy is relevant, but a degree of play (Dawson & Siemens 2014) is also required in order for users to navigate online environments and explore content. Bonk and Lee (2017:47) note that SDL 'often leads to exploration and creative outcomes'. This exploration requires an understanding of hypermedia and non-linearity, which is the next important issue.

The web-based nature of OER repositories and, to an extent, the OERs themselves implies that users must be able to follow hypermedia or non-linear resources. Furthermore, this reading of OER may also involve notetaking (Veletsianos et al. 2015), which implies further literacy requirements. Unlike print-based resources, most OERs are not necessarily linear, and different interfaces require dissimilar patterns of use and paths. For inexperienced users, adhering to the requirements of hypermedia and non-linearity might also imply additional skills that will have to be acquired. Successful navigation of hypermedia and non-linear resources requires a number of literacies. Firstly, this involves hyperacy or hyper-literacy through which users must be able to navigate through content presented in a non-linear fashion (Mioduser et al. 2008) and the related concept of branching literacy (Eshet-Alkalai 2004). Only through background in these

areas can multimodal hypertexts be effectively read. Furthermore, the environment itself also implies the wider concepts of web literacy (Summey 2013), cyber-literacies (Kapitzke 2000) and even technoliteracies (Kapitzke 2000). Finding actual resources might become a lengthy browsing exercise as, for example, the Open Washington and Teaching Commons repositories link to other repositories, which means additional steps to the user to reach the required OER. An OER lesson linked to Teaching Commons even requires software installation without providing any instructions or assurances with regards to computer viruses or other potential threats that would put novice users at risk.

Because of the nature of the medium of OERs, content is not only text-based but also includes pictures, icons, buttons, hyperlinks and even multimedia content. Hence, users must be able to read these different site-specific multimodal elements. Generally, icons are accompanied by textual descriptions, and the icons used are also fairly generic, with the use of the 'magnifying glass' (🔍) for search blocks, the 'down arrow' (▾) for additional menu options or 'three lines' (≡) – also called the *collapse menu* or *hamburger button* (cf. Tsiodoulos 2016) – for a menu. However, this is not performed consistently. The importance of visual literacy (Mioduser et al. 2008; Summey 2013) in terms of OER seems to be very important, and additional guidance would be necessary in this regard for inexperienced users. In addition, the concepts of multimedia literacy (Summey 2013) and photo-visual literacy (Eshet-Alkalai 2004) are also relevant as varying types of visual material are common in OER.

Some OERs – although they seem limited – require interaction with peers (Veletsianos et al. 2015) where OERs act as mediating artefacts (Ponti 2014). This not only implies the ability to verbally interact with peers (probably in English) but also employing technology to enable the interaction. With OER, such as on Coursera, where users might be from all over the world, the level of English of peers is a variable to consider. Hence, for users of OERs, a sense of intercultural literacy would be important. Furthermore, being able to facilitate peer interaction communication literacy

(Mioduser et al. 2008), socio-emotional literacy (Eshet-Alkalai 2004), network literacy (Summey 2013) and also network agility and citizenship (Dawson & Siemens 2014) must be taken into consideration. However, there are some OERs that basically entail one-way communication and no interaction by peers or instructors. In this regard, Thompson (2011:2) observes – regarding the Khan Academy – that '[c]ritics argue that Khan's videos and software encourage uncreative, repetitive drilling – and leave kids staring at screens instead of interacting with real live teachers'. However, as Murphy et al. (2014) found, Khan Academy resources can be used effectively in blended or multimodal learning or teaching contexts. According to Murphy et al. (2014:15), 'using Khan Academy in combination with close teacher monitoring and extended periods for math instruction can improve student learning'. Such a multimodal approach could facilitate peer interaction in OERs, but not all resources are set up to provide support or to facilitate effective or any peer interaction and collaboration.

In the selection of OER, users must be able to judge the value and validity of resources (Ponti 2014). Horn et al. (2018:198) state that '[a]fter finding learning resources, evaluating them for relevance to the learning goals and curating them in a meaningful way takes considerable time'. Being able to judge the value of a resource ties in with the requirements of information literacy (Eshet-Alkalai 2004; Gallardo-Echenique et al. 2015; King 2011; Summey 2013) as well as media literacy (Gallardo-Echenique et al. 2015; Summey 2013). These literacies, previously associated with libraries, now become essential requirements for any online educational activity. This also prompts for greater collaboration and support from libraries and librarians. Furthermore, this aspect even implies a degree of critical literacy (Perry 2012) or critical media literacy (Mirra et al. 2018). Critical engagement is necessary and, according to Navehebrahim (2011:866), 'students should be encouraged to use higher order thinking and develop deep understandings'. Correspondingly, Caravello et al. (2015:24) state that, in research on technology preparedness and OERs, students should be supported to become 'critical information seekers'.

The ease of adding information – on Wikiversity, for example – could also be associated with the perpetual fear of the authority and validity of Wikipedia (cf. Friesen & Hopkins 2008; Leuf & Cunningham 2001; Olivier 2014:61) content. Leitch (2014) makes the following remark with regard to this phenomenon:

> Many teachers categorically forbid their students to cite Wikipedia in their assignments, though this interdiction does not prevent students, or indeed the teachers themselves, from consulting Wikipedia without citing it. Wikipedia is the source everyone uses but no one is supposed to use or admits using. (p. 4)

Hence, as with Wikis such as Wikipedia and OER, in general, the essential educational need is for students to be able to judge the authority, value and validity of any information regardless of the interface. This is significant as '[o]nline sources that are filled with logical flaws, fallacies, and factual errors can look trustworthy if their architecture and visual design look professional' (Leitch 2014:12). Critical evaluation would especially be relevant in cases where there is no or limited peer review of OERs in repositories.

A common phenomenon on OER repositories is that quite a number of different resources can be included, and one acquires the sense that it can easily become a text midden where any random document can be dumped. On the one hand, a proliferation of resources provides more options and resource opportunities, but as with any online content, 'the very proliferation of texts undermines the authority of any one of them' (Leitch 2014:4). When a user follows the link to 'Find Open Access Materials' on Humanities Commons, for example, all the possible resources are listed and, unfortunately, filtering can only be performed with regard to item type, year and detailed level subjects. In this instance, the so-called 'subjects' act rather as keywords than actual subjects and therefore categorisation and subcategorisation are advised for such repositories. A similar approach is followed by Open Stax CNX. This curation can perhaps be achieved through more generally accepted taxonomies or classifications that could be linked to country-specific nomenclature. The HippoCampus and The Orange Grove

repositories have a very sensible approach where subjects are listed on the front page, which leads presentations, examples and simulations within categories and subcategories, thereby allowing easy access to relevant resources.

Using an OER could also imply certain administrative skills such as organising various downloaded resources and scheduling with regard to time management and completion of OER-related tasks or assessments. Veletsianos et al. (2015:572) highlight the importance of 'time management and self-discipline needed to be successful' in using MOOCs. These skills require personal information management literacy (Mioduser et al. 2008) as well as task effectiveness and efficiency (Dawson & Siemens 2014). In addition, not all OER repositories allow users to access resources directly, and they require an online registration process. Where a repository such as SOL*R allows access to resources after a couple of clicks, sites such as Gooru and Coursera require registration, creating a course and then adding resources or signing up for set courses. Some repositories even provide the opportunity to opt for registration linked to existing online profiles, such as an existing Google or Facebook user account. In this context, users should be aware of their online footprint and the nature of data shared between sites. Furthermore, most OER repositories provide OER in a straightforward manner, merely listing them based on thematic categories or education level. However, in some instances, the repositories Khan Academy, Open Learning Initiative and Gooru, for example, allow for different interfaces between students and teachers. Interestingly, Khan Academy even has a separate login for parents.

Open educational resources not only imply use but also reuse and creation of OERs. Hence, users working towards these aims should be able to revise various types of content. Being able to create requires certain demiurgic literacies. The term 'demiurgic' is derived from the Greek δημιουργός (dēmiourgós), which refers to a worker for the public or common good (GreekLexicon.org 2018). Demiurgic literacies involve the ability to create resources, and this requires reproduction literacy (Eshet-Alkalai 2004),

literacy in terms of products and creation (Dawson & Siemens 2014), appropriation (Dawson & Siemens 2014) and multimodal literacy (Neville 2015). Bonk and Lee (2017:47) also highlight positive feedback from users of MOOCs in terms of being able to contribute to content. Users showed evidence of 'personal pride in creating or contributing something to the MOOC or informal learning resources that others could use' (Bonk & Lee 2017:47).

From the analysis of the OER and OER repositories, the importance of resources being editable is essential. Here the different file formats of content on SOL*R, for example, show promise as open textbooks are provided as an editable Open Document Text file (odt) and editable Hypertext Markup Language (HTML) file, among other formats. Similarly, Teaching Commons also includes open textbooks in both Microsoft Word and Portable Document Format (PDF) formats. However, this implies that users are familiar with different text types and appropriate applications to be able to access these files. At least, such downloadable content allows for offline use of the content and even accessibility through mobile devices. In the South African context, being able to download resources or using resource offline is highly relevant as access to and financial implications for Internet use can be problematic. In terms of formatting, the question remains as to what extent fairly linear and static online texts sufficiently exploit online advantages provided by the medium. It is unfortunate that being editable and being accessible through various applications could potentially limit effective utilisation of the benefits of online multimodal texts. Another approach is that of Wikiversity (Friesen & Hopkins 2008) where content can be edited using the simplified Wiki markup language (cf. Olivier 2014). This environment links up with the approach followed by other Wikis such as Wikipedia (cf. Leitch 2014; Leuf & Cunningham 2001). Yet, effective use of markup language would require additional support (cf. Olivier 2014).

In the process of creating OERs, users need to be able to use and determine what can be considered as authentic materials. To facilitate the use and selection of authentic material, authentic literacy (Perry 2012; Rowland et al. 2014) must be considered. In terms of

SDL, De Beer and Gravett (2016:58) found (in using cases) that 'student teachers viewed the authentic real-life character of cases as powerful'. Similarly, Havenga (2016:76) also noted the importance of 'working mainly collaboratively to solve authentic problems' in PBL within an SDL context. Regarding open learning, Waks (2016:164) notes that, within open learning centres, 'courses are augmented by such enrichment experiences that provide rich contexts for what is learnt, and they link learning to real-world activities'. Therefore, both SDL requirements and open learning authentic materials and, by implication, identifying such materials are imperative.

Finally, it is important to consider how OER could provide for epistemological access (Morrow 2007, 2009). Epistemological access should also be considered in terms of what Morrow calls formal access. In this regard, Morrow (2007:2) describes formal access as 'access to the institutions of learning, and it depends on factors such as admission rules, personal finances, and so on', and epistemological access 'is access to knowledge' where teaching 'is the practice of enabling epistemological access'. To facilitate such access to knowledge, students require what Gee (2008) describes as emancipatory literacy. To an extent, the epistemological aspect also requires all the aforementioned literacies to be attained.

The next section provides some general conclusions on multiliteracies regarding SDL and OER, after which a multiliteracies framework is proposed based on the literature review and empirical investigation.

■ Multiliteracies in support of self-directed learning through open educational resources

■ Multiliteracies pedagogy and open educational resources

As this research was conducted within the context of multiliteracies, it was essential to determine how the four components of the multiliteracies pedagogy (cf. Cope & Kalantzis 2015) can be

compensated for with OER. These four components can be described as follows:

- Situated practice relates to: '[…] immersion in meaningful practices within a community of learners who are capable of playing multiple and different roles based on their backgrounds and experiences' (The New London Group 1996:85).
- Overt instruction pertains to: 'Systematic, analytic, and conscious understanding. In the case of multiliteracies, this requires the introduction of explicit metalanguages, which describe and interpret the Design elements of different modes of meaning' (The New London Group 1996:88).
- Critical framing involves: 'Interpreting the social and cultural context of particular Designs of meaning. This involves the students' standing back from what they are studying and viewing it critically in relation to its context' (The New London Group 1996:88).
- Transformed practice implies: 'Transfer in meaning-making practice, which puts the transformed meaning to work in other contexts or cultural sites' (The New London Group 1996:88).

In order for situated practice to succeed, OERs need to be supplemented by mentoring and in this context, 'the affective and sociocultural needs and identities of all learners' (The New London Group 1996:85) must be considered and accommodated.

Regarding overt instruction, 'conscious awareness and control over what is being learned' (The New London Group 1996) must be ensured. Overt instruction, according to The New London Group (1996), involves:

> Active interventions on the part of the teacher and other experts that scaffold learning activities, that focus the learner on the important features of their experiences and activities within the community of learners, and that allow the learner to gain explicit information at times when it can most usefully organize and guide practice, building on and recruiting what the learner already knows and has accomplished. (p. 86)

Critical framing implies being able to frame (The New London Group 1996):

> [G]rowing mastery in practice (from Situated Practice) and conscious control and understanding (from Overt Instruction) in relation to the

historical, social, cultural, political, ideological, and value-centered relations of particular systems of knowledge and social practice. (p. 86)

Despite the multimodal nature of technology, it is evident that information on the Internet is still heavily text-based, and therefore basic literacies are still essential (Dawson & Siemens 2014).

In the selection of OER, the concept of critical framing is essential, as through this process (The New London Group 1996):

Learners can gain the necessary personal and theoretical distance from what they have learned, constructively critique it, account for its cultural location, creatively extend and apply it, and eventually innovate on their own, within old communities and in new ones. (p. 87)

With regard to transformed practice, it is important to take note of the following (The New London Group 1996):

With their students, teachers need to develop ways in which the students can demonstrate how they can design and carry out, in a reflective manner, new practices embedded in their own goals and values. (p. 87)

Bonk and Lee (2017:51) observe that '[s]elf-directed learners not only want to learn from others, they also want access to productivity tools that allow them to offer something creative or generative in return'. Consequently, any transformed practice in terms of SDL would require environments in which students can be creative multimodal content creators.

In using OER and to foster SDL, Robertson (2011) suggests that blogs should be used to:

[S]upport the self-directed learning skills of generating one's own learning goals, planning how to tackle a problem, evaluating whether learning goals have been met, and re-planning based on this evaluation. (p. 1643)

However, other online tools or social media platforms can also fulfil this role. Furthermore, Summey (2013:n.p.) identifies five digital literacies that are also valid within the context of OER, namely, 'locating and filtering; sharing and collaborating; organising and curating; creating and generating; and reusing and repurposing'. These literacies cover the process of OER selection, use, reuse and creation.

■ Multiliteracies framework

To determine the necessary multiliteracies in support of SDL through OER, it is necessary to determine the requirements for SDL. Unlike the multiliteracies associated with OERs, these SDL multiliteracies were drawn directly from the literature on SDL. To facilitate effective use of OERs while supporting SDL, both sets of multiliteracies need to be considered. Table 6.2 provides an overview of the relevant SDL multiliteracies.

Regarding the use of OERs, specific multiliteracies – as were drawn from the empirical investigation – are relevant. The summary of these OER multiliteracies is presented in Table 6.3.

TABLE 6.2: Self-directed learning multiliteracies.

SDL requirement	Relevant multiliteracies
Problem-solving (Guglielmino & Guglielmino 2001)	Functional literacy
Collaboration (Garrison 1997; Gibbons 2002; Gitsaki 2005)	Functional literacy Intercultural literacy Communication literacy (Mioduser et al. 2008) Socio-emotional literacy (Eshet-Alkalai 2004) Network literacy (Summey 2013)
Resource selection (Knowles 1975)	Information literacy (Eshet-Alkalai 2004; King 2011; Robertson 2010; Summey 2013) Media literacy (Summey 2013) Critical literacy (Perry 2012) Critical media literacy (Mirra et al. 2018)
Critical thinking (Garrison 1997; Gibbons 2002; Guglielmino & Guglielmino 2001)	Information literacy (Eshet-Alkalai 2004; Gallardo-Echenique et al. 2015) Media literacy (Gallardo-Echenique et al. 2015; Summey 2013) Critical literacy (Perry 2012)
Motivation (Garrison 1997; Gibbons 2002; Gitsaki 2005; Van Zyl 2016)	Affective literacy (Cole & Yang 2008; Leander & Boldt 2013)
Initiative (Guglielmino & Guglielmino 2001)	Functional literacy Critical literacy (Perry 2012)
Self-monitoring (Garrison 1997; Van Zyl 2016)	Functional literacy Personal information management literacy (Mioduser et al. 2008)
Self-management (Garrison 1997; Van Zyl 2016)	Functional literacy Intercultural literacy Communication literacy (Mioduser et al. 2008) Socio-emotional literacy (Eshet-Alkalai 2004)

TABLE 6.2 (Continues...): Self-directed learning multiliteracies.

SDL requirement	Relevant multiliteracies
Metacognition (Gibbons 2002; Tsai et al. 2018)	Metaliteracy (Mackey & Jacobson 2014)
Integration of thought (Guglielmino & Guglielmino 2001)	Functional literacy Critical literacy (Perry 2012)
Integration of resources (Guglielmino & Guglielmino 2001)	Information literacy (Eshet-Alkalai 2004; King 2011; Summey 2013) Media literacy (Summey 2013) Critical literacy (Perry 2012) Critical media literacy (Mirra et al. 2018)

SDL, self-directed learning.

TABLE 6.3: Open educational resource multiliteracies.

OER requirement	Relevant multiliteracies
Accessing devices and interfaces	Computer literacy (Summey 2013)
	Digital literacy (Eshet-Alkalai 2004; Gallardo-Echenique et al. 2015; Ng 2012; Robertson 2010; Summey 2013)
	ICT/IT literacy (Ng 2012)
	e-Literacy (Gallardo-Echenique et al. 2015)
	New literacies (Ng 2012)
	Experimentation (Dawson & Siemens 2014)
Locating (Ponti 2014) and accessing resources (Dawson & Siemens 2014)	Functional literacy
	Play (Dawson & Siemens 2014)
Following hypermedia or non-linear resources	Hyperacy (Mioduser et al. 2008)
	Branching literacy (Eshet-Alkalai 2004)
	Web literacy (Summey 2013)
	Cyber-literacies (Kapitzke 2000)
	Technoliteracies (Kapitzke 2000)
Reading multimodal resources	Multimedia literacy (Summey 2013)
	Photo-visual literacy (Eshet-Alkalai 2004)
	Visual literacy (Mioduser et al. 2008; Summey 2013)
Interaction with peers – OERs as mediating artefacts (Ponti 2014)	Intercultural literacy
	Communication literacy (Mioduser et al. 2008)
	Socio-emotional literacy (Eshet-Alkalai 2004)
	Network literacy (Summey 2013)
	Network agility and citizenship (Dawson & Siemens 2014)

TABLE 6.3 (Continues...): Open educational resource multiliteracies.

OER requirement	Relevant multiliteracies
Judging the value and validity of resources (Ponti 2014)	Information literacy (Eshet-Alkalai 2004; Gallardo-Echenique et al. 2015; King 2011; Summey 2013)
	Media literacy (Gallardo-Echenique et al. 2015; Summey 2013)
	Critical literacy (Perry 2012)
	Critical media literacy (Mirra et al. 2018)
Administrative skills	Personal information management literacy (Mioduser et al. 2008)
	Task effectiveness and efficiency (Dawson & Siemens 2014)
Reuse and creation of OERs	Reproduction literacy (Eshet-Alkalai 2004)
	Products and creation (Dawson & Siemens 2014)
	Appropriation (Dawson & Siemens 2014)
	Multimodal literacy (Neville 2015)
Authentic materials	Authentic literacy (Perry 2012; Rowland et al. 2014)
OER providing epistemological access (Morrow 2007, 2009)	Emancipatory literacy (Gee 2008)

OER, open educational resource; ICT/IT, information and communicatin technology and information technology.

Navehebrahim (2011:866) notes that, with a multiliteracies approach, 'learning is significant for students, connected to their interests and understandings about the world'. However, it is unclear how this can be accounted for by means of OER without thorough localisation. Tochon, Karaman and Ökten (2014) researched how the use of open resources can support SDL in Turkish. The importance of localisation is also emphasised because 'human knowledge, when it is applicable to practice, is primarily situated in sociocultural settings and heavily contextualized in specific knowledge domains and practices' (The New London Group 1996:84). Within the Malaysian context, Nasri (2017:2) notes that 'a failure to acknowledge local context could lead to deterioration in the process of introducing SDL approaches'. Hence, as they are central to multiliteracies, cultural and linguistic diversity need to be taken into account.

The synthesis of the aforementioned literacies in support of SDL through OERs is presented in Figure 6.1.
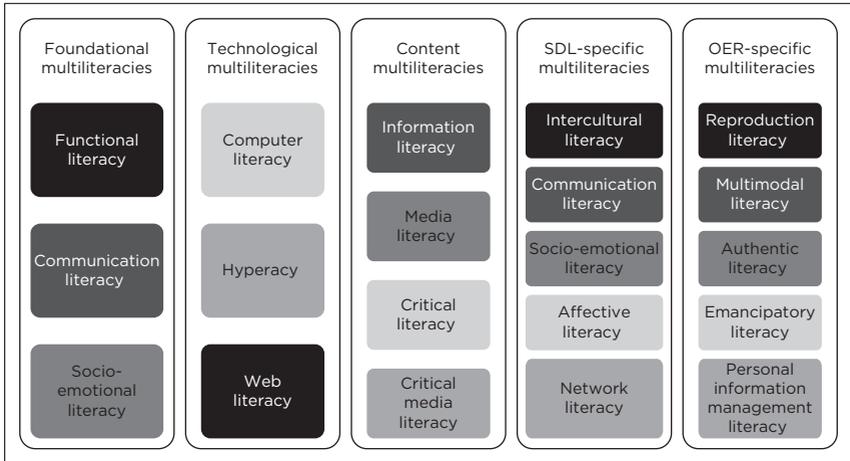
FIGURE 6.1: Synthesis of multiliteracies in support of SDL through OER.

On the basis of the identified multiliteracies and the synthesis shown in Figure 6.1, the multiliteracies framework is presented in Figure 6.2. On an access level, certain foundational and technological multiliteracies need to be considered. In this regard, several skills are required from students, and these variables are prerequisites to address the first two multiliteracies levels. On an epistemological level, a range of multiliteracies are necessary to critically interpret content. Finally, on a practical level, a range of specific multiliteracies are also relevant to SDL and OER.

■ Recommendations regarding the implementation of the framework

In operationalising the literacies in the presented framework shown in Figure 6.2, it is important that the following findings by Nasri (2017) are considered:

1. educators should establish a positive and collaborative relationship with the learner
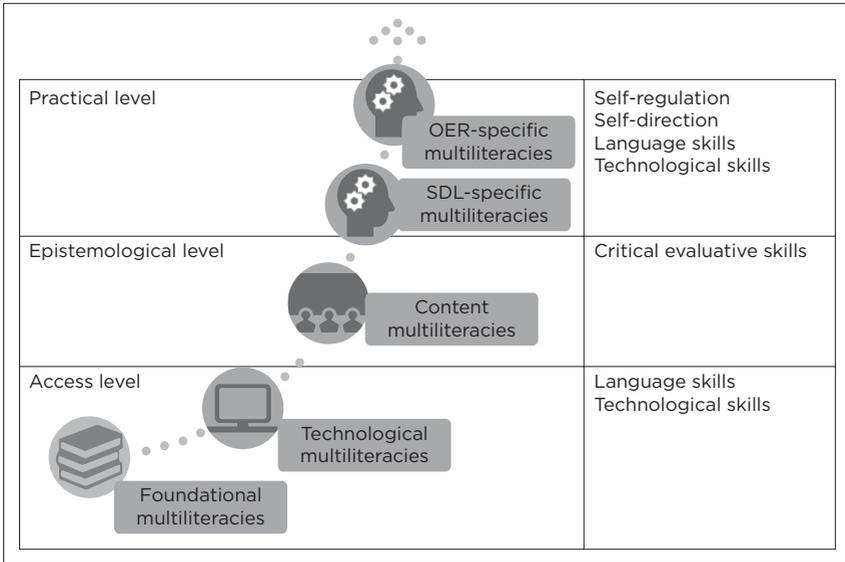
SDL, self-directed learning.
FIGURE 6.2: Multiliteracies framework in support of SDL through OER.

2. educators should recognize the available learning resources and restrictions existing within the actual learning context as this would allow for an effective implementation of the SDL
3. the universities should play their part in assisting educators to plan their teaching strategies which facilitate the learners' learning direction by conducting ongoing, in-service, training programs, encouraging self-development, and supporting educators to work alongside colleagues. (p. 7)

Hence, in classroom practice, subject lecturers should also be made aware of needs with regard to the range of multiliteracies required to foster SDL in the use of OER. In addition, such subject lecturers could potentially also provide subject-specific support in terms of the relevant multiliteracies.

A possible future application of this framework would be to investigate the role of learning analytics in terms of multiliteracies in support of SDL and OERs, as was achieved with multiliteracies

assessment by Dawson and Siemens (2014). Veletsianos et al. (2015:581), regarding learners using MOOCs, pose the question, '[w]hat literacies for online navigation and communication do they possess?' Through such research, individualised interventions can be implemented through diagnostic assessment of students' multiliteracies throughout a course while providing appropriate interventions or resources as required by the students. To this end, the framework of multiliteracies needs to be reduced to measurable skills and assessable items.

Having data on the state of students' multiliteracies can also inform online assessment practices. Dawson and Siemens (2014) found that:

> [*A*]lternate and diverse assessment techniques and instruments are necessary to better align and reflect the technical and information complexity and multimodal learning that form the core of 21st century education. (p. 298)

Therefore, assessment literacy in this context could also be a potential area for further research.

Another future research topic emanating from this research is the nature of self-direction in acquiring the necessary OER-related multiliteracies as well as the different theoretical angles from which the interplay between these concepts can be approached.

■ Limitations of this research

A central limitation of this research is the fact that in the literature there is no consistent use or definitions of literacy terminology. Furthermore, interpretations in this chapter have been made based on the secondary literature and resources consulted by the author. The selected OER and conclusions might have differed if additional sources were consulted. In addition, subject-specific needs may also imply the importance of additional literacies.

In some instances, certain content is limited and can only be accessed after registration or even payment. It was therefore not possible to access all the content of OERs included

in repositories. Gooru is a case in point where even after registration one can only access the table of contents for courses through the library. Curriki and Open Learning Initiative, on the other hand, allow users to search for content, but only after registration.

■ Conclusion

The purpose of this research was to create a framework of multiliteracies in support of SDL through OERs. As such, the theoretical context of multiliteracies and multiliteracies pedagogy was considered. Multiliteracies provide a sufficient foundation through which SDL within the use of OER can be fostered. The concept of SDL refers to a dynamic process where students take the initiative of and for their own learning and also specifically the selection of resources. Consequently, in the context of this research, such resources would typically be OERs. Furthermore, OERs as free and open online resources were defined and discussed, and the complex nature and increasing importance of these phenomena are evident.

From the integrative literature review and document analysis, a range of multiliteracies were identified in reference to SDL and OER, after which multiliteracies were synthesised in the form of a framework. It is clear that OERs are dynamic texts that vary considerably in format and complexity, and relevant multiliteracies should thus be approached individually within the specific contexts they are used. Consequently, it is proposed that these multiliteracies are reduced to specific practices based on additional empirical research conducted on OER contexts, lecturers and students. Furthermore, integrated measuring instruments can also be developed to determine the nature and state of multiliteracies in support of SDL through OER.

■ Acknowledgements

A systematic review of research on the use of technology-supported cooperative learning to enhance self-directed learning

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■ Abstract

Self-directed learning has been proved to be a vital aspect of 21st-century education. Other 21st-century skills include collaboration, communication, creativity and critical thinking.

The use of technology has also never been more prominent. In line with this context of today's education, we set out to determine what the scope is of the body of scholarship on TSCL to enhance SDL, which theories underpin TSCL and what we could learn from the implementation of TSCL to enhance SDL. To answer these three questions, we embarked on a systematic review of the literature of the past 10 years and found that no specific trend regarding the scope of the corpus was visible. Regarding the theories underpinning TSCL, the most prominent theory found was Vygotsky's social constructivism, which is understandable, as most studies from the corpus implemented unstructured collaborative learning. Results also indicated that, although TSCL to enhance SDL is evident, no research regarding the implementation of the five basic elements of CL that have been proved by many scholars as needed to implement successful CL was found. We make a case for the implementation of the five basic elements in TSCL to enhance SDL, and we show how the body of scholarship is lacking in this regard.

■ Introduction and problem statement

Self-directed learning has been proved to be a vital aspect of 21st-century education. Bagheri et al. (2013) refer to SDL as an essential skill and argue that higher education needs to place more emphasis on teaching–learning strategies to enhance SDL. Memorisation and reproduction of facts, which might soon be redundant, will not equip learners for the needs of the 21st-century workplace. Students in the 21st century should be able to take responsibility for their own learning for life. They should also be able to collaborate and communicate effectively with others, think creatively and critically solve new problems that have never existed before, at the same time continuously adapting to new technologies. Unfortunately, a large percentage of young people leave secondary and tertiary education, especially in South Africa (National Skills Development Strategy 2011–2013 n.d.), and enter the labour market with inadequate skill levels and poor work readiness. Self-directed learning is

seen as a solution for students to keep up with the rapidly changing technological society of the 21st century (Stubbé & Theunissen 2008) where traditional teacher-centred learning environments and rote learning no longer provide satisfactory answers.

As it is no longer viable to support teaching that is mere transmission of knowledge in a teacher-centred environment, teachers as facilitators of learning continuously need to seek ways in which students, as self-directed learners, can be actively involved in their own learning to prepare them for their eventual place in the world (Simons 2000). Students need to practise to work together, communicate effectively and solve problems to foster critical and creative thinking. Three of the top characteristics required by employers in the 21st century are teamwork skills, communication skills and interpersonal skills (Hansen & Hansen 2015). These skills are closely linked to the outcomes of CL (Johnson & Johnson 2013), and the key to the development of a self-directed student. However, in an ever-changing educational environment that demands the delivering of teaching–learning experiences to users anytime, anywhere and in different ways to accommodate different learning styles, the pressing need is to determine how technology could support CL effectively to enhance SDL.

It remains a challenge for teachers and facilitators to design an effective CL environment that also employs technology. However, even that will not necessarily enhance SDL. The primary aim of this chapter was to report on the scope of the current body of scholarship on TSCL. In the research, attention was devoted to the learning theories upon which the implementation of TSCL is built as well as the effectiveness of the implementation of technology and of CL elements. The secondary aim of the chapter was to offer our conclusions regarding the possible contribution of TSCL to the enhancement of SDL thus far reported in research. We finally draw on our findings in offering a number of possible guidelines regarding the implementation of TSCL for the purpose of promoting SDL in students.

■ Conceptual and theoretical framework

Collaborativism, a major learning theory to guide 21st-century learning with technologies, focuses on knowledge-building processes whereby technology advances and augments human learning (Harasim 2017a, 2017b). It builds on existing theories such as social constructivist theories of learning. According to Harasim (2017a:15), 'collaborativist theory differs from constructivist learning theory by locating active learning within a process of social and conceptual development based on knowledge discourse'. To understand TSCL to enhance SDL within the collaborativist theory, we need to have a common understanding of SDL, technology-supported learning and CL.

■ Self-directed learning

Researchers in SDL depend on different theories for understanding the essence of SDL. Knowles (1975) builds on the theories of andragogy when explaining SDL as:

> [*A*] process by which individuals take the initiative, with or without the help of others, in diagnosing their learning need, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies and evaluating learning outcomes. (p. 18)

Andragogy claims that adults learn differently from children (Taylor & Hamdy 2013). However, Knowles (1984) indicates that SDL is not only applicable to adults but that young children may also be self-directed in their learning. Loizzo et al. (2017) describe SDL as a theory on its own, one that also depends on self-determination theory (Ryan & Deci 2000). This, as Loizzo et al. contend, is because of the unique focus of SDL on motivational aspects. Other theories that have influenced SDL research are also visible in the body of scholarship, such as the theory of socio-constructivism, where the SDL development of students is seen as occurring in a social context (Sze-Yeng & Hussain 2010).

This theory is often cited as viable in SDL research. The interdependence theory was linked by Higgs and Boud (1991) to SDL, as both SDL and the interdependence theory emphasise learning with and through others. Lastly, the capability theory is seen to be 'rooted in the core thesis that all people possess capabilities to do and become what they have reason to value' (Van der Walt 2016:14), and hence it is regarded by Van der Walt as fundamental to SDL.

Self-directed learning is an approach to learning that promotes the active engagement of students[1] in the learning process to acquire higher-order thinking skills, such as problem-solving, critical thinking and reasoning (Okoro & Chukwudi 2011). A self-directed student should have the ability to acquire new knowledge (what) and the competence in managing the learning process (how) easily and skilfully for the rest of his or her life.

Stubbé and Theunissen (2008:5) identify five elements that support students to become more self-directed in their learning, namely 'learner (student) control', 'self-regulation', 'reflection', 'interaction with the social' and 'interaction with the physical world'. They (Stubbé & Theunissen 2008:5) also argue that 'dynamic social interaction with others makes it possible' for students to perform and practise higher mental functions. Self-directed learning therefore needs to be embedded into a social environment, such as CL.

■ Cooperative learning

In CL, where students work together to accomplish a shared goal or plan, or to monitor and assess their learning (Johnson & Johnson 2013), they need to take responsibility for their own and each other's learning, and in the process of working together, they improve their teamwork, communication and interpersonal skills, which are real-life skills that students need for future careers. Students are

1. In this chapter, 'student' refers to any individual engaging in learning.

therefore active participants in their own learning, they communicate, apply critical and reflective thinking, and motivate each other to achieve their goals (Johnson & Johnson 2016).

According to Johnson and Johnson (1996), there are at least three general theoretical perspectives guiding research on cooperation in learning:

- cognitive developmental theories, which include constructivist and social constructivist theories
- behavioural theories
- social interdependence theory.

Brame and Biel (2015) argue that CL also builds on the constructivist theory and Vygotsky's (1978) zone of proximal development theory, as learning takes place beyond the current level of development when working together on a mutual goal where each member is accountable for achieving the learning outcome. Johnson and Johnson (1996) position CL within the social interdependence theory (based on the work of Deutsch [1949]) where:

- *positive interdependence* creates a commitment among group members to achieve the goal together
- *individual accountability* assures no free riding or one member dominating the learning
- *promotive interaction* ensures that everyone understands and achieves the goal
- good *social skills* prevent students from being isolated or from withdrawing from discussions
- *group processing* results in reflection on the effectiveness of the group. (p. 789)

Cooperative learning is characterised by the active structuring of these five basic elements to ensure effective and optimal learning within the group (Johnson & Johnson 2016). It remains a difficult task to ensure that the five elements are included in any face-to-face CL environment, and even more so when it has to be incorporated within a TSCL environment.

Collaborative learning, on the other hand, builds on the sociocultural activity learning theory (based on the work of

Vygotsky [1978]), which assumes that learning 'occurs in [the] interaction between the individual and the social environment' (Bailey & Mentz 2016:624). Vygotsky made it clear that learning occurs on two levels or planes; firstly, on a social level, and then on a personal level, where the collective meaning-making is internalised. Learning is a social and collaborative activity that involves participation where thinking can be developed together and shared with others (James 2006). Although much confusion exists among researchers on the difference between CL and collaborative learning, the core difference between them can be traced back to the theoretical underpinning of the two strategies (Johnson & Johnson 1996). We are of the opinion that the extent to which the two theories can be drawn together to accommodate the strengths of both might influence the success of TSCL.

The main distinction between CL and collaborative learning lies in the role of the teacher who needs to plan CL environments carefully to incorporate the five basic elements (Johnson & Johnson 2016), as opposed to collaborative learning where the five elements are not intentionally built into the assignment.

Cooperative learning provides students with the opportunity to seek outcomes that are beneficial to themselves as well as to other group members (Johnson & Johnson 2016). The five elements that form the basis of CL, namely, positive interdependence, individual accountability, promotive interaction, social skills and group processing (Johnson & Johnson 2016), need to be present for CL to be successful (Mentz, Van der Walt & Goosen 2008). Promotive interaction results in an interpersonal process where social skills, supporting and encouraging efforts to learn, and participation become a joint process for each individual in the group. Within a cooperative group, individuals should be held accountable for their individual efforts to achieve their own learning goals as well as to help other group members to achieve their learning goals (Johnson & Johnson 2016). Cooperative learning thus supports students to take responsibility for own learning, which is a characteristic of a self-directed student.

Collaborative learning, on the other hand, can be seen as less structured, with less input from the teacher (Mentz 2012) as it is assumed that interaction with others should be structured solely by the students. The disadvantages of a less structured collaborative learning environment are often reported as, among others, that participation is not compulsory, and students need to set their own rules for collaboration (Pata 2009). Positive interdependence will not necessarily be accomplished if not structured by the teacher as facilitator before the learning activity commences. Positive interdependence creates promotive interaction (Johnson & Johnson 1996) and therefore it might be possible that, without the active structuring of the five basic elements, learning might not be effective (Mentz et al. 2008). Students nevertheless are in a position to take responsibility of their own learning when having to structure their own interaction with their peers and, as a result, collaborative learning may also enhance SDL, but does not necessarily set the stage to do so (as is the case with CL).

To incorporate CL within a technology-supported teaching–learning environment, it is essential to investigate how the five elements of CL should be addressed.

▉ Technology-supported cooperative learning

When referring to TSCL in this research, it includes any technology-rich learning environment, including e-Learning, online learning, blended learning, web-learning, computer-supported learning, network-enhanced learning environments and mobile technologies for learning. All of these environments have one common characteristic: the use of some form of technology in learning. Although these technologies are common among people in the 21st century, Kivunja (2015) is of the opinion that the use of technology in teaching, learning and assessment is still in the beginning stages of development. The same accounts for learning theories connected with TSCL. Harasim (2017b) discusses two

theories for online learning, namely, connectivism and collaborativism. According to Harasim (2017b), connectivism was originally based on self-organised learning but evolved into network-organised learning. Siemens (2004) already coined 'connectivism' as a learning theory in 2004, identifying general principles that underpin the theory. One of these general principles is accurate and up-to-date knowledge, which should characterise all learning activities. Connectivism is also based on the principle that learning may reside outside ourselves in non-human appliances. Unfortunately, connectivism as a learning theory has received much criticism. Harasim (2017b), for instance, is of the opinion that connectivism was propounded as a theory of learning for the digital age without empirical or practical evidence to confirm the claim.

Collaborativism is a learning theory that 'provides a model of learning in which students are encouraged and supported to work together to learn and to create knowledge' (Harasim 2017b:118). 'Most commonly, the discourse is text-based and asynchronous, taking place in a web-based discussion forum or computer conferencing system' (Harasim 2017b:117). The collaborativist learning theory focuses on 'group discourse that supports and advances intellectual convergence and knowledge construction activities' (Harasim 2017b:109).

According to McConnell (2013), software to support CL can be divided into structured and less structured software, which should not be seen as alternatives but rather as complementary. The structured software might provide more opportunities to build in the five basic elements of CL than the less structured software. Less structured or unstructured software, according to McConnell (2013:33), does not try to model 'an observed real situation', but enables users to create their own structures within a normally asynchronous environment. These environments might be especially suitable for more unstructured collaboration activities.

According to Johnson and Johnson (1996:787), TSCL exists when 'the instructional use of technology is combined with the

use of cooperative learning'. The question could however be asked whether a collaborativist learning theory provides sufficient ground for positive interdependence and individual accountability as well as promotive interaction, which traditionally forms an important motivation for CL within a face-to-face environment based on the social interdependence theory (Johnson & Johnson 2016). It might be viable to define a cooperativist learning theory to accommodate the social interdependence within an online environment, but known literature will first have to be investigated. In the next section, the methods employed in this systematic review are discussed.

◼ Methods

We utilised an exploratory systematic review on the literature concerning TSCL and SDL to answer the research questions set for this investigation:

- What is the scope of research conducted on TSCL to enhance SDL?
- Upon which learning theories is the research on TSCL built?
- What can we learn about the implementation of TSCL to enhance SDL?

We used the following databases as search instruments to obtain all research conducted between 2009 and 2018 concerning TSCL to enhance SDL:

- Scopus
- EBSCO host
- Web of Science
- Google Scholar.

The key criteria used as keywords were in various combinations:

- 'SDL' and 'technology-supported cooperative learning'
- 'SDL' and 'technology-supported collaborative learning'
- 'SDL' and 'computer-supported cooperative learning'
- 'SDL' and 'computer-supported collaborative learning'.

These searches yielded a total of 306 results. With the exception of doctoral theses, we included all other types of research outputs to which we had access (i.e. journal articles, conference proceedings and papers delivered at conferences).

Once the results had been obtained, a process of elimination started. Firstly, the results were studied in terms of the titles, abstracts and overall notion of the outputs in terms of our keywords. Sixty-one results were deemed relevant. Secondly, if no specific mention was made of SDL in the text, the result was eliminated. Thus, only 30 results remained. A final round of elimination followed. In this round, we scrutinised each article to determine whether all three aspects of the study were indeed visible in the output (i.e. SDL, collaborative learning or CL) and whether some form of technology usage were was indeed visible in the output. From this, only 17 results remained, which formed the final corpus of our study.

Information from each document was coded in accordance with the answers to the three research questions. We designed two spreadsheets illustrating the scope of the research of each document, explaining some descriptive information of the journal, the year of publication as well as the focus, method, population and sampling, findings and the underpinning theories of each output (see Table 7.1 and Table 7.2). Next, we developed a table illustrating whether it was clear from the output how TSCL to enhance SDL should be implemented. We also included notes on the guidelines that had been given for implementation (applicable to our study) (Table 7.3).

Interrater reliability was assured by having two researchers coding the outputs independently and then comparing the results. Each output included in the systematic review was discussed to determine whether agreement regarding the codes and information was possible.

The tables mentioned above as well as a discussion of what was learnt from these data are discussed next.

TABLE 7.1: Descriptive information.

No.	Journal or book	Year	Author(s)	Title	Keywords
1	*The Turkish Online Journal of Educational Technology*	2009	Choo, K.A., Eshaq, A.R.M., Samsudin, K. A. and Guru, B. K.	An evaluation of a constructivist online collaborative learning activity: A case study on geometry	constructivist learning environment, engagement theory, Online Collaborative Learning (OCL), secondary school, case study
2	*Learning and Individual Differences*	2016	Choy, D., Deng, F., Chai, C.S., Koh, H.L.J. and Tsai, P.-S.	Singapore primary and secondary students' motivated approaches for learning: A validation study	SDL, collaborative learning, Motivated Strategies for Learning Questionnaire, Measurements invariance, 21st century skills
3	*Journal of Computer Assisted Learning*	2014	Ciampa, K.	Learning in a mobile age: An investigation of student motivation	digital games, engagement, iPads, motivation, mobile learning
4	*Asia-Pacific Educational Research*	2013	Goh, A., Chai, C.S. and Tsai, C.-C.	Facilitating students' development of their views on nature of science: A knowledge building approach	nature of science, knowledge building, self-directed learning (SDL), collaborative learning, Information and Communication Technology (ICT)
5	*Proceedings of the 7th International Conference on Networked Learning*	2010	Hodgson, V. and Reynolds, M.	Learning, teaching and assessment in networked learning	networked learning manifesto, learning community, participation, assessment
6	*International Journal of Engineering Education*	2013	Kashefi, H., Ismail, Z., Yusof, Y.M. and Mirzaei, F.	Generic skills in engineering mathematics through blended learning: A mathematical thinking approach	blended learning, communication, creative problem solving, engineering mathematics, generic skills, mathematical thinking, teamwork, technology
7	*Computers & Education*	2014	Kim, R., Olfman, L., Ryan, T. and Eryilmaz, E.	Leveraging a personalised system to improve SDL in online educational environments	online learning, SDL pedagogical issues, teaching/learning strategies
8	*Computer Science and Information Systems*	2014	Laanpere, M, Pata, K., Normak, P. and Põldoja, H.	Pedagogy-driven design of digital learning ecosystems	digital learning ecosystems, pedagogy-driven design

TABLE 7.1 (Continues...): Descriptive information.

No.	Journal or book	Year	Author(s)	Title	Keywords
9	*Journal of Computer Assisted Learning*	2014	Lee, K., Tsai, P.-S., Chait, C.S. and Koh, J.H.L.	Students' perceptions of SDL and collaborative learning with and without technology	collaborative learning, SDL, structural equation modelling, technology-based learning
10	*Journal for the Education of the Gifted*	2014	Mammadov, S. and Topçu, A.	The role of e-Mentoring in mathematically gifted students' academic life: A case study	e-Mentoring, gifted students, motivation, collaboration, practicing as professionals
11	*Computer Assisted Language Learning*	2012	Nor, N.F.M., Hamat, A. and Embi, M.A.	Patterns of discourse in online interaction: Seeking evidence of the collaborative learning process	online discussion forum, e-Learning, collaborative learning, behaviour, SDL
12	*Educational Technology & Society*	2009	Pata, K.	Modelling spaces for SDL at university courses	learning design, learning niches, affordances, SDL
13	*Computers & Education*	2011	Robertson, J.	The educational affordances of blogs for self-directed learning	blogs, SDL, computer science
14	*Decision Sciences Journal of Innovative Education*	2016	Sorgenfrei, C. and Smolnik, S.	The effectiveness of e-Learning systems: A review of the empirical literature on learner (student) control	academic areas, e-Learning, online education, pedagogical approaches, SDL
15	*Technology, Pedagogy and Education*	2013	Wong, L.-H.	Enculturating self-directed students through a facilitated seamless learning process framework	mobile seamless learning (MSL), learning process framework, 1:1 technology-enhanced learning, mobile assisted language learning, mobilised science learning
16	*Open Learning*	2015	Yamagata-Lynch, L.C. Do, J., Skutnik, A.L., Thompson, D.J., Stephens, A.F. and Tays, C.A.	Design lessons about participatory self-directed online learning in a graduate-level instructional technology course	SDL, online learning, participatory learning, instructional technology
17	*Computers & Education*	2010	Yap, K.C. and Chia, K.P.	Knowledge construction and misconstruction: A case study approach in asynchronous discussion using knowledge construction – message map and knowledge construction – message graph (KCMG)	computer-mediated communication, cooperative or collaborative learning, interactive learning environments, secondary education, teaching/learning strategies

TABLE 7.2: The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
1	Article	To explore and investigate the nature of students' interaction and participation in Diary or OCL, and to investigate whether Diary was able to promote effects in cognitive and affective learning aspects as perceived by the students.	Not pertinent, but aspects of SDL evident. SDL is mentioned.	Collaborative learning is mentioned, but not CL.	Developed technology called 'Diary system' where students worked online (messaging and email).	DBR Case study	32 secondary school students (13–14 years)	Motivation decreased until field trip was mentioned. Some students were very self-directed regarding Diary (taking responsibility and problem-solving).	Engagement theory Constructivist theory Sociocultural constructivism
2	Article	[T]he purpose of this paper is to explore Singapore students' motivation and their perceptions of engaging in SDL and CL with or without the support of ICT.	SDL is part of the main aim of the study. They define SDL clearly. Make a clear case for SDL.	Focuses on collaborative learning. Makes a case for collaborative learning and technology.	Defines technology in terms of ICT. Combines ICT with collaborative learning and ICT with SDL.	Quantitative design Confirmatory factor analysis	1035 participants (Grades 4–6 and Grades 7–10) from 14 public schools	Motivation in relation to SDL and Collaborative learning (MSDLCL) questionnaire is reliable. Seven dimensions of MSDLCL emerged. Two higher-order dimensions can be explained: motivation and learning approach.	Social development theory Zone of proximal development (ZPD).

Table 7.2 continues on the next page →

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
3	Article	The study sought to examine taxonomy of intrinsic motivation through the lens of mobile learning; studied lived experience of Grade 6 teacher and her students who used tablets in class; determined what were motivational affordances of mobile devices.	Brings SDL to the fore by placing it in Malone and Lepper's taxonomy for motivation. Indicates how mobile learning promotes SDL.	Places cooperation and collaborative learning in the 'cooperation' section of Malone and Lepper's taxonomy for motivation. Indicates how mobile learning promotes CL.	Uses mobile learning in their study. Investigates motivation during mobile learning. Uses tablet as mobile learning device.	Qualitative design Case study	Grades 5 and 6 teachers and 24 students (aged 10-12)	Challenge and feedback play important role in motivation. Tablets allowed students to work at their own pace – increased students' choice. Self-direction was increased as well as possibility of collaboration.	Malone and Lepper's taxonomy of motivation SCT Vygotsky's ZPD

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
4	Article	This study aimed to investigate the knowledge-building approach to reach perceptions of SDL and CL in ICT. Research questions: What are the effects of knowledge-building approach on students' views on nature of science? What are the effects of knowledge base pedagogical approach on students' perceptions of SDLT and CLT?	The study makes a strong case for the development of SDL. It posits that students' views on their learning practices are SDL and CLT with ICT. The study specifically focused on SDL.	This article makes no mention of CL, but it focuses strongly on collaborative learning. The study proved that using the knowledge-building approach might promote SDL and collaborative learning. The knowledge base approach also promotes interactive learning (which forms part of collaboration).	The technology incorporated in this study was that of the knowledge forum, which was used to stimulate collaboration and self-direction.	A quasi-experimental design was implemented in this study.	369 secondary one and two students participated in a pilot study to validate the instrument (views of the nature of science [VNOS], SDL and CL – 36 items). 68 secondary one students from same school participated in the empirical study to determine the effects of knowledge base pedagogy on students' perceptions.	Knowledge base pedagogy decreased dependence on certain sources. Students were more intentional with knowledge construction. Students built on and challenged each other's ideas.	Social constructivist perspective.

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
5	Paper in proceedings	To consider the networked learning manifesto in terms of the ideas behind each of them and the meaning and relevance of some of the key ideas to the current theory and practice of networked learning.	Only mentions SDL as a participative approach alongside student-centred learning and community learning.	No CL is discussed; however, collaborative learning is indicated as the main pedagogical method for networked learning. Indicates how collaborative networked learning always has the possibility of unequal power and control.	Networked learning is positioned in technological online environment; however, the paper does not specify which online technology was used.	The paper does not specify a design that the researcher only set out to review networked learning manifesto against the current theories and practice of networked learning.	NA	Specific questions emerged from the study: Which values and beliefs underlie practice? Are claims to democratic pedagogy justified? Which interpretations of 'community' are found in use? Do they take into account the social and political processes involved? As tutors, what ideas do we draw on to help make sense of these processes? Do networked learning practices support critical reflection and the co-construction of knowledge? Do assessment procedures reflect the same values as are embodied in other aspects of the pedagogy? If there are differences, are they at least acknowledged? Do our pedagogies support space and time for trust and confidence to develop?	Connection between communities of practice and networked learning theories are mentioned.

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
6	Article	The study identified the effectiveness of designed blended learning mathematics courses on engineering students' generic skills, such as communication, teamwork, problem-solving and technology skills.	The study emphasised that SDL is part of the generic skills required from engineers.	The study emphasised that communication and teamwork are part of the generic skills required from engineers. Although not specifically focusing on CL or collaborative learning, the researcher still investigated the development of the two aforementioned skills.	The development of the generic skills was tested before and after the implementation of blended learning.	Quantitative and qualitative	62 students from a multivariate calculus class in Iran, aged between 18 and 21		Blended learning instruction was based on the theory of Tall (2003), Watson and Mason (1998) as well as Lumsdaine and Lumsdaine (1995), and theories were incorporated when designing the classroom activities.

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
7	Article	The purpose of this article is to investigate the effect of a self-directed learning system (SDLS) on students' competency to self-manage their own learning processes. Does the use of SDLS in an online course improve students' competency to self-manage their own learning processes?	The study reported and conceptualised SDL as student control. Notes how SDL activities are integral to formal education. SDL framework was discussed. The study incorporated SDL framework into MediaWiki. Students could set own goals, reflect on learning, self-monitor and collaborate with others.	Using the SDL framework, and the technology designed, the authors set out to reinforce collaborative learning. Through the technology, students were able to collaborate with one another.	Gives details about the Web 2.0 technology used: MediaWiki.	Qualitative, using interviews Quantitative, using SDL Competencies Self-Appraisal Form (SDLCSAF)	Students were business majors: 12 (first pilot), 19 (second pilot) and 60 (experimental study).	The study revealed that students could increase their SDL when supported with appropriate tools. SDL system (using MediaWiki) worked to promote elements of SDL and elements of CL as the MediaWiki addressed SDL aspects and were required to share these aspects with peers. The study also emphasised that SDL development does not happen in isolation.	Used SDL as a theory that informed the design, conceptualisation, implementation and evaluation of the system.

Table 7.2 continues on the next page →

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
8	Article	How to design next-generation TEL systems with built-in pedagogical affordances, which enhance innovative teaching and learning practices and reflect modern learning theories.	SDL is included as a contemporary pedagogical framework upon which the foundations of their intervention are built. They define SDL from Knowles' (1975:18) definition.	Collaborative knowledge-building as framework (like SDL) also forms part of the contemporary pedagogical framework upon which the foundations of the intervention are built.	The technology aspect of the article is focused on the web environment developed: Dippler.	Design-based research, using case study	Eight pilot courses with 164 MA students in Tallinn University (country)	Three-component model for pedagogy-driven design. Found that Dippler, which combines LMS and blog-based PLEs, illustrates how a next-generation TEL system with built-in pedagogical affordances, which enhance innovative teaching and learning practices and reflect modern learning theories, should be designed.	Build their intervention on the theory of biological ecosystems (digital ecosystems – digital learning ecosystems).
9	Article	To explore perceptions of SDL and CL with or without technology.	Good conceptual and theoretical framework on SDL.	Discusses the co-construction of knowledge through collaborative interactions.	Implements a technology-supported SDL and collaborative environment.	Quantitative, pilot, and main study surveys	219 (pilot) 500 (main)	Students who engaged in SDL and CL in face-to-face contexts also engaged in these forms of learning in technology-supported contents. Students should be well prepared in a face-to-face environment to be successful in a CL online environment.	Vygotsky's ZPD

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
10	Article	What are the academic and psychosocial effects of an e-Mentoring programme on gifted eight graders? How do students collaborate and interact with each other in an e-Mentoring programme and does the program have an effect on students' motivation?	Motivation indirectly connected with SDL.	Collaboration and interaction during e-Mentoring. No specific CL theories mentioned. Intervention involves group-work problem-solving with real-life scenarios.	E-Mentoring programme.	Qualitative inquiry Case study	Five gifted 8-graders	Group work effective in terms of motivation and engagement. Good communication, interaction, harmony and respect in the team work. Students are eager to contribute to teamwork; challenging tasks enhance student cooperation. Students more eager to work as a team than individually.	Socially immersed online learning model and Community of Inquiry (CoI) - online learning theory

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
11	Article	To understand how students interact and collaborate on topics previously discussed face-to-face. To investigate the extent to which the online discussion forum successfully promoted collaboration and whether the forum led to greater responsibility for learning.	Specifically in terms of responsibility for learning.	Collaborative learning behaviour model comprises: 1. contributing 2. seeking input 3. monitoring.	Online discussion forums – advantages and disadvantages.	Qualitative and quantitative Content analysis for analysis of students' discourse 14-week course with online discussion forum	20 M-students	Collaborative behaviour identified: contributing, exploring, providing information and giving feedback. Even with minimal intervention from the lecturer, the students actively participated. Feedback given obtained highest percentage. Discussion forms played a positive role in providing a platform for collaborative learning.	NA (student-centred approach)

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
12	Article	To conceptualise the theoretical framework of modelling learning spaces for SDL. To propose the aspect of ecological learning design model. To provide empirical evidence on how descriptions of student-defined learning spaces could be used for determining the learning environment and activity design.	Using a combination of tools and activities in an online environment to enhance SDL. Explores SDL with learning environments.	Collaborating with social software tools (Pbwiki, Zoho, Google Docs, Vyew, forums and blogs). Explains student responsibilities to organise and plan the group work activity and divide the responsibility.	Social software to create learning spaces for SDL.	Qualitative and quantitative Analyses 10 collaborative activities	53 master's students; Convenient sample	Students' active contribution that affects the learning environment and activities of a course needs more attention while modelling e-Learning designs for SDL.	Constructivist

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
13	Article	To determine how higher-order skills could be developed to extend the educational value of blogging and how the educational affordance of blogging supports SDL.	Good conceptual framework on SDL, indicating the link with SRL.\n\nAnalyses SDL skills of students as demonstrated in their diaries.	Not specifically mentioned, but students should utilise social software and blogs to collaborate with each other but still work independently on own projects.	Social software, blogs, technology-supported social environments.	Analysis of design diaries	113 freshmen students in computer-supported (CS) programming module	Framework in which blogging could assist groups of students in development of cognitive, social and SDL skills.\n\nStudents did not coach each other on higher-order skills.\n\nProvide suggestions on how it could be achieved.	Collaborative constructivism
14	Article	To determine the role of student control in e-Learning to predict how autonomous learning affects effectiveness of e-Learning.\n\nUnder which conditions is student-controlled e-Learning effective?	Autonomous learning, self-determined, student-controlled, active student participation in learning.	No explanation of specific collaboration practices.	E-learning and online-based learning systems; virtual and asynchronous self-paced tools.	Systematic review	54 documents	Derives at a conceptual framework as a reference model to illustrate how student control affects e-Learning effectiveness.	Constructivist learning model

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
15	Article	To provide guidelines for effective application of the framework to inform the design of MSL environments design projects.	Mentions SDL and lifelong learning, autonomous self-inquirers; seamless learning.	Contextualised collaborative learning activities; online peer learning with Wiki, Web 2.0, online discussions.	Technology-enhanced learning – online discussions, mobile technology.	Design-based research, surveys, interviews, field notes, video or audio recordings, pre-test-post-test	Primary school students (45)	Proposes a facilitated seamless learning model. Student learning should move beyond the acquisition of content knowledge to develop the capacity to learn seamlessly. To nurture self-directed seamless students, practitioners ought to develop and enact systematic and cyclic facilitated seamless learning processes to enculturate the students. Needs to transform the epistemological beliefs and methods of learning of the facilitators and students.	Inquiry learning

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
16	Article	How does self-directed and participatory learning help adult students stay engaged in online learning activities? Which lessons could a team of graduate students and the instructor learn about self-directed participatory online learning from a collaborative design project?	Explains participatory self-directed online learning.	Small-group activities during a 5-day asynchronous discussion period responding to peers in a group of 3–4. Synchronous sessions with 15–20 min synchronous discussions and activities. Students work collaboratively in participatory learning, negotiate goals and tasks and share meaning towards the construction of a product. Only mentions team reflection as evidence of CL; course participation grant rules.	Online learning environment. Asynchronous and synchronous technologies with a collaborative course design.	Case study 15 weeks Participatory research	17 master's students	SDL can play a vital role in the success of online learning. Participants are more likely to experience meaningful learning when they are engaged in activities that help them gain a sense of social presence, teaching presence and cognitive presence.	Social constructivist philosophy

TABLE 7.2 (Continues...): The scope of research reported in the documents.

Doc no.	Doc type	Research aim or question	Self-directed learning	Cooperative learning	Technology	Design	Population or sampling	Findings	Underpinning theory
17	Article	To trace the communication patterns and knowledge construction as well as misconception process of students working in groups. To describe the process of mapping students' electronic discussion to analyse intergroup cognitive development and knowledge construction. What is the extent of individual knowledge construction as a result of interaction?	Real-life authentic situations.	Computer-supported collaborative learning. Asynchronous discussion. Various members of groups did not move in unison in terms of cognitive understanding; they seemed to be reluctant in reflecting misconceptions and they did not scaffold each other;	Online asynchronous discussions.	Qualitative and quantitative;' Case study; Analyse content of asynchronous discussion	Grade 8 students Purposive sample	SDL through asynchronous discussion has to be monitored by facilitators as students reflected misconceptions that could potentially mislead other participants. Student dominates the discussion, not the facilitator. Asynchronous discussions did not necessarily lead to higher levels of cognitive development.	Constructivist paradigm

CLT, cognitive load theory; CS, computer-supported; ICT, Information and Communication Technology; LMS, Learning Management Systems; MA, Master of Arts; MSDLCL, motivation in relation to self-directed learning and collaborative learning; NA, not applicable; SDL, self-directed learning; SDLCSAF, Self-directed Learning Competencies Self-Appraisal Form; SDLS, self-directed learning system; SDLT, self-directed learning with technology; SRL, self-regulated learning; TEL, technology-enhanced learning; VNOS, views of the nature of science; ZPD, zone of proximal development

TABLE 7.3: The implementation of TSCL to enhance SDL.

Document number	Insight into implementation of TSCL to enhance SDL (Yes/No)	Comments on implementation of different interventions (not necessarily TSCL to enhance SDL)
1	No	Discusses the Diary software implemented in the intervention. Notes how students were put into groups and how collaborative learning occurred. Also states the fact that the whole intervention took six and a half months of which there were three phases: beginning phase, ice-breaking phase and collaborative phase (collaborative phase occurred in the classroom).
2	No	The article reports on confirmatory factor analysis conducted to determine reliability of a newly developed questionnaire: Motivated Self-directed Learning and Collaborative Learning (MSDLCL) with or without ICT support in the classroom. The questionnaire is reliable and hence could be used in the context of our study; however, it does not address the implementation of TSCL to enhance SDL. Implementation suggestions can be derived from the questionnaire, but no explicit mention is made.
3	No	From the study, it became evident that the teacher used tablets in her classroom. Not much is said regarding how she implemented the tablets, apart from the fact that students were allowed to use it when there was spare time (as an example). The study indicated that the use of mobile learning affords motivational development (examined by using Malone and Lepper's taxonomy). Although the use of tablets formed part of the study, the focus was on the affordances of learning motivation from using the tablets (mobile learning).
4	No	The article reports on the use of the knowledge forum as collaborative tool informed by the knowledge base approach. Students using the knowledge forum could improve on each other's ideas and synthesise group knowledge. Furthermore, the teacher drove the system by posting initial ideas, building onto each other's ideas and also synthesising knowledge. Some guideline is given regarding how the system was implemented (TSCL), and the point of departure of the study was on developing SDL. No specific mention is made of how CL or collaboration was stimulated apart from the teacher scaffolding the system. The article makes a case for moving from the 'divide and conquer' approach to collaboration to 'idea-centred' collaboration.
5	No	The paper is based on a comparison between the networked learning manifesto and theories and practice of networked learning (also based on communities of practice).

TABLE 7.3 (Continues...): The implementation of TSCL to enhance SDL.

Document number	Insight into implementation of TSCL to enhance SDL (Yes/No)	Comments on implementation of different interventions (not necessarily TSCL to enhance SDL)
6	No	The study elaborates on the use of blended learning structured as follows: (1) classroom tasks were based on prompts and questions. (2) Assessments included quizzes, tests and written assignments. (3) Computer and web aid consisted of using MOODLE as LMS with many resources uploaded and many tools incorporated. (4) Strategies included designing prompts and questions in such a manner that communication was facilitated. No specific mention is made of how to design TSCL to support SDL. The article reports mainly on the use of blended learning and determining the effect thereof on communication, teamwork and problem-solving.
7	No	The article clearly shows how the SDL system (as discussed in the article) was designed and what it looked like. Although the researchers set out to promote SDL and collaboration, they did not specifically mention how collaboration was established. What is mentioned is how collaboration and SDL were made possible in the designed MediaWiki.
8	No	The article clearly illustrates how the Dippler system was designed. Furthermore, the article also reports on the designs that led up to the design of Dippler. It does not indicate how Dippler is implemented, but rather focuses on how it was designed, justifying its design. It also gives examples of how students could use it and how teachers could use it, but not necessarily how these uses stimulate CL or SDL within these environments.
9	No	The paper only mentions how students were exposed to ICT in a classroom environment. Furthermore, they note that collaborative learning is implemented nationally; however, they do not state how this was implemented. They also mention the use of asynchronous online platforms.
10	No	Defines e-Mentoring (using electronic media as a channel of communication between mentors and mentees). Three tasks for group work and three for individual work. In groups, they used discussion forum and Skype – students had to write detailed blogs at the end of each week. During these weeks, the mentor asked questions, gave problems and noted useful Internet sources. Group work was studied, technology (using online forums and blogs) was studied and the need for SDL was noted; however, these three concepts were not placed together. Although good insights into synchronous group work were given (illustrating the advantages of using synchronous environments), the exact implementation thereof was not elaborated.

TABLE 7.3 (Continues...): The implementation of TSCL to enhance SDL.

Document number	Insight into implementation of TSCL to enhance SDL (Yes/No)	Comments on implementation of different interventions (not necessarily TSCL to enhance SDL)
11	Yes	Students were expected to be self-directed, and the study hence used online discussion forums (technology) to stimulate collaboration and in doing so attempted to encourage SDL. The use of online forums is described in much detail in the article. The role of the lecturer as well as the role of the student is described. The fact that the lecturer was still present during the online discussion (posting comments to demonstrate interest in students' work) is emphasised. It is also made clear that students gave more feedback (almost other-directed as such) than initiating questions or comments.
12	Yes	The author used a combination of different social software tools to develop SDL. Students had to combine their learning environments to conduct individual and collaborative activities. During group activities, they had to form groups, select tools to complete assignments, decide how to organise the communication and how to divide the responsibilities.
13	No	Indicates several collaborative strategies that could support SDL. Some of these collaborative strategies were executed online (blogs) and some were performed in a face-to-face environment (classroom). Students were required to complete design diaries online via blogging. Although the study did not focus on CL, it illustrated how blogs (other online collaborative tools) could be used to promote SDL.
14	No	The article gives a systematic review of the literature on student control during e-Learning. It illustrates how student control affects e-Learning.
15	No	The article reports on facilitated seamless learning framework. Framework illustrates the interaction between individual learning and social learning (both online and in class). Furthermore, six guidelines are reported that should be kept in mind when seamless learning design is implemented.
16	Yes	An overview of course design is given. This includes addressing how self-directed participatory online learning within collaborative learning could occur. Self-directed online learning as well as collaborative course design is also discussed.
17	No	The article is focused on the analysis of data and not necessarily on how collaborative learning (which was analysed) should be implemented. The researcher however notes that the intervention used asynchronous discussion in StudyWiz. The teacher's role as well as the roles of student is explained.

SDL, self-directed learning; TSCL, technology-supported cooperative learning; ICT, Information and Communication Technology; LMS, Learning Management Systems; MSDLCL, Motivated Self-directed Learning and Collaborative Learning.

■ Results

To illustrate the results obtained from the systematic review, we drew up the three above-mentioned tables. In Table 7.1, descriptive findings on publication types (journal or book), year of publication, authors, titles and keywords are given. Table 7.2 gives the scope of each publication – this comprises the document type, the research aim or question, how SDL is addressed in the publication, how CL is addressed in the publication, and how technology is addressed in the publication. Furthermore, the design, population or sampling, findings and underpinning theory evident from the document are provided.

In Table 7.3, a brief summary of the contribution of each of the documents towards insights into the implementation of TSCL to enhance SDL is presented with a short discussion on the specific intervention and what could be derived in terms of implementation in the context of TSCL to enhance SDL.

In the next section, the key findings from these results are discussed.

■ Findings and discussion

The discussion of the findings of the systematic review is in relation to the three main research questions posed for this research.

■ The scope of research on technology-supported cooperative learning to enhance self-directed learning

In Table 7.1 (indicating the final corpus after sifting took place), it is clear that no output refers specifically to TSCL (evident from the titles explored). This already indicates a lacuna that needs to be filled. Furthermore, it is also evident that a higher production of outputs occurred in 2013 and 2014 (with seven of the 18

outputs being published in those 2 years). One also notices that there is no trend – all outputs are scattered over different foci, although three of the 18 outputs were placed in a mathematics context. It is also evident that the findings by the different authors differed and that no specific author or journal dominated the field (although the journal *Computers & Education* appeared three times out of 18).

When looking at the scope of research conducted on TSCL to enhance SDL over the past 10 years, it is evident that the overwhelming majority of the research related to collaborative learning (*n* = 14) in a technology-supported asynchronous environment. This environment is characterised by a lack of formal structure for cooperation. In the majority of cases, the collaboration was not compulsory or structured, but students sought help on forums and discussion boards as needed.

Regarding the chosen technologies, some outputs are not clear on which technologies they were implementing (these were categorised as 'other technologies'). From the corpus, the technologies used were identified as:

- blogs and Web 2.0 (*n* = 4)
- forums or online communication (*n* = 4)
- mobile (*n* = 1)
- software (*n* = 1)
- other (*n* = 8).

What is however most evident is that the majority of outputs correctly defined SDL (as defined in this article) and had SDL as one of the key concepts in their studies (*n* = 11). It was often found that SDL is defined in the literature as self-study, independent study or SRL (Knowles 1975; Loyens, Magda & Rikers 2008); however, the corpus in this systematic review illustrated the correct use of the term.

As evident from this discussion, the outputs were widely spread and no single answer to the question how to enhance SDL within a TSCL environment was found. The following section describes the underpinning theories from Table 7.2.

■ Learning theories underpinning the research on technology-supported cooperative learning

It is evident from Table 7.2 that not only one theory was relied on when doing research on TSCL. Nine different theories for underpinning the research on TSCL were mentioned in the 17 documents as well as another seven theories not generally recognised as learning theories (added in brackets in Table 7.2). Of the nine theories, five theories mentioned in 10 of the documents related to Vygotsky's social development theory (1978). This includes the sociocultural constructivist theory, the SCT, inquiry learning and Vygotsky's ZPD (1978). Some of the documents mentioned more than one theory or only referred to online learning theories. The overwhelming majority thus supported some or other form of Vygotsky's learning theory. Two documents placed their work within the engagement theory and the network learning theory. Both had meaningful engagement with others as common goal, but were also linked to Vygotsky's idea that knowledge is socially constructed. Four documents identified the theory upon which their work was based as constructivism (in terms of which students constructed their own knowledge and meaning from their experiences) and did not mention specifically whether it was socially constructed. Another document used intrinsically motivated instruction as described by Malone and Lepper (1987) as the underpinning theory. According to this theory, learning needs to be fun, and it should create a challenge, a fantasy and a curiosity to the student (Malone & Lepper 1987). It appears that a form of constructivism, which is infused with social interaction, where learning takes place in relation to others, can be seen as the most common theory that is used by the majority of documents. Interesting enough, no document used the social interdependence theory, but it might be because no document specifically mentioned CL as its strategy.

■ The implementation of technology-supported cooperative learning to enhance self-directed learning

From the corpus of 17 documents, it was evident that no document specifically used TSCL to enhance SDL; however, 3 of the 17 documents provided useful information regarding how (in our context) TSCL could be implemented. Although document 12 focused on TSCL (collaborative learning), it still provided useful information on how collaboration is stimulated, how SDL can be stimulated and how the facilitator should conduct the class. The authors conclude that it is important for the facilitator to be present and act as guide, although the teaching–learning strategies should be student-centred. Document 13 also focused on collaborative learning, but made an interesting case regarding the implementation of various social media tools to stimulate SDL development. In this study, students not only worked individually but also needed to form groups, select tools to complete assignments, decide how to organise the communication and how to divide the responsibilities. The author nevertheless did not provide detailed information on how to foster collaboration between students. In CL, the teacher will be especially involved during these processes to ensure that the five elements of CL are stimulated. In document 17, the authors provided insight into collaborative learning and how it could stimulate SDL development when implemented online (using asynchronous discussions). What is important to note in document 17 as well is the fact that the five elements of CL are not mentioned. One can therefore not tell whether all members of the groups benefited, participated or achieved the learning outcomes. Not all documents made mention of how the authors implemented collaborative learning. The majority used asynchronous technology environments, which made the incorporation of the five elements of CL even more difficult.

Although we attempted to conduct our systematic review thoroughly, some limitations are evident, and these are discussed below.

■ Limitations of the study

We attempted to ensure trustworthiness in our systematic review and therefore eliminated as many limitations as possible. However, not all databases were searched. Only four databases were consulted (these databases are well known for yielding many results, and therefore we are confident that the results are representative). Furthermore, seminal works (not in the 10-year time frame) were not consulted. We are aware that some seminal work on the topic has been performed (e.g. Johnson & Johnson 1996); however, these works were not included, as our aim was to determine the current status of TSCL to enhance SDL. When designing our TSCL to enhance SDL, these seminal studies will however be included as they provide insights into the topic.

■ Conclusion

From our systematic review, it became evident that research as reported in all of the studies provides some valuable research findings; however, none of the studies provided insight into TSCL to enhance SDL. It was clear that SDL is considered an important outcome of education, and the majority of studies specifically made a case for using technology-supported environments to foster SDL development. However, no evidence was found regarding the question whether the enhancement of SDL indeed occurred. Authors also did not provide specific guidelines on how to structure technology-supported environments to foster SDL.

Vygotsky's (1978) SCT is the most widely used theory when dealing with technology-supported collaboration; however, as none of the studies were specifically focused on TSCL, this theory will still have to be tested in terms of the virtues of CL and its underpinnings of the social interdependence theory (Johnson & Johnson 2016).

Lastly, it was found that during TSCL to enhance SDL, teachers still have to be present (providing feedback, giving guidance and providing the necessary questions and resources); however, the focus of the teaching–learning activity is placed on the students,

who in some cases are held responsible to choose their own resources, organise themselves and monitor their own progress (aspects that speak clearly of SDL development). What is clear is that the effectiveness of the collaboration in terms of the individual and group accountability as well as the sense of positive interdependence where the success depends on the participation of all the group members cannot be assured (and was not necessarily stimulated). Evidence from the corpus illustrated that most of the group activities were not compulsory and students could choose to collaborate when they needed support. Even with more formal collaboration, there was evidence of some students misguiding others (see, e.g., Yap & Chia 2010) and not promoting each other's learning. Without the presence and guidance of a good facilitator and the stimulation of the five elements of CL, effective learning may not occur within an asynchronous collaborative online environment. We also found that the success of collaboration in terms of the five elements of CL appears more possible in a synchronous environment than in an asynchronous environment (e.g. Mammadov & Topçu 2014).

The systematic review yielded many new insights into the body of scholarship regarding TSCL to enhance SDL, but it is quite clear that innovative research is needed to build a case for TSCL to enhance SDL. Attention should be given in a synchronous or asynchronous technology-supported environment to actively include the five elements of CL. Facilitators need to be present, guiding students by means of comments and prompts. Finally, the technology chosen to support the CL should support the incorporation of the five elements, allowing the facilitator to be present and involved.

■ Acknowledgements

A teaching–learning framework for adaptive instruction using cooperative learning and Socratic questioning to promote self-directed learning: A systematic literature review

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∎ Abstract

The need to develop 21st-century and SDL skills in students is evident in the field of education. Adaptive instruction using CL and Socratic questioning is one possible way to address this issue. The purpose of this study was to explore what the body of scholarship showed about teaching and learning where CL and Socratic questioning were used in adaptive instruction to promote SDL. This chapter presents the findings of a systematic literature review that explored the concepts 'SDL', 'cooperative learning', 'Socratic questioning' and 'adaptive learning' in various settings. A number of databases were scrutinised for suitable material that addressed these themes, and through a rigorous process of sorting and selection, 39 documents were coded by using Computer Assisted Qualitative Data Analysis Software (CAQDAS), ATLAS.ti™. The findings showed that SDL is best developed in a social environment where students can still take individual responsibility for their own learning. One such area is adaptive instruction, which provides students with personalised opportunities to develop. The use of Socratic questioning has shown positive effects on group activities. The current review encourages further research in the field of developing, implementing and testing an adaptive system that makes use of CL and Socratic questioning to promote SDL.

∎ Introduction

South Africa finds itself in a challenging time where technological resources are becoming increasingly necessary yet are still very scarce (Herselman 2003). Furthermore, a dire need for

personalising education to cater for students' specific needs (Bray & McClaskey 2018) as well as a focus on developing SDL skills – critical thinking, creativity, communication and collaboration skills and curiosity (Guglielmino 2014) – has emerged. Self-directed learning is defined by Knowles (1975) as a process where individuals assume responsibility for their own learning, set their own learning goals, gather resources and choose appropriate learning strategies and evaluate their progress – all of this can be achieved with or without the help of others. Although there is confusion regarding the difference between SDL and SRL, Long (2000) places SRL (along with others) as a primary dimension of SDL. In this chapter, we specifically focus on SDL, as there is a great need for this to be developed. The question arises whether we can develop an adaptive system for the personalisation of learning content, which at the same time also promotes the above-mentioned skills, especially in areas where the students are struggling.

Cooperative learning as well as Socratic questioning has proved to be successful in SDL (Bailey & Mentz 2015). Both of these teaching–learning strategies allow individuals to:

- experience different opinions and viewpoints
- see different ways to solve problems (critical thinking)
- benefit from the experience of others
- communicate and explain thoughts that contribute to deeper understanding
- improve academic achievement
- improve social skills
- in turn improve SDL (Bailey & Mentz 2015; Johnson & Johnson 2013; Mentz & Van Zyl 2016).

On the other hand, adaptive instruction, using technology, holds the possibility to give each student the opportunity to learn at his or her own pace and address individual issues that may surface and a pre-programmed system adapts his or her learning process accordingly (Ahmed, Sangi & Mahmood 2017; Wauters, Desmet & Van den Noortgate 2010).

As the need in education has shifted to promoting SDL, teaching and learning should therefore shift too. One possibility

to address this need is to incorporate Socratic questioning, adaptive instruction and CL in education. There are relevant studies about the benefits of technology-based adaptive learning, but profound knowledge of didactic concepts and large-scale research are still very scarce (Johnson et al. 2016). The research question that guided this research was, 'what does the body of scholarship reveal about teaching and learning with adaptive instruction using cooperative learning and Socratic questioning to promote SDL?'

The research design and methodology of this research (to answer the research question) are discussed in the next section.

■ Research design and methodology

Systematic literature reviews adhere closely to specific scientific methods that aim to limit bias by identifying, selecting and synthesising all relevant studies for a particular question to be answered (Briner & Denver 2012). It also provides a source of evidence-based information that could support practice and professional development and aids in identifying new developments and gaps in knowledge bases (Petticrew & Roberts 2006). It is often used as a prelude to further research activities (Kitchenham 2004), and it anchors the rest of the scholarly work (Okoli & Schrabram 2010). For these reasons, we considered the systematic literature research to be a suitable method to identify and synthesise the basics on the main topics of our multi-level research project, in which teaching and learning with adaptive instruction using CL and Socratic questioning to promote SDL were explored.

■ Data sources and search terms

All processes in the systematic literature review were documented in detail, as suggested by Briner and Denyer (2012). In total, 33 searches were performed by using various combinations of the following keywords:

- 'self-directed learn* or sdl'
- 'cooperative and learning'
- 'cognitive and load'
- 'adaptive'
- 'socratic and questi*'.

The databases that were consulted included Scopus, EBSCOhost, ScienceDirect, Web of Science, JSTOR, Google Scholar and SA ePublications.

■ Selection of documents for inclusion

Upon completion of the searches, 1986 documents were identified. Six phases of selection took place. Two researchers mined the data in terms of suitability. This was achieved by firstly scanning the titles and then abstracts. Once suitable data had been identified, the full text was reviewed. This process delivered 39 suitable documents that were coded in Computer-Assisted Qualitative Data Analysis Software (CAQDAS), ATLAS.ti™. The selection criteria for the suitability of documents were as follows:

- two of the four key concepts of the study (SDL, CL, Socratic questioning and adaptive learning) were addressed (at face value)
- work relating to quantitative, qualitative or mixed-method research
- documents published between 2008 and 2018
- documents published in peer-reviewed journals, conference proceedings and books to which the researchers had access.

■ Coding and synthesis procedure

A shared codebook (Table 8A1) was created, which the two researchers updated in Google Sheets™ with emerging codes, definitions and examples of codes throughout the coding process (DeCuir-Gunby, Marshall & McCulloch 2011; Saldaña 2009). This ensured that the researchers were completely clear and in agreement with the detailed procedures necessary when

undertaking the scientifically rigorous systematic review (Okoli & Schrabram 2010). The researchers used inductive data analysis, which meant that codes, concepts and categories emerged as the documents were studied.

Various measures were put in place to ensure validity and reliability in the review process. These included:

- a detailed audit trail (Creswell 2007) of the procedures that were followed when selecting, analysing and coding the documents
- ensuring researcher responsiveness (Given 2008) by determining interrater reliability
- using rich, thick descriptions (Creswell 2007) in reporting the findings.

The researchers independently coded a randomly selected article, and the interrater reliability was calculated using Cohen's Kappa = 0.941 (Cohen 1960). According to McHugh (2012), a Kappa value of above 0.90 has an almost perfect level of agreement.

■ Findings

From the process described above, 39 documents emerged as suited to our criteria. Although some documents at first seemed to have addressed two of the four main concepts, upon closer look it seemed they did not. Table 8.1 illustrates the documents and indicates what each set of data showed about the four main themes (SDL, CL, Socratic questioning or critical thinking and adaptive learning) of this review.

■ Ideas emerging

□ Need for investigation

From the documents studied, several 'future research' needs were highlighted in the texts. These suggestions for further research were categorised into the four main themes of this study. The documents showed the following suggestions for future research (see Table 8.2).

TABLE 8.1: Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Balakrishnan, B.	Motivating engineering students learning via monitoring in personalized learning environment with tagging system	2018	Using a PLE, it became evident that students need guidance to develop into more self-effective self-directed learners.	NA	NA	No specific mention of adaptive learning, but similarities are visible between adaptive learning and PLE.
Bednall, T.C. and Kehoe, E.J.	Effects of self-regulatory instructional aids on self-directed study	2011	The study investigated support (in the form of prompts and design changes) on self-regulated, self-directed homework. In essence, the study was focused on SRL rather than on SDL.	NA	The context of the study was focused on an online critical thinking module.	NA
Bélanger, P.	Theories in adult learning and education	2018	The theoretical book focused on predominant theories of adult learning of which SDL forms a part. Theories included behaviourism, cognitivism, constructivism, humanism, experiential learning and transformative learning.	NA	NA	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Cárdenas-Robledo, L.A. and Peña-Ayala, A.	Ubiquitous learning: A systematic review	2018	Investigated u-learning and found that the taxonomy for u-learning approaches (TULA) should include self-directed collaborative learning.	Only briefly mentions CL but does not make any claims based on elements of CL.	Investigated u-learning and found TULA should include critical thinking development.	NA
Cueli, M., González-Castro, P., Krawec, J, Núñez, J.C. and González-Pienda, J.A.	Hipatia: A hypermedia learning environment in mathematics	2016	NA	NA	NA	The study focused on developing hypermedia learning environment (synonymous to adaptive learning environment) that incorporates mathematical competence, problem-solving, SRL and affective-motivational aspects. It proves that an adaptive learning environment could promote SRL.

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Dreifuerst, K.T.	Getting started with debriefing for meaningful learning	2015	NA	NA	Investigated the use of debriefing for meaningful learning (DML) to foster students' reflective thinking. DML includes Socratic questioning and active learning.	NA
Havenga, M. and De Beer, H.	Project-based learning in Consumer Sciences: Enhancing students' responsibility in learning	2016	The study investigated the effect of implementing project-based learning on consumer sciences students' SDL. The study proved the value of project-based learning for SDL development.	NA	NA	NA
Ibáñez, M.-B. and Delgado-Kloos, C.	Augmented reality for STEM learning: A systematic review	2018	Noted the value of augmented reality for SDL development.	NA	Discusses the value of augmented reality for critical thinking development.	Illustrates the use of Augmented Reality as adaptive learning.

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Inglis-Jassiem, G., Statham, S.B. and Hanekom, S.D.	What does an enquiry-based approach offer undergraduate physiotherapy students in their final year of study?	2014	Investigated enquiry-based learning to develop physiotherapy students' SDL. The finding was that enquiry-based learning had a positive effect on these students' SDL development.	Did not investigate CL per se but focused on collaborative learning.	The study found that enquiry-based learning promotes higher-order thinking skills, such as critical thinking, but support from lecturer is also needed.	NA
Izumi, L., Fathers, F. and Clemens, J.	Technology and education: A primer	2013	Indicates how DreamBox adaptive system improves learners' SDL.	Indicates how Khan Academy included possibilities for CL.	Indicates how LearnSmart develops learners' critical thinking.	Reports on various adaptive systems already in use: LearnSmart (McGraw-Hill), Khan Academy and DreamBox.
Kwak, D.-J.	Ethics of learning and self-knowledge: Two cases in the Socratic and Confucian teachings	2016	NA	NA	Compares Confucianism with Socratic-influenced teaching.	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Law, Y.-K.	The effects of cooperative learning on enhancing Hong Kong fifth graders' achievement goals, autonomous motivation and reading proficiency	2011	Mentions the value of CL for SDL development.	Indicates how CL should be implemented and how teachers should guide the process. The study also compared drama and traditional teaching with that of using the jigsaw strategy and found that students in the jigsaw groups outperformed the rest.	Mentions how student autonomy should be managed to promote critical thinking.	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Lee, S., Barker, T. and Kumar, V.S.	Effectiveness of a learner-directed model for e-learning	2016	Mentions the reality of SDL and autonomous learning.	NA	Indicates that the model they developed is based on constructive learning, which highlights problem-solving and critical thinking.	The study emphasised the importance of using adaptive systems to optimise learner direction and learner control (both SDL elements).
Lehmann, T., Hähnlein, I. and Ifenthaler, D.	Cognitive, metacognitive and motivational perspectives on preflection in self-regulated online learning	2014	NA	NA	Mentions how prompts in adaptive systems may improve critical thinking.	Indicates the positive effect of using prompts in adaptive and personalised learning instruction.
Loncar, M., Barrett, N.E. and Liu, G.-Z.	Towards the refinement of forum and asynchronous online discussion in educational contexts worldwide: Trends and investigative approaches within a dominant research paradigm	2014	The findings indicate that asynchronous online discussion promotes SDL.	NA	The findings indicate that asynchronous online discussion promotes critical thinking.	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Malan, S.B., Ndlovu, M. and Engelbrecht, P.	Introducing problem-based learning (PBL) into a foundation programme to develop self-directed learning skills	2014	Investigated the use of PBL to promote SDL. The researchers found that PBL can indeed promote SDL; however, they caution that students' beliefs in approach should also be supported.	Indicates that CL should be incorporated into PBL; however, it does not refer to the five elements of CL.	NA	NA
Marques, S.	Can we teach to think in primary schools? A comparative analysis of the English and the Brazilian National Curriculum and the impact of a small-scale cognitive enhancement study in Brazil	2014	Sketches the importance of developing SDL.	NA	The study indicated that group debates (possibly guided by Socratic traditions) increased students' thinking.	NA
Neitzel, C. and Connor, L.	Messages from the milieu: Classroom instruction and context influences on elementary school students' self-regulated learning behaviors	2017	No specific mention is made of SDL; however, the study focused strongly on SRL and the way teachers influence learners' SRL development. It also speaks significantly about metacognition (which forms a part of SDL).	NA	NA	NA

Table 8.1 continues on the next page →

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Nguyễn, T.M.T. and Nguyễn, T.T.L.	Influence of explicit higher-order thinking skills instruction on students' learning of linguistics	2017	No specific mention is made of SDL; however, the study focused strongly on SRL and the way metacognition and collaborative learning influence students' SRL.	Makes mention of how CL promotes higher-order thinking skills, such as critical thinking.	Indicates how Socratic techniques improve higher-order thinking skills such as critical thinking.	NA
Park, J.J., Long, P., Choe, N.H. and Schallert, D.L.	The contribution of self-compassion and compassion to others to students' emotions and project commitment when experiencing conflict in group projects	2018	NA	Investigated the role of emotion when students are busy with projects (incorporating CL). Intragroup conflict and compassion are the two main drivers for emotion.	NA	NA

Table 8.1 continues on the next page →

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Pieger, E. and Bannert, M.	Differential effects of students' self-directed metacognitive prompt	2018	Investigated self-directed metacognitive prompts versus pre-defined prompts.	Mentions the positive effect of prompts on cooperation.	Comparison between self-directed metacognitive prompts and pre-defined metacognitive prompts. No significant difference between the prompts was found; however, prompts in general proved beneficial.	NA
Santhanam, R., Sasidharan, S. and Webster, J.	Using self-regulatory learning to enhance e-learning-based information technology training	2008	Notes how e-Learning requires high self-direction; however, the study itself focuses on SRL and its positive effect on learning outcomes.	Describes a technology-mediated learning method that incorporates CL.	NA	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Saravanamuthu, K.	Reflecting on the Biggs–Watkins theory of the Chinese learner	2008	NA	NA	The article contrasts Chinese (Confucian) teaching with Western (Socratic) teaching.	NA
Schneider, M. and Preckel, F.	Variables associated with achievement in higher education: A systematic review of meta-analyses	2017	NA	NA	Reports a systematic review of how critical thinking is a variable of achievement in higher education.	NA
Shih, J.-L., Chuang, C.-W. and Hwang, G.J.	An inquiry-based mobile learning approach to enhancing social science learning effectiveness	2010	Mentions the positive effects of inquiry-based learning on learners' SDL.	NA	NA	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Stolk, J., Martello, R., Lobe, T., Taratuitin, B., Chen, K-C. and Herter, R.	Work in progress: En route to lifelong learning?	2012	Reports on longitudinal study tracking students' SDL defined as: 'We posit that self-directed learner development is a complex and multifaceted process shaped by the interaction of specific learning environments with students' learning beliefs, motivations, goal orientations, and metacognitive knowledge and skills' (Stolk et al. 2012:1).	NA	NA	NA
Strang, K.D.	Asynchronous knowledge sharing and conversation interaction impact on grade in an online business course	2011	Argues that SDL (in an individual manner) does not necessarily yield as good a result as when effective group interaction takes place. Important to note however that it is evident that SDL is defined in terms of individual learning as opposed to Knowles' (1975) more complex definition.	Argues for collaboration in online education; however, it does not make mention of CL per se.	Uses Socratic questions to encourage online discussions.	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Stubbé, H.E. and Theunissen, N.C.M.	Self-directed adult learning in a ubiquitous learning environment: A meta-review	2008	Investigated how the elements of SDL should be included in ubiquitous learning environments. Refers to the five elements of SDL, namely, learner control, self-regulating learning strategies, reflection, interaction with the social world and interaction with the physical world. The study proved the use of ubiquitous learning supporting these elements of SDL.	NA	NA	NA
Tarmizi, R.A. and Bayat, S.	Collaborative problem-based learning in mathematics: A cognitive load perspective	2012	Mentions the positive effects of PBL on SDL.	Mentions that PBL is based on the theoretical frameworks of: information processing theory, CL, constructivist learning and contextual learning theory.	Notes how critical thinking is improved by the use of PBL.	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Thota, N.	Connectivism and the use of technology/media in collaborative teaching and learning	2015	Argues that connectivism is a theoretical lens that encourages self-directed and collaborative learning. The study was conducted with Asian learners.	Only makes mention of collaborative learning, not CL.	Mentions how collaborative technologies encourage critical thinking.	NA
Van Seggelen-Damen, I.C.M., Van Hezewijk, R., Helsdingen, A.S. and Wopereis, I.G.J.H.	Reflection: A Socratic approach	2017	NA	NA	The article reports on the Socratic method or dialogue and how it controls reflection.	NA
Wang, Y.-H.	Could a mobile-assisted learning system support flipped classrooms for classical Chinese learning?	2016	Notes that mobile learning and the flipped classroom approach could promote SDL; however, some students are adverse to the idea of taking responsibility for learning and becoming more self-directed, hence, prohibiting them from developing.	NA	NA	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Wanner, T. and Palmer, E.	Personalising learning: Exploring student and teacher perceptions about flexible learning and assessment in a flipped university course	2015	Argues how students are not ready for SDL as they might still want to be spoon-fed.	NA	NA	Specifically talks about personalised learning, but defines it as being similar to adaptive learning. Makes an argument that it will be teachers' responsibility to design these learning opportunities and that teachers are somewhat reluctant because of time constraints.
Winston, K.A., Van der Vleuten, C.P.M. and Scherpber, A.J.J.A.	The role of the teacher in remediating at-risk medical students	2012	NA	NA	Mentions that remediation may increase medical students' critical thinking and self-regulation.	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Wittwer, J. and Renkl, A.	Why instructional explanations often do not work: A framework for understanding the effectiveness of instructional explanations	2008	NA	Creates a framework for instructional explanation and includes elements of CL in this framework.	NA	Presents a framework for adaptive teaching (although using explanation).
Wosnitza, M.S., Labitzke, N. Woods-McConney, A. and Karabenick, S.A.	Consistently inconsistent: Teachers' beliefs about help seeking and giving when students work in groups	2014	Investigated 'help seeking' during group learning situation. Specifically considered SDL environments. It became evident that teachers use 'help giving' moments to encourage learners' SDL and cooperation.	NA	NA	NA

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Yeh, Y.-C.	Integrating e-learning into the direct-instruction model to enhance the effectiveness of critical-thinking instruction	2009	Mention is made of self-reflection, but SDL is not discussed in detail.	The study reports using CL in experimental instruction, but the elements of CL are not evident.	The study indicates that by integrating e-Learning with direct instruction, preservice teachers' critical thinking skills could be improved.	NA
Yilmaz, R.	Exploring the role of e-learning readiness on student satisfaction and motivation in flipped classroom	2017	The study found that the students' SDL skills were important predictors of satisfaction and motivation in technology-supported flipped classroom environments.	The study reports on the use of CL; however, the five elements are not discussed pertinently.	NA	The study reports that individual development of students in terms of content can be ensured by using an adaptive LMS within the flipped classroom model.

TABLE 8.1 (Continues...): Final list of documents from systematic review.

Author(s)	Title of output	Year published	SDL	Cooperative learning	Socratic questioning or critical thinking	Adaptive learning
Yu, Z. and Wang, G.	Academic achievements and satisfaction of the clicker-aided flipped business English writing class	2016	SDL is encouraged in a flipped classroom approach. This results in an increase in students' self-regulation and self-efficacy.	NA	The flipped classroom approach assists in increasing students' critical thinking as opposed to traditional teaching methods.	NA

DML, debriefing for meaningful learning; LMS, learning management system; NA, not applicable; SDL, self-directed learning; PBL, problem-based learning; PLE, personalised learning environment; STEM, science, technology, engineering and mathematics; TULA, taxonomy for u-learning approaches.

TABLE 8.2: Future research identified from documents.

Source	Date	Suggested research	Categorisation according to themes
SDL			
Stubbé, H.E. and Theunissen, N.C.M.	2008	'Future research needs to identify how an adaptive learning environment can contribute to self-directed learning' (p. 23).	SDL
Tarmizi, R.A. and Bayat, S.	2012	More extensive research on PBL in learning statistics needs to be performed.	PBL (SDL)
Cárdenas-Robledo, L.A. and Peña-Ayala, A.	2018	There is a need for a theoretical baseline for the grounding of the conception, development, deployment and exploitation of u-learning.	SDL
Personalised and adaptive learning			
Santhanam, R., Sasidharan, S. and Webster, J.	2008	Technical aspects used in designing e-Learning tools that are able to provide messages throughout training and need be personalised for each learner should be examined.	Personalised learning
Wittwer, J. and Renkl, A.	2008	More research is necessary to understand how to use instructional explanations in an adaptive system.	Adaptive instruction
Izumi, L., Fathers, F. and Clemens, J.	2013	Better quantitative, empirical research needs to be performed regarding the benefits of adaptive technology, as well as keys to success when implementing and using it.	Adaptive instruction
Wanner, T. and Palmer, E.	2015	Literature is lacking information about the level of control students want to have in personalised learning.	Personalised learning
Wanner, T. and Palmer, E.	2015	Research should determine at what level of flexibility an adaptive course is still effective.	Personalised learning
Wanner, T. and Palmer, E.	2015	Research should determine whether the flipped classroom and personalised learning result in better marks and learning outcomes.	Personalised learning
Pieger, E. and Bannert, M.	2018	Learner characteristics that play a role in different types of prompts should be tested.	Adaptive instruction
CL and collaboration			
Santhanam, R., Sasidharan, S. and Webster, J.	2008	To determine the types of group projects and other instructional strategies that could encourage learners to communicate better and share ideas in CL should be determined.	CL
Law, Y.-K.	2011	Students' goal orientation and autonomous motivation in CL activities should be investigated.	CL

TABLE 8.2 (Continues...): Future research identified from documents.

Source	Date	Suggested research	Categorisation according to themes
Wosnitza, M.S., Labitzke, N. Woods-McConney, A. and Karabenick, S.A.	2014	A variety of schools, subjects and countries should investigate the use of help seeking and giving in group learning settings.	Collaboration
Havenga, M. and De Beer, H.	2016	Cooperative learning should be investigated as a strategy to enhance group work in a project-based learning context.	CL
Yu, Z. and Wang, G.	2016	Future studies on the flipped classroom should focus on educational technologies that encourage discussions in and out of class.	Collaboration and CL
Yilmaz, R.	2017	More qualitative studies should be conducted to determine students' opinions regarding the flipped classroom as well as their interaction in an online environment (student–teacher interaction, student–student interaction and student–content interaction).	Collaboration
Ibáñez, M.-B. and Delgado-Kloos, C.	2018	Collaborative instructional strategies should be used to support group interaction, interdependence among group members and individual accountability.	CL
Park, J.J., Long, P., Choe, N.H. and Schallert, D.L.	2018	Investigation should be done on whether interventions to increase compassion for self and/or others could lead to greater positive emotional experiences.	Collaboration
		Projects should explicitly consider compassion in student motivation and collaboration.	
Socratic questioning or critical thinking			
Shih, J.-L., Chuang, C.-W. & Hwang, G.J.	2010	Further research to understand the aspects of learning such as critical thinking, creative thinking and CL in the context of mobile learning should be undertaken.	Critical thinking and CL
Yeh, Y.-C.	2009	Mechanisms that influence preservice teachers in learning how to use critical thinking skills should be explored.	Critical thinking

CL, cooperative learning; SDL, self-directed learning; PBL, problem-based learning

The suggested future research was categorised into the four main themes of this investigation, which included:

- three documents made suggestions relating to SDL
- five documents suggested future research concerning personalised and adaptive learning
- eight documents showed information about future research in cooperative and collaborative learning
- two documents offered suggestions relating to critical thinking.

The most pertinent suggestion about SDL, which relates to this chapter is, '[f]uture research needs to identify how an adaptive learning environment can contribute to self-directed learning' (Stubbé & Theunissen 2008:23). Although this document was published in 2008, it is clear from the number of documents that were gleaned during the current search that not much work has been performed yet on adaptive learning and its effect on students' SDL, hence the need to explore aspects relating to SDL within an adaptive learning environment.

Concerning personalised and adaptive learning, the suggested research can be classified into two categories, namely, research about the benefits of personalised and adaptive learning, and the design process of personalised and adaptive learning. Documents as recent as 2015 still express the need to do research about the benefits of personalised and adaptive learning (Izumi et al. 2013; Wanner & Palmer 2015). Because working in the field of technology is such a dynamic environment (Chai & Kong 2017), the need to do more research on the design of the adaptive learning environment can be expected. Some suggestions to address are:

- technical aspects related to the design of e-Learning tools (Santhanam et al. 2008)
- the use of instructional explanations (Wittwer & Renkl 2008)
- the level of control that students have within the system as well as the level of flexibility (Wanner & Palmer 2015)
- the role of student characteristics in the use of prompting (Pieger & Bannert 2018).

Thus, the importance of investigating different design options as well as the effects or benefits thereof is still relevant and justifies the need to explore how, for instance, an adaptive system should be designed when using CL and Socratic questioning to ultimately enhance students' SDL.

The suggested research relating to CL and collaboration can all be categorised into one category, namely, strategies for encouraging group work. All future research suggestions express the need to explore strategies concerning:

- better communication and the sharing of ideas (Santhanam et al. 2008)
- investigating students' motivation (Law 2011), seeking help (Wosnitza et al. 2014) and compassion (Park et al. 2018) in a group setting
- CL to enhance group work (Havenga & De Beer 2016)
- promoting discussion in and out of class (Yu & Wang 2016)
- group interaction, interdependence among group members and individual accountability (Ibáñez & Delgado-Kloos 2018).

Yilmaz (2017) specifically mentions the need for qualitative research to be conducted about interaction within groups (student–teacher, student–student and student–content). These findings emphasise the importance of CL and collaboration within the adaptive learning context. The final theme of Socratic questioning or critical thinking focuses on the research that should investigate the development of critical thinking skills (Shih et al. 2010; Yeh 2009).

The suggested research as discussed above and summarised in Table 8.2 clearly illustrates the gaps in the literature regarding the use of adaptive learning to promote SDL. The systematic literature review, which formed part of a multi-level investigation, focused on showing these gaps in the literature. Thus, the emphasis was on the role of Socratic questioning, which links closely with critical thinking and CL within the adaptive system and the effect thereof on students' SDL development. With the need for investigation discussed, the findings from the corpus of documents reviewed will subsequently be elaborated.

☐ Teaching and learning strategies to enhance self-directed learning

From the 39 documents analysed, it became evident that specific teaching–learning strategies or approaches are evident in the body of scholarship. Although these documents do not all specifically mention how these strategies promote SDL (most focusing on enhancing SRL), all documents report on the need for more active engagement of students (i.e. active teaching–learning strategies) to cope with the requirements of the 21st century. Specific mention is made of critical thinking development (Marques 2014; Nguyễn & Nguyễn 2017), the use of technology in education (Pieger & Bannert 2018), the need to adapt learning to accommodate students' specific needs (Cueli et al. 2016) and the benefits of allowing for social teaching–learning (Thota 2015). The following categories relating to teaching and learning strategies emerged.

☐ Individual, active teaching–learning strategy

Stubbé and Theunissen (2008) emphasise that student-centred approaches should be encouraged in teaching where individuals have the opportunity to engage in activities that promote SDL. These approaches should also be focused on stimulating, among others, problem-solving. From all the researchers (n = 5) who commented on the importance of problem-solving strategies, only Stubbé and Theunissen (2008) mentioned problem-solving as an individual teaching–learning strategy (although also emphasising the value of peer learning).

Another strategy that often occurs individually (yet socially between teacher and student) is that of Socratic questioning (Nguyễn & Nguyễn 2017; Van Seggelen-Damen et al. 2017). Four outputs made specific mention of the value of Socratic questioning. As noted by Kwak (2016:11), Socratic questioning is all about self-knowledge, 'what enables us to see the real possibility of knowing within ourselves'. This also plays a vital role in SDL as well as critical thinking. Three of the four researchers

who made mention of Socratic questioning emphasised its importance for development of critical thinking.

Although it seems possible to develop SDL with individual teaching–learning strategies as discussed above, the majority of the documents reported on the value of peer, collaborative and CL (i.e. socially active teaching–learning strategies) (Law 2011; Santhanam et al. 2008).

☐ Socially active teaching–learning strategies

Of the 39 documents scrutinised, 25 made specific mention of socially active teaching–learning strategies:

- CL, for example, Law (2011) and Park et al. (2018)
- collaborative learning, for example, Nguyễn and Nguyễn (2017), Yeh (2009) and many more
- enquiry-based learning, for example, Inglis-Jassiem et al. (2014)
- project-based learning, for example, Havenga and De Beer (2016)
- PBL, for example, Tarmizi and Bayat (2012), Wang (2016) and Yu and Wang (2016).

From these studies, it is evident that the authors in our corpus favoured socially active teaching–learning strategies for developing SDL.

Although Johnson and Johnson (2013) and researchers such as Mentz, Van der Walt and Goosen (2008) emphasise the importance of the five elements of CL (positive interdependence, promotive face-to-face interaction, individual accountability, social skills and group processing) to increase success in socially active teaching–learning strategies, only two researchers in the corpus of documents reviewed made mention of CL (as defined by the five elements), namely, Park et al. (2018) and Law (2011). Notwithstanding the fact that CL yielded better results than collaborative learning, 23 of the 25 documents focusing on social teaching–learning in this context specifically mentioned collaborative learning, indicating an obvious lack in the literature on CL (n = 2).

Havenga and De Beer (2016) defined project-based learning as a socially active teaching–learning strategy (in which students have the opportunity to work collaboratively) focused on authentic activities to create authentic products. Problem-based learning is more broadly defined as a teaching–learning strategy (based on the information processing, CL, constructivist and contextual learning theories) that engages students in solving ill-structured problems relevant to the content (Tarmizi & Bayat 2012).

A number of studies (14 out of 39) reported on the use of technology in education.

☐ Technology- or computer-supported teaching and learning

Loncar et al. (2014) found that effective learning during collaborative learning is increased when incorporated with computers (i.e. technology). Furthermore, Yeh (2009) reported that technology use in education promotes critical thinking as well as collaboration. Pieger and Bannert (2018) noted that CS learning specifically places emphasis on the role of the student and gives students the opportunity to take responsibility for the decisions they make. As noted in the previous section, individual learning (using active teaching–learning strategies) may be beneficial, but socially active teaching–learning strategies hold many more benefits. Problematic to this is the fact that Santhanam et al. (2008) found that not many technologies support socially active learning. A gap in this regard exists in the body of scholarship. Apart from technologies not being designed specifically to support effective CL, several studies point to the advantages of technology use to support self-regulation.

Thirteen documents in our corpus advocate the use of technology during teaching and learning. Pieger and Bannert (2018) pointed out that CS learning (i.e. technology) assists in developing students' self-regulation. They noted that the instruction (that accompanies technology use) should be designed in such a manner that students'

self-regulation is supported as they themselves often do not know how to regulate themselves. Santhanam et al. (2008) supported this notion and found that technology interventions should be designed in such a manner that students are persuaded to follow self-regulated strategies. These two studies focus on self-regulation; however, because of similarities between SRL and SDL (SRL forms part of SDL), it can be deduced that similar truths are applicable for instruction that aims to promote SDL. Technology use in education is advantageous; however, it should be designed in such a manner that the students' SDL is developed (albeit in a social environment).

Four of the documents analysed were concerned with the flipped classroom model (Wang 2016; Wanner & Palmer 2015; Yilmaz 2017; Yu & Wang 2016). Wang (2016) is of the opinion that the flipped classroom model is a critical factor in assisting students to be more self-regulated. The flipped classroom model is a flexible learning environment where students have choices regarding where, what and how to study (Wanner & Palmer 2015). This has been shown to improve students' self-efficacy and self-regulation and increased their engagement (Yu & Wang 2016). Further to the flexible learning environment offered by the flipped classroom, the selected documents showed information regarding flexible, personalised and adaptive learning, which are discussed in the next section.

☐ Flexible, personalised and adaptive learning

In the collection of documents that were scrutinised, information regarding personalised learning as well as adaptive learning was evident here and there. A generic term 'flexible learning' appeared in two studies, a discussion on 'personalised learning' appeared in three studies and 'adaptive learning' appeared in seven studies. A synopsis of these discussions is presented next.

Flexible learning is a personalised learning experience for students with varied choices, which focuses 'on the personalisation of learning experiences' and increases the opportunity for collaboration (Wanner & Palmer 2015). In flexible learning

situations, such as the flipped classroom, the role of the facilitator is extremely important, especially for achieving collaborative and CL (Wanner & Palmer 2015). This is echoed by Balakrishnan (2018) when referring to a PLE. Students prefer their personalised learning to take place through interactive, collaborative, well-structured activities (Wanner & Palmer 2015).

Adaptive learning systems are web-based application programmes that provide a PLE (Cueli et al. 2016), in which the software alters itself based on the user's inputs (Izumi et al. 2013). Adapted instruction and explanations allow students to engage better in the construction of knowledge and therefore extend and deepen their understanding (Wittwer & Renkl 2008). Adaptive instruction not only has the potential to alter traditional classrooms, but also creates possibilities for distance education as it allows for students to learn at their own pace (Izumi et al. 2013) and receive immediate feedback (Cueli et al. 2016). With increased economic pressure and international competition, higher education is shifting towards increased online, collaborative and interactive instruction (Wanner & Palmer 2015).

Adaptive learning environments could foster SRL (Cueli et al. 2016; Wittwer & Renkl 2008), promote problem-solving (Cueli et al. 2016) and assist students in making self-directed choices (Izumi et al. 2013). In an adaptive system, there are various types of help-seeking strategies – one in which students request hints and explanations rather than solutions to problems, which promotes SRL (Wosnitza et al. 2014). As mentioned in Table 8.2, the suggested future research is that more quantitative, empirical research about the benefits of adaptive technology as well as factors influencing its success needs to be conducted (Izumi et al. 2013).

A PLE can provide a suitable platform for collaborative learning by assisting students to find relevant sources, create material and collectively create knowledge and manage their own process of

making meaning of material and regulating their own learning (Balakrishnan 2018). Information and communication technology has become the means by which to offer personalised learning, thus making higher education more student-centred. It provides students with greater diversity in learning through personalised and flexible learning spaces (Wanner & Palmer 2015). Within a PLE, a tagging mechanism, which allows for sharing sources among users, could encourage collaborative learning in a self-directed environment and may develop students' cognitive ability and encourage DL (Balakrishnan 2018).

Balakrishnan (2018) highlights the benefits of using a PLE, namely:

- students can choose their own learning materials
- students have control over their own learning
- students can experience informal and formal learning
- lecturers believe that the PLE assists them to guide, monitor and motivate students in an SDL environment.

Personalised learning can improve student engagement and the students' learning experiences (Wanner & Palmer 2015). Some notes cautioning the use of a PLE are that some students have low self-efficacy and high assessment anxiety when working in a PLE (Balakrishnan 2018). Not allstudents are open to or ready for personalised and SRL; thus, the onus is largely on institutions and lecturers to implement flexible learning (Wanner & Palmer 2015). Wanner and Palmer (2015) are of the opinion that the lecturer plays a central role in achieving effective cooperative and collaborative learning.

From the discussion above, it is clear that no literature is available regarding adaptive instruction using CL and Socratic questioning to promote SDL. What is evident is that a synergy between these concepts is possible. In the next section, a discussion, grounded in literature, on how these concepts can be intertwined, is presented followed by suggestions on how the teaching–learning environment should be designed.

■ Discussion of results

Although no literature is available on the use of adaptive instruction using CL and Socratic questioning to enhance SDL development, some cornerstone findings regarding each aspect were found. These can be combined to inform the development of such an adaptive system. The findings discussed here are divided into the four main themes of the study.

■ Self-directed learning

Referring to Stubbé and Theunissen (2008:5) it emerged that SDL consists of five aspects, namely, 'learner control, self-regulating learning strategies, reflection, interaction with the social world and interaction with the physical world'. To foster these elements, the teacher becomes the facilitator and monitor (Balakrishnan 2018), and he or she can implement several suggested teaching–learning strategies. Teaching–learning strategies to promote SDL include project-based learning (Havenga & De Beer 2016), PBL (Inglis-Jassiem et al. 2014) and ubiquitous learning (Stubbé & Theunissen 2008). The common denominator in these suggested teaching–learning strategies is socially active learning to promote SDL (see also Bailey & Mentz 2015). It has also been found that learning with others improves motivation and performance (Stubbé & Theunissen 2008). To measure success in SDL, Williamson's (2016) Self-Rating Scale of Self-Directed Learning (SRSSDL) questionnaire can be used (Havenga & De Beer 2016). In short, SDL can be developed, but most success will occur when attempting to develop it within a social environment.

■ Cooperative learning

From the corpus, it became clear that not much literature is available on CL and Socratic questioning (in the context of adaptive instruction). Law (2011) however found that CL is most effective when the teacher acts as the guide of instruction.

Law (2011) further notes that CL should emphasise students' responsibilities (also promoting SDL) and grouping should be performed randomly and heterogeneously.

Although SDL is best developed in a social environment, Stubbé and Theunissen (2008) emphasise interaction with the physical environment. In the light of this, the physical environment researched was adaptive instruction.

◼ Adaptive instruction

Izumi et al. (2013) specified six design elements that promote effective adaptive systems:

- present topics as building-blocks
- incorporate animations
- incorporate web features
- give short quizzes
- offer help if needed
- guide students through mastery.

Although Stubbé and Theunissen (2008) focused their research on SDL, they found that adaptive systems should consider students' characteristics, experiences, attitudes and needs.

Some instructional strategies that were used in the design and implementation of the studies showed in this search include the following:

- students have the opportunity to collaborate, cooperate and organise teams on their own (Yu & Wang 2016)
- each study unit contains an introductory example with its explanation (Bednall & Kehoe 2011)
- students are not only given hints to complete tasks, but also have the opportunity to search for information on the database provided to them or the Internet (Shih et al. 2010)
- prompts must be critically reviewed to be effective in personalised and adaptive learning environments (Lehmann et al. 2014)
- pre-reflective prompts should be utilised that could promote reflection before dealing with content (Lehmann et al. 2014).

It was also found that adaptive instruction best occurs when questioning is used (Cueli et al. 2016); hence, Socratic questioning was investigated.

◼ Socratic questioning

Although the searches were on Socratic questioning, it became evident that critical thinking is integral to Socratic questioning. Many studies thus reported on critical thinking development, and not necessarily on Socratic questioning. Kwak (2016) however noted that Socrates invented critical thinking. In line with SDL, Kwak (2016) found that Socratic questioning increases autonomy. Furthermore, Loncar et al. (2014) noted that Socratic dialogue increases critical thinking; hence, one can agree that Socratic questioning can be used during CL. Nguyễn and Nguyễn (2017) also advocated the use of Socratic questioning in small-group activities.

◼ Conclusion

◼ General conclusions

To synthesise the four themes as discussed above, it is evident that SDL can be developed and is best developed in a social environment that still caters for individual responsibility. This can address the fact that students need to be individually developed and that they should also be given the opportunity to be guided by a teacher (without necessarily having the teacher with them). Moreover, adaptive instruction promotes the ability for students not to be left behind or held back as they develop. From the literature, it was suggested that questioning should be used in adaptive systems and also that questioning and especially Socratic dialogue has positive effects during group activities. We thus surmised (as shown in Figure 8.1) that an adaptive system that uses CL and Socratic questioning to promote SDL would be beneficial.
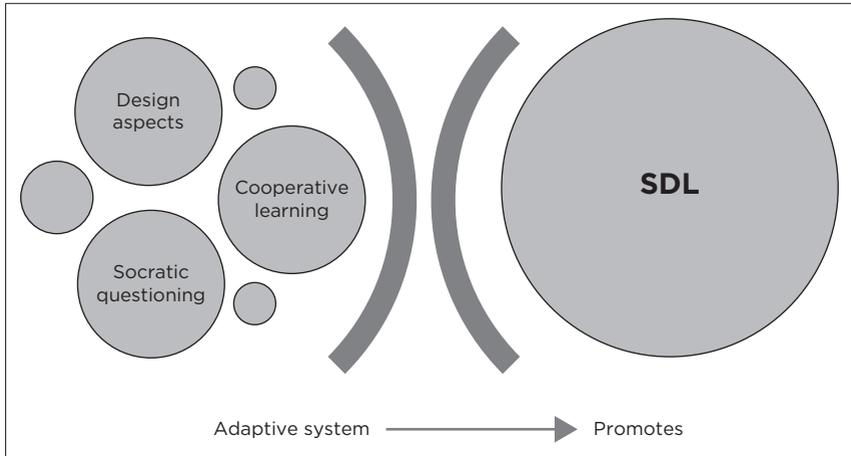
SDL, self-directed learning.
FIGURE 8.1: A teaching–learning framework for adaptive instruction using CL and Socratic questioning to promote SDL.

The systematic literature review proved to be effective in showing the essence of current research relating to the use of adaptive learning to promote SDL. Although not much literature indicates active research in this area, the need for investigating adaptive learning to promote SDL is evident from the discussion above and is also evident in suggested future research recorded in the reviewed documents. It is crucial to take various design options into account when designing an adaptive system, specifically when incorporating the use of Socratic questioning and the use of collaborative techniques (in this case, particularly, the use of CL). The teaching–learning strategies used should focus on the active engagement of students through both social and individual strategies, which ultimately promotes SDL. Technology should be designed in such a way that these teaching–learning strategies can be fully utilised to facilitate the development of individuals' SDL within a social environment. The physical environment in this study takes the form of adaptive instruction, which offers students the opportunity to make

informed self-directed choices. The use of Socratic questioning is beneficial in group settings and enhances critical thinking.

Incorporating these four themes (as indicated in this chapter) proves necessary (as shown in Table 8.2) and proves viable (as shown in Figure 8.1). Regarding the research question that guided this systematic review (*What does the body of scholarship reveal about teaching and learning with adaptive instruction using CL and Socratic questioning to promote SDL?*), the results encourage us to develop, implement and test an adaptive system using CL and Socratic questioning to promote SDL, as a next step. Although the possibilities have been indicated, certain gaps for further research are notable.

◼ Limitations and implications for further research

In this review, every attempt was made to review the full body of literature relating to the topic; however, as with any review, it is possible that documents may have been overlooked. A common limitation to reviews in general, as was the case with this review, is the selection and use of search terms, and the complexity of locating texts that otherwise would have been included in the review.

◼ Final thoughts

This analysis showed the need for further research in the area of SDL in adaptive instruction. It would be beneficial for researchers and instructional designers to have empirical data on the design aspects necessary to design an effective adaptive system that could enable students to improve their SDL skills. The review also showed that there was very limited information on the use of CL within an adaptive system, which calls for future research in

this field. Although the association between CL, Socratic questioning and self-direction has been investigated, this review did not show any studies that have explored these themes within the context of adaptive learning. This suggests another field of study worth exploring.

■ Acknowledgements

■ Appendix A

TABLE 8A1: Codebook used between researchers.

Codebook	
Code	**Researcher's own comments**
#SDL	Based on aspects of Knowles' definition
#Other directed approach	Opposite of SDL
##SDL elements	Elements of SDL, not entirely SDL
##SDL guidelines	How should SDL development occur
##Lifelong learning	Learning that continues throughout one's life
###Self-efficacy	An element of SDL that requires that learners believe in their abilities to succeed
###Self-regulation	Sources of Zimmerman, etc.
###SDL Measuring instrument	Ways in which authors are measuring SDL skills or development
####SRL development	Self-regulated learning development by what means
####Learners avoiding SRL	Learners are not always willing to self-regulate
####SRL Strategy	Strategies used in self-regulated learning
####Questioning and SRL	Use of questioning or prompts to promote SRL
####High SRL	Characteristics of highly self-regulated learners
###21st century skills	Communication, creativity, critical thinking, collaboration (to name but a few)
###Problem-based learning	Teaching learning strategy often used to promote SDL or SRL
###Project based learning	Any discussion on project-based learning. Note it may be project-based learning or project-based learning
###Enquiry based learning	Teaching learning strategy often used to promote SDL or SRL
###Collaboration	Learners working together, perhaps in structured way, but not necessarily guided by the five elements of Johnson and Johnson
###Reflection	The cognitive activity of questioning; the presence of self-awareness
####Group selection in collaboration	An indication of how the groups are selected in collaborative learning situations
###Active learning	Teaching learning strategy often used to promote SDL or SRL
###Problem solving	Teaching learning strategy often used to promote SDL or SRL
##Lecturer role in promoting SDL	The role that the lecturer or teacher should take in promoting SDL skills
###Reasons for promoting SDL	Reasons offered in the literature about why SDL should be promoted
###Metacognition	Thinking about one's thinking
###Reflection	Important component of SDL and SRL
###Real-life contexts	Authentic learning tasks

TABLE 8A1 (Continues...): Codebook used between researchers.

Codebook	
Code	**Researcher's own comments**
öCooperative learning	Teaching learning strategy that incorporates Johnson and Johnson's five elements and is structured
ööBenefits of cooperative learning	Benefits of CL
ööChoice and cooperative learning	How CL influences learners' choice and how choice plays a role in CL
ööTeacher training for cooperative learning	How teachers are trained to incorporate CL in their classrooms
öööCooperative learning intervention	Interventions that are based on CL teaching–learning strategy
?Technology use in education	How and why technology should be used in education
???e-Learning	Any learning that takes place electronically
???Forums	Use of forums as technology in education
??Augmented reality	e-Learning strategy that incorporates augmented reality into teaching and learning
??Benefit of technology	Benefits of using technology in education
??Challenges of technology	Challenges faced when using technology in education
??Blended Learning	Teaching–learning strategy which uses f-2-f and e-Learning combined
???Flipped classroom	Blended learning strategy that allows learners to view lectures outside class time and engage in active teaching–learning in the classroom
??Design of Environment	Tips and guidelines on how e-Environment should be designed
???Teaching presence (BL)	Aspect of Community of Inquiry focused on the design of how learners experience the presence of the facilitator during learning
???Student technology ability/mastery	The ease and knowledge with which students interact with technology (or lack thereof)
???Community of Inquiry	Community of inquiry is a group of individuals who collaboratively engage in purposeful critical discourse
???Mobile Learning	The use of mobile technology in an educational context
????Experience of mobile learning	How do learners experience mobile learning
???Technology-based course design	The manner in which technology-based courses are designed
???Computer Supported Collaborative learning	Collaborative learning achieved on, and supported by computers
(Personalised learning	PLE or learning that the individual guides and which the individual can manipulate according to their own needs. NB: Not the same as adaptive
((Advantages of PLE	What advantages are visible in PLE

TABLE 8A1 (Continues...): Codebook used between researchers.

Codebook	
Code	**Researcher's own comments**
((Structure of PLE	How should PLE be structured or designed
((Lecturers role in PLE	What should the lecturer or educator do when using PLE
((Benefits of PLE	Benefits (almost similar to advantages) of PLE
(((PLE and Collaboration	Collaboration during PLE
(((Tagging in PLE	When collaboration is promoted and users can 'tag' another user as in Facebook
(((Motivation and PLE	Increase or decrease in motivation during PLE
((Caution regarding PLE	What pitfalls are visible in PLE
((Negativity towards PLE	Some teachers and learners are hesitant to implement PLE
(((Flexible teaching and learning	Innovative and adaptable pedagogies
(((Individual Learning	Learners who work individually during PLE
(((Assessment in flexible teaching and learning	Adapted assessment practices in flexible teaching and learning
!Adaptive Learning	Learning that adapts to the inputs of the learners
!!Benefits of adaptive learning	Benefits of using adaptive learning
!!Prompting in adaptive instruction	Using prompts during adaptive instruction
!!Examples of adaptive systems	Examples of adaptive systems
!!Need for adaptive learning	Reasons why adaptive learning is necessary
!!Design of adaptive systems	Designs and design guidelines of adaptive systems
!!Assessment in adaptive systems	How assessment can be conducted in adaptive systems
!!Negativity towards adaptive learning	Learners and teachers may be negative to implement adaptive learning
&Socratic Questioning	Teaching–learning strategy inspired by Socrates' ways of teaching i.e. teaching by questioning
&&Critical Thinking	Analysis and evaluation of an issue to form a judgement. Could be disposition or skill
&&&Critical Thinking elements	Aspects relating to critical thinking such as skills needed
&&&Critical thinking development	How to develop critical thinking
&&&&Need for critical thinking development	Why critical thinking should be developed
&&HOTS	Higher-order thinking skills
&&&Developing HOTS	How to develop higher-order thinking skills
&&&Benefits of developing HOTS	Benefits of developing higher-order thinking skills
&&LOTS	Lower-order thinking skills

TABLE 8A1 (Continues...): Codebook used between researchers.

Codebook	
Code	**Researcher's own comments**
&&Critical Thinking Skills	Skills associated with critical thinking e.g. reasoning, logic etc.
§Teaching Approach	The approach used by the teacher
§§Traditional Teaching Approach	Direct teaching approach. Behaviourist of nature
§§§Negativity re traditional teaching approach	Negative aspects relating to the traditional teaching approach
§§Teaching approach to develop HOTS	Teaching approaches conducive to the development of higher-order thinking skills
§§§Assessing HOTS	Assessment of higher-order thinking skills
§§Student-centred teaching approach	Teaching approach not like traditional teaching approach. The student or learner stands in the middle of the teaching–learning process
'Distance Learning'	Learning that occurs on distance, less contact time (if any) more independent learning
%Research Process	A brief description of the research process followed in the study
%%Research Instrument	Instruments used in study (any way of measuring what is investigated)
%%Intervention	Interventions used by study
%%Sample	Samples used during study
*Academic Achievement	An indication of the academic achievement (or lack thereof) as a result of the study or intervention
*Influences on learning	All the aspects that influence learning
**Influences on Mathematics learning	What plays a role in students' maths learning and performance
^Suggestions for future research	Suggestions offered in the text that suggest future research opportunities
@Cognitive load	Aspects relating to the cognitive load, WM or transfer
@Achievement goal theory	Theory based on competence aims of individuals. Consists of mastery goals and performance goals
@Mastery goal theory	Sub-element of achievement goal theory
@Performance goal theory	Sub-element of achievement goal theory
@Gestalt theory	Theory based on the ability to acquire meaningful perceptions
@Cognitivist theory	Learning theory focused on the cognitive activities that guide learning
@Constructivist theory	Learning theory that posits that the learner constructs his or her own knowledge from experiences
@Situated cognition theory	Learning theory that highlights the importance of knowing by doing and hence focused on the learning context

TABLE 8A1 (Continues...): Codebook used between researchers.

Codebook	
Code	**Researcher's own comments**
@Socio constructivist theory	Learning theory that highlights social construction of knowledge but influenced by the context e.g. culture, economy, etc.
@Humanist theory	All about Humanism ... note this and SDL go together quite well
@Experiential learning theory	Learning theory based on Kolb's four-stage cyclical theory of learning
@Transformative learning theory	Learning theory based on Mezirow's notion that people use critical self-reflection
@Social constructivist theory	Learning theory that highlights social construction of knowledge
@Capability theory	The capability approach is a theoretical framework that entails two core normative claims: first, the claim that the freedom to achieve well-being is of primary moral importance, and second, that freedom to achieve well-being is to be understood in terms of people's capabilities
@Learning Theories	Varied theories of learning
@Social cognitive perspective	Learning theory focused on the cognitive activities that guide learning when in social context
£U-Learning	Ubiquitous learning

Developing self-directed learning skills of Geography student teachers through online problem-based learning designs

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■ Abstract

The noticeably rapid growth of online learning at universities and in higher education, in general, has led to the redesign and

implementation of online teaching and learning environments supported by best applicable technologies or applications. As a result of this, questions are being asked about the best online teaching and learning strategies, especially for higher-order active online learning activities that also foster SDL skills. Online PBL is one such teaching and learning strategy. The aim of this one-shot experimental case study was to explore the influence of integrated online PBL designs on Geography Bachelor of Education student teachers' (*n* = 111) perceptions of their self-directedness in learning. Two online PBL activities were integrated in two third-year Geography modules of two consecutive years (2016 and 2017) at a university in South Africa. It was further necessary to evaluate the students' perceptions of the online teaching and learning environments according to CoI framework principles and to determine if any correlation exists between the online learning design and the self-directedness in learning of the students. The study used both quantitative and qualitative data to present and clarify the findings. The findings from the study indicate that there is no real evidence of improvement of the students' perceptions of their self-directedness in learning skills (according to Williamson's self-rating instrument) over the two years. However, the findings show a slight improvement in some of the subsections of SDL from 2016 to 2017. A reason for this finding might be the change from the Wiki of the LMS to Google Docs as a much more interactive online collaboration environment for group work. The students held positive views about this intervention.

■ Introduction and problem statement

Taking responsibility for one's own learning (thus, being a self-directed learner) is an important skill for being successful at learning in the online learning environment. In this regard, Vovides et al. (2007) point out that students come to the online learning environment varying in their SDL skills. It is, therefore, necessary for lecturers to implement online learning strategies, such as online PBL, to help develop students' SDL skills. Problem-

based learning depends heavily upon the principles of SDL and can have an influence on SDL. (Jackson 2003; Lee, Mann & Frank 2009; Rideout & Carpio 2001).

The rapid increase of online learning is challenging universities and colleges to ensure that their online courses and modules are equal in quality to that of their traditional classes and that higher-order learning is also effective online, with the best applicable teaching and learning strategies. Higher education, in general, is increasingly incorporating technologies in teaching and learning environments to enhance students' online teaching and learning experiences (Hamid et al. 2015; Lee 2014) (Morueta et al. 2016).

> Most of these online [*modules*] are being developed within a LMS software application. Within this context, [*discussion forums*] and [*collaboration spaces*] allow high levels of student-[*to*]-student and student-[*to-educator*] interaction, which support teaching and learning models suitable for higher education. (p. 122)

Moreover, research has shown (with online PBL in mind) that asynchronous and more so synchronous online discussion is ideal for learning in online environments because students can collaborate and communicate with their co-students, share and construct knowledge and solve problems, all of which require and foster a higher level of thinking (e.g. De Wever et al. 2010). Doing PBL online matches the above research, and subsequently the question may also be asked if it holds possible advantages for students' self-directedness.

■ Literature review

■ Self-directed learning

The most common definition of SDL is that of Knowles (1975), who defines SDL as:

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

Garrison (1997) describes SDL as:

> [*A*]n approach where learners are motivated to assume personal responsibility and collaborative control of the cognitive (self-monitoring) and contextual (self-management) processes in constructing and confirming meaningful and worthwhile learning outcomes. (p. 18)

Spencer and Jordan (1999) also define SDL as a process where learners take responsibility of their own learning to determine their aims and learning resources, to deal with appropriate activities and to evaluate their learning results.

Hmelo-Silver, Duncan and Chinn (2007) point out that SDL is different from individual unguided learning, which has shown little promise as an effective teaching and learning strategy. In a scaffolded environment, educators play an important role in guiding, supporting and assisting students to develop the cognitive and organisational skills necessary to effectively engage in SDL processes (Dignath & Buttner 2008). It is necessary that individuals in an SDL environment should be supported to learn on their own. A strategy to achieve this is to implement teaching and learning environments, such as online PBL, in their Geography curriculum to enhance SDL.

To understand and facilitate the SDL of Geography students, it is necessary to measure students' readiness for SDL. Kwan (2003 cited in Golightly 2018:n.p.) states that 'readiness for SDL exists along a continuum and is, to some extent, present in all [people]'. Self-directed learning readiness is defined as 'the degree [to which] the individual possesses the attitudes, abilities and personality characteristics necessary for self-directed learning' (Wiley 1983:182). The instrument 'most widely used in educational research to measure SDL readiness is Guglielmino's [(1978)] Self-directed Learning Readiness Scale (SDLRS)' (Fisher, King & Tague 2001:518), although more recent instruments are the SDLRS developed by Fisher, King and Tague (2001) and the Self-rating Scale of Self-directed Learning (SRSSDL) developed by Williamson (2007), which was used in this study.

■ Online technologies and learning

The CoI framework is used because it appears to be the most suitable for analysing online learning environments in higher education (Garrison, Anderson & Archer 2000). This framework is seen by many researchers as a valid and dependable instrument to measure the quality of online learning by focusing on three important factors that contribute to the quality of online courses (Shea, Pickett & Pelz 2003; Shea et al. 2005).

Furthermore, Morueta et al. (2016) mention how a number of 'studies have demonstrated its validity to analyse the processes of online learning associated with higher-order learning outcomes' (e.g. Swan, Garrison & Richardson 2009; Szeto 2015). This model has been studied well in the literature (the article has been cited over 2900 times in Google Scholar) and has been shown to be a meaningful framework for course development or design. Creating an online learning environment that generates effective teaching, social and cognitive presences, according to the model, will allow students to become engaged in the process of critical inquiry necessary to engage in higher-order online activities (according to Bloom's taxonomy) (Rapchak 2017).

It is necessary for the purpose of this study to contextualise and define the CoI framework in more detail. The CoI is theoretically grounded (Cho, Kim & Choi 2017):

[/]n social constructivism that views collaboration among the participants as [*essential*] for meaningful knowledge [*construction*] (Garrison, Cleveland-Innes & Fung 2010). Students' mindful engagement in interactions with the instructor [*or tutors*] and with other students can help them to develop relevant knowledge [*and skills*] (Garrison, Anderson & Archer 2001). (n.p.)

The CoI framework consists of three interactive presences, namely, social presence, cognitive presence and teaching presence. According to Cho et al. (2017) and Morueta et al. (2016), these can briefly be described as seen in what follows.

Social presence refers to (Garrison 2009):

> [*T*]he ability of participants to identify with the community (e.g. course of study), communicate purposefully in a trusting environment, and develop interpersonal relationships by way of projecting their individual personalities. (p. 352)

'Social presence emphasises participants' communication skills in relation to other members and contributes to the creation of a collaborative learning climate' (Akyol & Garrison 2011:184):

> Social presence is divided into three categories affective, interactive, and cohesive and reflects a supportive context for emotional expression, open communication, and group cohesion for the resolution of the respective task. Social presence, an important factor critical to face-to-face teaching, is a challenge for instructors to facilitate in online learning environments. (Morueta et al. 2016:123)

Cognitive presence refers to 'the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry' (Garrison et al. 2001:11). 'Through cognitive presence, students develop meaningful knowledge' (Cho et al. 2017:n.p.). Furthermore, the cognitive presence can be categorised into four phases, with specific descriptors for each phase (Morueta et al. 2016):

> (1) [*A*] triggering event (an issue is identified for inquiry); (2) exploration (exploring the issue through discussion and critical reflection); (3) integration (constructing meaning from the ideas developed through exploration); and, (4) resolution (applying new knowledge into a real-world context). (p. 122)

Teaching presence refers to 'the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes' (Anderson et al. 2001:5). Teaching presence plays a key role in nurturing, supporting and sustaining the social and cognitive presences of online learning environments (Akyol & Garrison 2011; Garrison et al. 2010). This presence consists of two general functions (Morueta et al. 2016):

> (1) [*T*]he design of the educational experience; and, (2) facilitation among the instructor and the students. It is the responsibility of the

instructor to design and integrate both cognitive and social presence for educational purposes through scaffolding, modelling or coaching. (p. 124)

To summarise, social presence reflects the ability to connect and collaborate with members of an online community of learners at a more personal level. The cognitive presence, as the most important part of online learning, is the process of constructing meaning and deep learning through collaborative inquiry. Teaching presence is the integrating power and interactive online facilitation that structures and leads the educational process in a constructive, collaborative and continuous manner. It is the balanced overlapping of these three elements that generate the core of a CoI framework where collaborative constructivist teaching and learning experiences can be accomplished (Garrison 2006). The framework, therefore, suggests that online learning experiences should continuously advance in the interaction between these presences. Therefore, the CoI is a recursive model in that the three presences support each other. In general, research indicates that a CoI could maximise students' learning experiences because the three presences essentially promote social, intellectual and cognitive interaction among participants and study materials in online learning situations to successfully achieve the learning outcomes (Annand 2011).

As PBL is seen as a higher-order learning activity (according to Bloom's taxonomy as reference), it can also foster SDL skills in students. It is therefore necessary to ensure a proper design according to the CoI framework principles. To perform higher-order learning tasks online, the following guidelines will apply according to Morueta et al. (2016):

- A strong teaching presence is necessary, which entails continuous guidance, structure and support to students.
- It is the responsibility of the facilitator to design, scaffold, model and coach properly before and during the online activity. Regarding the social presence, the frequency of group members' involvement will increase as the level of the task (according to Bloom's taxonomy) increases.

- In support of this, Richardson and Ice (2010) 'found that [a] discussion based on real cases can stimulate more critical thinking than other types of tasks, such as a theoretical study or debate'. (n.p.)

Finally, the degree of complexity and the nature of the task seem to condition the level of group cognitive activity. Thus, for complex activities, it is necessary to ensure a good social presence to achieve a high cognitive presence and awareness (Morueta et al. 2016).

◼ Online problem-based learning and Geography education

In the '2016 International Charter on Geography Education', it was strongly 'recommended that Geography educators should [implement] PBL in Geography education' (Golightly 2018; Kolossov, Van der Schee & Lidstone 2016). In PBL environments, Jonassen (2000) stated that problems differ in structure and complexity. 'Well-structured problems have concrete solutions, present all relevant elements to the [student] and require the application of a limited number of well-structured rules and principles' (Horton 2014:22). In contrast, ill-structured problems may have multiple solutions and require problem solvers to exercise personalised opinions and beliefs. PBL is a teaching and learning strategy adopted by McMaster University for medical education in the mid-1960s. Barell (2007) defines PBL as a process of research in which the students try to solve real-world problems. Celia and Gordon (2001) state that PBL has five primary components, namely, problem-based, student-centred, reiterative, small-group and facilitation components. They further point out that problem scenarios are designed to challenge the students to meet the curriculum outcomes. Since its initiation at the McMaster University, PBL was also implemented in other disciplines, such as engineering and nursing. During the last decade, PBL as a teaching and learning strategy was also implemented in Geography and Geography

education worldwide (e.g. Caesar et al. 2016; Golightly 2018; Golightly & Guglielmino 2015; Golightly & Muniz 2013; Kwan 2008). Most of these studies were conducted in face-to-face PBL tutorial sessions. It is necessary to highlight that Crawford (2011) indicates various benefits that online PBL can offer to prepare students for SDL. Some of the more important benefits include that it provides flexibility, and co-participation, encourages student autonomy, allows [for the] construction of meaning (Crawford 2011) and encourages students to solve real-world problems. Recently, only the study of Golightly (2018) in Geography education research in a South African context discusses the implementation of face-to-face and online PBL in a Geography Bachelor of Education (BEd) programme. In other disciplines, more studies on the implementation of PBL in online learning environments have been published (e.g. Duncan 2009; Günbatar & Çavuş 2011; Gürsul & Keser 2009; Sulaiman 2011; Tsai & Chiang 2013).

It is necessary to highlight some of the potential challenges that Geography educators can experience in the implementation of PBL or online PBL (Ertmer et al. 2009; Jonassen 2000). Most educators lack pedagogical knowledge on how to design and plan (online) PBL environments, how to involve students in real-world, ill-structured problem-solving, a reliance on traditional direct instruction, and assessment demands that place substantial constraints on the implementation of PBL in the curriculum (Ertmer 2005; Kim & Hannafin 2011). Simons, Klein and Brush (2004) noted that educators also 'experience frustration with the amount of time it takes to plan for and implement' (Ertmer & Simons 2006:41) PBL activities, and Gallagher (1997) reports difficulty in transitioning students into more active roles.

It is thus of utmost importance for Geography teacher educators to involve and assist Geography student teachers in the planning, designing, implementing and facilitating of PBL or online PBL activities. In this regard, Tawfik and Kolodner (2016) highlighted that if educators do not facilitate the PBL process

well, then solving complex problems is too difficult for students, and if reflection is not facilitated well, students will not be able to draw lessons from the PBL activities.

◼ The online problem-based learning process

'The [online] PBL process is anchored by an ill-structured, real-world problem' (Golightly 2018) (in the case of this study a Geography problem) that has more than one solution. The students may be organised into small online tutorial groups in which five to eight students function as members of a team (Chernobilsky, Nagarajan & Hmelo-Silver 2005; Dolmans et al. 2001). The students begin to discuss the problem online and conceptualise their real-world problem into more specific learning objectives. These learning objectives are conceptualised into different learning tasks, and the group members have to do independent investigation of the stated learning objectives in their own time. They then have to consult different resources, such as textbooks, Internet articles and field studies. The students share and work with new information on the problem together (Lam 2009). After the discussion and analysis of the problem, the group members formulate multiple solutions to the stated problem (Tick 2007).

'Online technologies enable PBL to be conducted anywhere, on any compatible device, and at any time' (Hazwanie et al. 2017:n.p.). In the online PBL environment, all discussions take place electronically, 'using the telephone, text-based chat or audio [or] video conferencing, or asynchronously, using discussion forums or email' (Cheaney & Ingebritsen 2005:n.p.). The 'production of reports or presentations on their approach and solution is a common element of PBL activities' (Glover 2014:n.p.). In the online PBL design, tools such as Wikis or Google Docs 'offer ways for students' in different locations 'to create reports and presentations collaboratively' on the same document (Glover 2014:n.p.). One useful feature is the ability to add comments and automatically include a timestamp and the commenter's name

(Ó Broin & Raftery 2011). In this regard, Google Docs, in comparison with Wiki, holds more advantages for students working collaboratively online in solving the stated problems. Some other advantages of Google Docs include a box at the bottom right-hand side that shows when another person is editing the document at the same time, and that it allows multiple users to collaborate and edit the document simultaneously. A very handy revision history is readily available that archives each saved version, which can be easily accessed, reviewed and allowed for comparisons between versions with the advantage that changes made to the document are highlighted and colour-coded to indicate who has made the changes (Reynolds 2016).

Online tutors have to be included as observers in each group to track the development of the work. However, Chng, Yew and Schmidt (2011) highlight that the online tutor plays an active role in facilitating the online PBL process and 'guiding students to develop frameworks for the construction of knowledge' (Chng et al. 2011:491). During the online PBL process, the online tutor provides guidance and feedback to students and assesses the group's progress (Schmidt et al. 2009). In this regard, Hmelo-Silver et al. (2007) highlighted that correctly implemented PBL activities include extensive student support, which assists students experience success even when facing learning difficulties in solving the stated problems.

■ (Online) problem-based learning and self-directed learning

Problem-based learning is embedded in the social constructivist approach of learning and therefore shifts the focus from teacher-centred to learner-centred instruction and can facilitate SDL (Rideout & Carpio 2001). Hmelo and Lin (2000) state that specific PBL features support the development of students' SDL skills. Chirkov and Ryan (2001) concur with them and stated that PBL enhances students' independent learning skills, in that students need to take the initiative in learning. The learner-centred nature

of PBL, identification and formulation of learning objectives, students working in collaborative learning environments to solve real-world problems, the identification of their own knowledge deficits, the search for and critical assessment of 'resources, the application of new knowledge to the problem and the collaborative reflection on their SDL skills are all crucial features that foster SDL' (Loyens, Magda & Rikers 2008:415).

In the literature, most of the evidence supporting PBL in fostering students' self-directedness in learning has been reported by universities and colleges with pure face-to-face PBL curricula (in a pure PBL model Savin-Baden (2007) stated that PBL is implemented in the entire curriculum) (Bao, Lin & Liu 2010; Koh et al. 2008; Litzinger et al. 2003).

With reference to the influence of integrated PBL models (PBL according to Kivela and Kivela (2005) is integrated into a traditional curriculum for a period of time) on SDL is inconsistent. Walker and Lofton (2003) reported a decrease in SDL readiness scores of PBL students in the first 16 weeks of their pharmacy studies. Golightly and Guglielmino (2015) and Aziz et al. (2014) reported an improvement in students' perceived readiness in SDL after the implementation of integrated PBL.

As mentioned, these studies have been conducted in face-to-face PBL environments. With the new developments in online technology, it is necessary to explore the implementation of an integrated online PBL on students' SDL skills. In a South African context, Golightly (2018) has determined in a longitudinal study the positive influence of 'face-to-face' and online PBL on Geography student teachers' SDL skills. Interestingly, in his study he pointed out that 'where most research supports pure PBL to foster SDL', he found that 'an integrated PBL model had positively influenced students' perceptions' (Golightly 2018:463) of their readiness in SDL. He also reported that Geography preservice teachers with lower readiness in SDL at the beginning of the PBL intervention have shown the greatest improvement with their involvement in the integrated PBL experiences in the Geography curriculum.

◼ Research objectives

The main objectives of this South African case study were:

• to determine if the online PBL design of the two Geography models is according to the principles of the CoI framework, as perceived by the Geography student teachers
• to report on the influence of the PBL designs on the Geography student teachers' SDL skills.

◼ Research methodology

A one-shot experimental case study approach was used for this research, which involved the collection and analysis of quantitative and qualitative data (Leedy & Ormrod 2001).

◼ Case study context

In this study, the third-year BEd Geography student groups of 2016 and 2017 were introduced to online PBL designs to challenge these students to take responsibility for their own learning. This is in line with the *Teaching and learning strategy – 2016 to 2020* (North-West University 2016) of the university at which the BEd Geography student teachers involved in this study were enrolled.

In a 2-h workshop, the third-year Geography student teachers received training in PBL and online learning in each year. The students received training in the online PBL process, as well as the roles of online tutors and online group members. It is important to highlight that the 2016 and 2017 Geography student groups completed the online PBL activities on Wiki and Google Docs, respectively. The online PBL activities were aligned with the two third-year Geography-module outcomes and dealt with the topics 'Urban health' and 'Climate change' (Appendix A).

◼ Participants

The participants in this study comprised all the full-time undergraduate BEd Geography student teachers of two third-year

modules of consecutive years (a cohort of 121 students) of a South African university. A total of 111 (n = 52 in 2016 and n = 59 in 2017) students completed the CoI questionnaire for 2016 and 2017. From the same cohort, 85 Geography student teachers completed Williamson's SRSSDL questionnaire (n = 46 in 2016 and n = 39 in 2017).

■ Data collection and analysis

Quantitative data: In this explorative case study (cf. Leedy & Ormrod 2001), the third-year Geography student teachers of 2016 and 2017 were asked to complete two questionnaires:

1. Williamson's SRSSDL – This is a self-rating instrument containing 60 items. Twelve items are categorised into five subsections of SDL, namely, awareness, learning strategies, learning activities, evaluation and interpersonal skills. The responses to each item are rated by using a 5-point Likert-type scale, where 1 = never, 2 = seldom, 3 = sometimes, 4 = often and 5 = always. Respondents with high scores indicate a high perceived level of self-directedness in learning. The following scoring range of the grand total is used to identify the level of self-directedness in learning, namely, low (60–140), medium (141–220) and high (221–300). Williamson (2007) used Cronbach's coefficient alpha to compute the internal consistency in the SRSSDL. The computed coefficient alpha in all five areas of SDL (awareness = 0.79, learning strategies = 0.73, learning activities = 0.71, evaluation = 0.71 and interpersonal skills = 0.71) indicates sufficient correlation.

The participants provided the following information on the SRSSDL: gender, year level and group. The internal reliability of this study supports the reliability of the SRSSDL instrument developed by Williamson (2007). The computed coefficient alpha in all five areas of SDL for this study was as follows: awareness = 0.83, learning strategies = 0.80, learning activities = 0.81, evaluation = 0.84 and interpersonal skills = 0.81.

The computed coefficient alpha for the five areas indicates that the SRSSDL instrument is reliable.

2. CoI questionnaire – The CoI 'was measured with the modified CoI [questionnaire,] consisting of social presence, cognitive presence, and teaching presence' (Cho et al. 2017:14; Arbaugh et al. 2008). The 5-point Likert scale of the CoI questionnaire, which contains 34 items, was adapted to fit the research context, where 1 = 'strongly disagree' and 5 = 'strongly agree'. 'The overall reliability of the CoI scale was greater than 0.90, and the Cronbach's alpha values for the teaching, social, and cognitive presences were 0.94, 0.91, and 0.95, respectively, suggesting a high internal consistency of the CoI scale. Descriptive statistics were used to examine the participants' responses to the three elements: teaching presence (items 1 [to] 13), social presence (items 14 [to] 22), and cognitive presence (items 23 [to] 34)' (Wu et al. 2017:147).

The items of the questionnaire were used as closely relevant to the current study so that we could accurately measure the participants' perceptions of online PBL. For social presence, an example item was 'I felt comfortable conversing through the online medium'. An example item for cognitive presence was 'The topics stimulated my interest in the course', and for teaching presence, an example item was 'The instructor provided clear instructions on how to participate in course learning activities'. In this study, item reliability was evaluated as $\alpha = 0.82$ for social presence, $\alpha = 0.90$ for cognitive presence and $\alpha = 0.94$ for teaching presence.

The researchers employed the following quantitative data analysis:

• Descriptive statistical techniques were applied to interpret the quantitative results for the Geography student teachers, as well as the differences between the 2016 and 2017 third-year Geography groups with *t*-tests and analysis of variances (ANOVAs).

- This was not a random sample, but a specific group of preservice teachers and no generalisations to a larger population will be made. Therefore, more emphasis will be placed on effect sizes (*d*-values). 'Practical significance indicates whether the differences are large enough to have an effect in practice (Ellis & Steyn 2003)' (Golightly & Raath 2014:63). The researchers 'used the following guidelines for [the] interpretation of the practical significance of results' (*d*-value) (Cohen 1988:n.p.): small effect: *d* 0.2; medium effect: *d* 0.5; and large effect: *d* 0.8.

Qualitative data: In the CoI questionnaire, two open-ended questions were included at the end of the questionnaire. The open-ended questions focused on the student teachers' perceptions of how the online PBL activity could be improved and their perceptions regarding the use of the LMS eFundi, the Wiki and Google Docs in the online PBL. The participants were also encouraged to elaborate on these questions. The qualitative analysis began with coding the data, dividing the texts into smaller units (phrases, sentences, and paragraphs) and assigning a label to each unit (cf. Creswell & Plano Clark 2007). The qualitative data received were used to enrich the quantitative findings and contribute to a better understanding and clarification of the qualitative data.

◼ Ethical considerations

This study took place within the PBL sub-project as part of the SDL project at the specific university. The SDL project was approved by the ethics committee of the university and complied with all the ethical regulations of the university. The participants provided written consent that the information could be used in this study.

◼ Results and discussions

Firstly, the Geography student teachers' perceptions of their readiness in SDL before and after the online PBL intervention will be highlighted. Then the influence of the online PBL designs, according to the CoI framework of the student teachers'

perceptions, will be discussed. The qualitative data were used to help interpret the quantitative data and, therefore, will be integrated within the themes, as discussed below.

■ The influence of online problem-based learning designs on Geography student teachers' perceptions of their readiness in self-directed learning

The Geography student teachers' perceptions of their readiness for SDL before and after the implementation of the online PBL activities in the third-year BEd Geography modules are shown in Table 9.1 and Figure 9.1. Most of the Geography student teachers

TABLE 9.1: Practical significance (effect size) in the subsections of SDL of Geography student teachers in the various year levels for 2016 and 2017.

Subsection of SDL	Year	N	Pre-test		Post-test		d-value
			Mean	SD	Mean	SD	
Awareness (Questions 6–17)	2016	46	3.99	0.42	4.06	0.39	0.18
	2017	39	3.95	0.37	4.13	0.35	0.50*
	Total	**85**	**3.97**	**0.40**	**4.10**	**0.37**	**0.32***
Learning strategies (Questions 18–29)	2016	46	3.86	0.35	3.83	0.40	0.03
	2017	39	3.68	0.42	3.85	0.36	0.40*
	Total	**85**	**3.78**	**0.39**	**3.84**	**0.38**	**0.16**
Learning activities (Questions 30–41)	2016	46	3.83	0.46	3.84	0.40	0.03
	2017	39	3.86	0.47	3.82	0.47	0.18
	Total	**85**	**3.80**	**0.46**	**3.85**	**0.43**	**0.10**
Evaluation (Questions 42–53)	2016	46	3.83	0.50	3.90	0.41	0.14
	2017	39	3.82	0.47	3.94	0.40	0.25
	Total	**85**	**3.83**	**0.49**	**3.92**	**0.40**	**0.19**
Interpersonal skills (Questions 54–65)	2016	46	3.97	0.41	3.93	0.48	0.10
	2017	39	3.89	0.50	4.06	0.43	0.35*
	Total	**85**	**3.93**	**0.45**	**3.99**	**0.46**	**0.13**
Total	**2016**	**46**	**233.67**	**21.53**	**234.78**	**20.51**	**0.05**
	2017	**39**	**229.36**	**22.35**	**238.13**	**19.55**	**0.39***
	Total	**85**	**231.69**	**21.88**	**236.32**	**20.03**	**0.21**

d-value: small effect: d » ~ 0.2; medium effect: d » ~ 0.5* = medium effect; and d » ~ 0.8** large effect. SDL, self-directed learning; SD, standard deviation.

in this study can be classified in the high SDL category according to Williamson's classification. The average level of readiness for SDL among the third-year Geography student teachers at the beginning of the intervention compared well to other studies in other disciplines using the same SDLRS questionnaire (Premkumar et al. 2014; Walker & Lofton 2003). The mean SDL score of the Geography student teachers at the beginning of the online PBL intervention was 231.69, and their mean SDL score at the end of the online PBL intervention had increased to 236.32. A small practically significant increase (d = 0.21) in student teachers' perceptions of their SDL had occurred with the implementation of the online PBL activities in the third-year Geography modules.

In this study, there was a slight increase in the Geography student teachers' self-directedness in learning after the implementation of online PBL. In other studies, there were decreases in students' SDL scores at the end of the first PBL experience (Litzinger et al. 2003; Reio & Davis 2005). It is important to remember that this was the first encounter with online PBL for the Geography student teachers and that this new learning environment, where the students had to take more responsibility for their own learning, could have been overwhelming for most of them. The researchers believe that a possible reason why the students in this study did not indicate a decline in their SDL scores with the integrated online PBL format is that the online tutors assisted, guided and supported the Geography student groups on a daily basis in the induction process of online PBL.

With reference to the subsections of SDL of all the Geography students, it is clear that 'awareness' and 'interpersonal skills' received the highest means before and after the online PBL intervention. Interestingly, only the 'awareness' subsection showed a slight increase in mean score after the online PBL intervention, with a small practically significant difference (d = 0.32) (Table 9.2 and Figure 9.1).

It is necessary to distinguish between the 2016 and 2017 student groups, as different online PBL designs were implemented
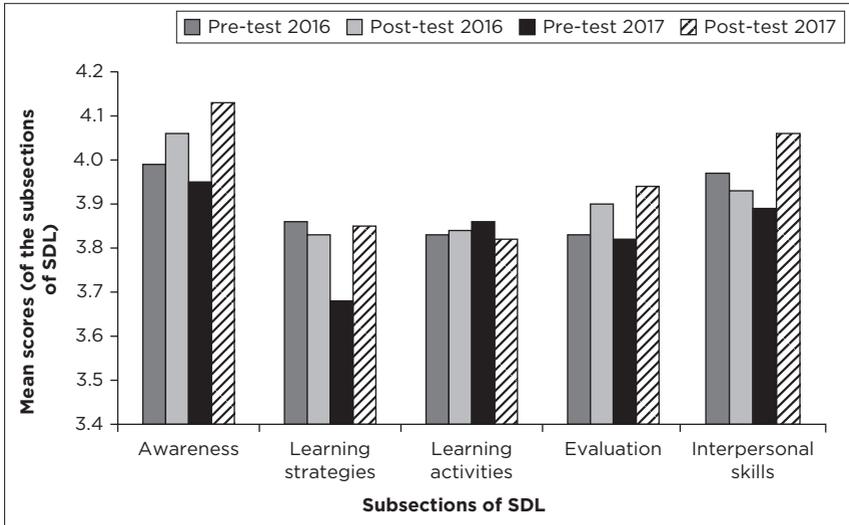
SDL, self-directed learning.

FIGURE 9.1: Comparison of the pre- and post-test mean scores of the subsections of SDL of Geography student teachers for 2016 and 2017.

TABLE 9.2: Summary of the evaluated scores of the three presences of the CoI framework evaluation, as perceived by the third-year Geography student teachers for 2016 (n = 52) and 2017 (n = 59), respectively.

Presences	Mean suggested score	Mean online PBL		% difference
Teaching	4.18[a]	2016	4.08	−2.0
		2017	4.29	+1.8
Social	3.98[a]	2016	3.57	−8.2
		2017	4.13	+3.0
Cognitive	4.14[a]	2016	3.71	−8.6
		2017	4.18	+0.4

Source: Van der Westhuizen (2017).
PBL, problem-based learning.
[a]Adapted from Arbaugh et al. 2008.

regarding the collaboration environments. The differences between the 2016 and 2017 groups of third-year Geography student teachers' perceptions of their self-directedness in learning with the implementation of online PBL are shown in Table 9.1 and Figure 9.1. The 2017 Geography student teacher group showed an overall better improvement in mean scores in

the 'awareness', 'learning strategies' and 'interpersonal' skills sections after the online PBL intervention, with medium practically significant increases with *d*-values of 0.50, 0.40 and 0.35, respectively. It is worth to mention that 'evaluation' also showed an improvement with a small practically significant increase (*d* = 0.25).

Figure 9.2 clearly shows the improvement of the 2017 online PBL design with the implementation of Google Docs in comparison with the 2016 online PBL design. Overall, the average of the subsections of SDL showed a more significant improvement in the 2017 group than the 2016 group (*d*-value of 0.05 in 2016 compared to 0.39 in 2017). The improvement of the SDL skills, as indicated above, especially in 'interpersonal skills', 'awareness' and 'learning strategies', can be as a result of the change of the online collaboration application, whereby the Wiki of the LMS
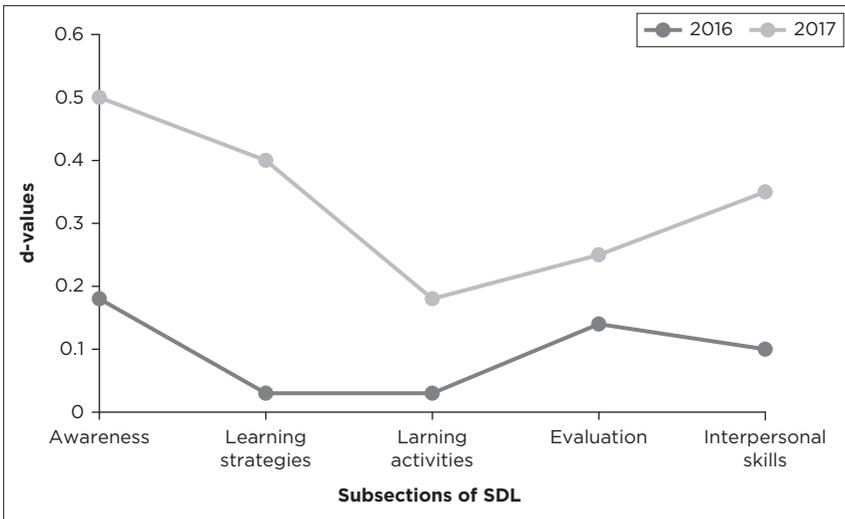
SDL, self-directed learning.
FIGURE 9.2: Practical significance differences (*d*-values) between the pre- and post-tests of the subsections of SDL of Geography student teachers for 2016 and 2017.

called eFundi at this university was replaced by Google Docs. Each group of five to six students could then work simultaneously on their PBL report and collaborate directly on site. This resulted in very positive perceptions of the students regarding collaboration on Google Docs: 'We could see who does what, we could help others or make comments on their work whilst working together online … we could help each other immediately' (female, 74, year unknown); 'The contribution of each group member could be seen, so all can see if your contribution is too little' (male, 77, year unknown); 'It helps with socialising' (female, 78); 'Group members can reflect on your contribution' (male, 80, year unknown); and lastly '… it improved my ICT skills' (female, 78, year unknown). This corroborates the higher post-test scores, specifically regarding 'awareness', 'evaluation' and 'interpersonal skills' in 2017 (see results in Table 9.2 and discussions in the next section dealing with the CoI framework evaluation). Table 9.2 shows a vast improvement of the social presence, which is linked to the effective collaboration environments for students.

Figure 9.1 shows a comparison of the mean pre- and post-test scores of the subsections of SDL of Geography student teachers for 2016 and 2017.

Figure 9.2 shows the practical significance differences (*d*-values) in the subsections of SDL of the Geography student teachers for 2016 and 2017. The graphs clearly show that the 2017 online PBL design has a better practical significance (*d*-values) between the pre- and post-tests of the five subsections of SDL than the 2016 online PBL design.

■ Evaluation of the Community of Inquiry framework elements of the online problem-based learning environments

Table 9.2 shows the guideline mean scores (mean suggested score), according to Arbaugh et al. (2008), for the evaluation of the three

elements of the CoI framework. The three interdependent elements are teaching presence, social presence and cognitive presence, which should be around 4.18, 3.98 and 4.14, respectively (on a five-point Likert scale evaluation), to be deemed as an acceptable and effective OCL environment. The mean scores of the respective presences for the 2016 and 2017 groups are also depicted here and compared with the suggested mean scores of each presence.

Figure 9.3 shows the comparison between the two online PBL designs compared against the mean suggested score adapted from Arbaugh et al. (2008). The 2016 design entails the application of online PBL on the Wiki tool of the university's LMS without the utilisation of Google Docs. With the 2017 design, the Wiki tool was replaced by embedding Google Docs on the LMS, enabling the students to edit simultaneously when working on the report. Figure 9.3 shows the emphasis of the results of Table 9.2 and the graphs clearly show the improvement of the students' perceptions regarding the three presences, not only from 2016 to 2017 but also against the suggested mean scores.

As shown in Table 9.2 and Figure 9.3 it is evident that the final design (in 2017) of the online PBL activity of these two Geography modules not only complies with the recommended average scores for acceptable and effective online collaborative activities according to the CoI framework as perceived by the students, but is even slightly better, with 4.29 for the teaching presence, 4.13 for the social presence and 4.18 for the cognitive presence, respectively (Van der Westhuizen 2017). According to Morueta et al. (2016), it is necessary to increase the social presence by increasing online social interaction or collaboration possibilities for students. It was found, as shown in Table 9.2 and Figure 9.3 and feedback from students, that the Wiki on the Sakai LMS did not allow for simultaneous collaboration by group members on their reports. Although the Wiki still provided collaboration opportunities, it was not simultaneous. Therefore, the Wiki tool of the university, as mentioned earlier, was replaced by embedding Google Docs within the LMS. By doing so, it resulted in an effective collaborative learning environment, according to the
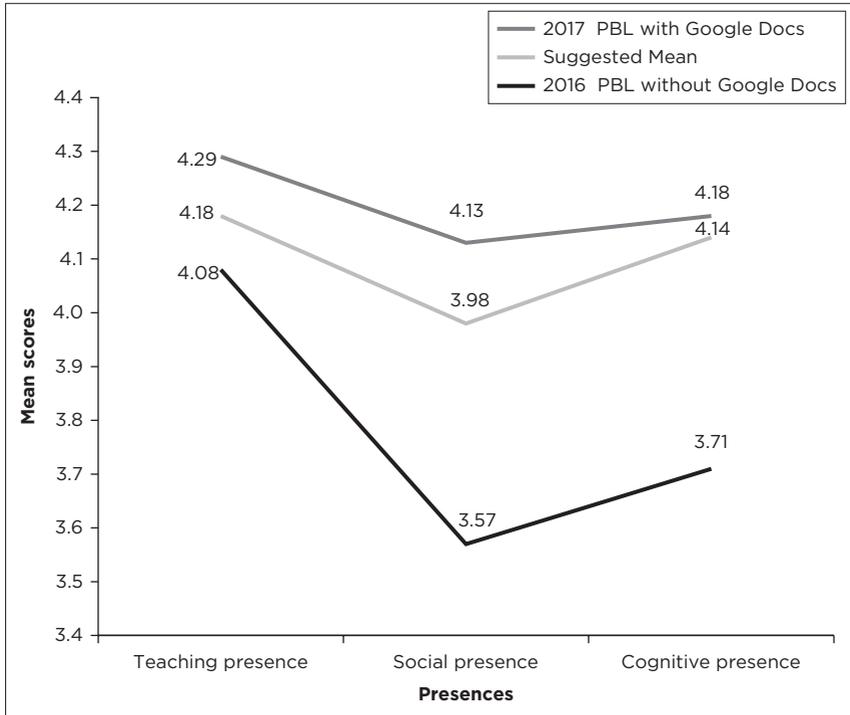
PBL, problem-based learning.
FIGURE 9.3: Summary and comparison of the evaluated scores of the three presences of the CoI framework evaluation, as perceived by the third-year Geography student teachers for 2016 (*n* = 52) and 2017 (*n* = 59), respectively.

CoI measurement: 'Google Docs is a very good manner for collaboration' (female, 104); 'It is much better to work online than to struggle to get together' (female, 103); 'Much easier way of doing group projects' (female, 54); and 'We could collaborate very well to complete the PBL assignment … it did not waste time to work together and, thus, encouraged us to work on the report' (female, 60). Finally, most students thought it was a very good teaching and learning strategy: 'Very good way of teaching and learning' (male, 63) and 'PBL on Google Docs is extremely inventive and it inspired me as a student to use it one day when I am teaching to apply it in practice' (female, 75).

As PBL is seen as a higher-order learning activity (according to Bloom's taxonomy as reference), this evaluation correlates with the findings of Morueta et al. (2016) that to perform higher-order tasks online, a strong teaching presence is necessary, which entails continuous guidance, structure and support to students. It is the responsibility of the instructor to design, scaffold, model and coach properly before and during the online activity. Regarding the social presence, the frequency of involvement by the group members will increase as the level of the task (according to Bloom's taxonomy) increases. In support of this, Richardson and Ice (2010) found that:

> [*A*] discussion based on real cases can stimulate more critical thinking than other types of tasks, such as a theoretical study or debate. Case studies showed a remarkable creative component because students had to build solutions to the real problem raised. (p. 57)

Therefore, the degree of complexity and the nature of the task seem to condition the level of group cognitive activity. Thus, for complex activities, it is necessary to ensure a good social presence to achieve a high cognitive presence and awareness (Morueta et al. 2016). This correlates neatly with the results of the SRSSDL, which showed a good improvement regarding 'awareness', 'learning strategies' and 'interpersonal skills' as subsections of SDL. It can then safely be argued that the online PBL activities, in this instance, adhere to good OCL environment principles, with Google Docs as the supportive online collaborative application.

In summary, regarding both the findings of the SDL scale and the CoI framework evaluation, in this study, the Geography student teacher group of 2017 that used Google Docs to complete their PBL reports online had a practically significant increase in their SDL. This finding supports Sua and Beaumont's (2010:n.p.) view that solving problems in Wikis online promotes interactive and collaborative learning, reflection, discussion and the 'sharing of information, ideas and [views] among group members'. These findings also concur with Brown and Adler's (2008) view that students who work collaboratively, face-to-face or online learn more effectively than students who work individually.

■ Conclusion and recommendations

The Geography student teachers' perceptions of their readiness for SDL before and after the implementation of the online PBL activities in the third-year BEd Geography modules compared well with those of other studies in other disciplines using the same SDLRS questionnaire of Williamson. With reference to the subsections of SDL of all the Geography students, it is clear that 'awareness' and 'interpersonal skills' received the highest means before and after the online PBL intervention.

The implementation of online PBL had a small practically significant influence on the Geography student teachers' self-directedness in learning. With reference to the different Geography student teacher groups, it is clear that there are notable differences between the 2016 and 2017 groups regarding their perceptions of their self-directedness in learning. The 2017 Geography student group had a medium practically significant increase in SDL after the online PBL intervention. This group also showed an improvement in the mean scores of the 'awareness', 'learning strategies' and 'interpersonal skills' sections of SDL after the online PBL intervention. This study indicates that it might be as a result of the change of the online collaboration application whereby the Wiki of the university's LMS was replaced with Google Docs. In Google Docs, the students could work simultaneously on their PBL report and collaborate directly on site. This resulted in very positive perceptions of the students regarding collaboration on Google Docs and increased the effectiveness of the online PBL activity. The researchers are of the opinion that the supportive online collaborative application of Google Docs (the design for 2017) had a practically significant increase in the Geography student teachers' SDL skills.

Future research may test if the same designs could be transferred to other subjects. Research to further refine the online PBL process with Google Docs to enhance all three presences is recommended. It is possible that the social presence can further be increased by using an SDL strategy such as CL instead of

collaborative learning to support and manage the group members and social interaction in an attempt to raise the cognitive presence. Research on how to improve the social coherence, ensuring equal, synchronised collaboration, is recommended.

Finally, the change in the online PBL design increased the collaboration opportunities between group members and led to a higher social presence (according to the CoI framework principles). By increasing the social presence, it also inevitably increased the cognitive presence, which is a good indication that higher-order learning (according to Bloom's taxonomy) activities take place online, in this instance in PBL. This correlates well with the results of Williamson's SRSSDL that showed good improvement regarding 'awareness', 'learning strategies' and 'interpersonal skills' as subsections of SDL.

■ Appendix A

Third-year online Geography problems

Third year	GEOE311 Population Geography and Urban Geography	GEOE321 Climatology and Geomorphology
	Theme: Poor health in low-income urban areas	**Theme: Climate change in South Africa**
	As beginner Geography teachers in a school situated in a low-income informal settlement in Ikageng, Potchefstroom, you become aware that the Geography learners in your class are absent on a regular basis. In discussions with the principal, teachers and the clinic sisters at the nearby medical clinic, the poor health conditions in the low-income dwelling areas are highlighted as the main reason. The government body of the school asks you to provide possible solutions to the poor health problems of learners and residents in the area.	Global warming and modern climate change are considered a serious problem worldwide and, according to scientists, this threatens the future existence of humans on earth. In South Africa there is great concern about the impact that climate change (global warming) will have on our country's people and environment.
		The Department of Agriculture Conservation and Environmental Affairs requests a report from the Geography students with reference to the presence of climate change in South Africa, as well as possible measures which the South African government could implement to, firstly, help manage this problem and, secondly, to combat it drastically. The Department also wishes to know what can be done by individuals and households to make a meaningful contribution.

Source: Golightly (2018:465).

Example of Work schedule to ensure a strong teaching, social and cognitive presence

1. **By Friday 23 Aug**: Do research and plan your PBL activity.
2. **By Monday 27 Aug** by 18:00 (after scheduled class time).

   In Google Docs, upload one single sentence to demarcate the problem to solve. Upload the learning outcomes or objectives needed to successfully complete the activity. We will give feedback with comments in Google Docs.

   Do research to collect the necessary information to answer to all possible outcomes that need to be achieved.

3. **By Thursday 30 Aug**: Broad structure and outlay of the report. Insert basic definitions and start with the draft report. Keep a bibliography updated at the end of the report. Ensure all group members work equally on Google Docs. Upload all your work documents and resources underneath 'Resources' on your group eFundi site (not the class site). We will give feedback. Complete assessment rubric on a continuous basis. Complete the assessment rubric and upload under Resources on the group eFundi site.

4. **By Monday 3 Sept.** Report should be 60%–75% completed. All group members should have contributed equally on a daily basis or according to this schedule. Bibliography should be updated. We will give feedback. Start building your PowerPoint presentations under PBL-Slides on your group eFundi site so that it can be monitored and evaluated continuously. Complete your self-assessment rubric as far as possible and upload on your group eFundi site under 'Resources'.

5. **By Thursday 6 Sept:** Report should be 90% completed. Bibliography should be updated. Ensure throughout resources used uploaded on your eFundi group sites underneath 'Resources'. Your PowerPoint (of 8 slides for a 5 min presentation) should be 80%+ completed. We will give final feedback (if necessary) on report. We will also give initial feedback on PowerPoint Presentation. MAKE USE OF LOTS OF GRAPHS, MAPS AND DIAGRAMS IN YOUR PP-SLIDES.

6. **By Monday 10 Sept.** Report should be completed by end of the day. Draft final PowerPoint presentations should be finalised for final feedback from lecturers.

7. **By Thursday 13 Sept:** Finalised report available on Google Docs. PowerPoint presentation should be finalised by the end of the day and ready to present on Monday. PowerPoint will be assessed by the end of the day. Presentations should be a summary of 8 slides presented in 5 min.

8. **By Monday 17 Sept:** Possible PowerPoint presentations in class. Class starts normal time 7:30.

Example of Assessment Rubric
GEOE 321 Climatology (PBL assessment Rubric)

Criteria	Weight (marks)	Excellent	Good	Efficient	Inefficient
Demarcation of the Problem	4	The demarcation of the problem has been very well achieved and complete. (4)	The demarcation of the problem has been satisfactory. (3)	The demarcation of the problem shows gaps and needs further attention. (2)	The demarcation of the problem is poor and vague and need to be reworked. (1)
Formulating of the learning purposes	8	The learning purpose is well defined and formulated completely. (7–8)	The learning purpose has been defined to satisfactory.(5–6)	The learning purpose is incomplete and not well defined. (3–4)	The learning purpose is poorly defined and incomplete. The learning purpose needs to be reformulated. (1–2)
The scope and quality of the provisional research	20	Exceptionally well-developed description of what 'global warming or climate change' is, its impact on weather systems and climate regions and also all causes and consequences shows a very good understanding of the problem. (16–20)	Satisfactorily developed description of what 'global warming or climate change' is, its impact on weather systems and climate regions and all causes and consequences shows a good understanding of the themes. (11–15)	The description of what 'global warming or climate change' is, its impact on weather systems and climate regions and all causes and consequences is not quite complete. (6–10)	Poor demonstration of knowledge about what 'Global warming or climate change' is, its impact on weather systems and climate regions and all causes and consequences. To be reworked. (1–5)
The use of recent literature, resources and data	8	The use of recent scientific resources and data is excellent. (7–8)	The use of resources and data is good. (5–6)	Recent resources and data have not been used and need further attention. (3–4)	Not enough resources and recent data have been used and they need to be reworked. (1–2)

Criteria	Weight (marks)	Excellent	Good	Efficient	Inefficient
Identification and recommendations of management guidelines for the management of the problem and measures for its prevention. Possible solutions to the problem in all sectors of society are represented	12	A complete and extremely well-written set of guidelines and weather warnings for the management and for prevention in all sectors of the society. Also solutions and recommendations for the problem are proposed in SA. (10–12)	A complete and well-defined set of guidelines and weather warning for the management as well as its prevention. Also solutions and recommendations for the problem are proposed in SA.(7–9)	Only certain, guidelines and weather warnings and measures are proposed for the management and prevention, as well as the solutions and recommendations that apply to the problem. Basic reference was made to SA.(4–6)	Poor formulated guidelines and weather warnings and measures are proposed for the management and prevention, as well as solutions and recommendations on the issue were made. No reference was made to SA. (1–3)
Writing skills	4	The report distinguished between measures that already exist to manage it and guidelines for demarcate it, is given impartially and is highly professionally written. (4)	The report is impartial and professionally written. (3)	Parts of the report do not testify to impartiality and professionalism. Spelling mistakes are common. (2)	The report does not testify of impartiality and professionalism. Too many spelling mistakes are present. Report needs to be rewritten. (1)
Referencing	4	Referencing in the discussion is professional, effective and correctly quoted. The bibliography is complete and correct. (4)	Referencing in the discussion was quoted well. Resources were quoted correctly in the bibliography. (3)	Some of the resources were not referenced or quoted correctly. Not all the resources were indicated in the bibliography. (2)	There were no references made to resources. Resources were not quoted correctly. Resources were not referred to in the bibliography. (1)
Total	**60**				

Constructive congruencies in self-directed learning and entrepreneurship education

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■ Abstract

Entrepreneurship education is crucial to empower South African learners with the knowledge and skills needed to overcome the high levels of poverty and youth unemployment experienced. Not only does entrepreneurship education hold potential economic benefits for learners, but it also creates social and environmental value for learners and their communities.

Recent research, however, suggests that neither the intended nor the enacted curriculum supports effective entrepreneurship education in South African schools. This raises concerns about how entrepreneurship education can be facilitated more effectively to open up its benefits for learners. Strategies to develop and support effective entrepreneurship education had to be investigated, especially for including it in the education of student teachers who will be working within the constraints of a curriculum that does not offer insights into entrepreneurship opportunities. Just adding on more pedagogical content in teacher education courses that are already content-heavy was not an option; alternative methodologies had to be considered. A literature review revealed that SDL is increasingly considered as a suitable process to support effective entrepreneurship education. Given the desire to slightly modify teacher education, rather than adding to the course, SDL seemed a suitable process to employ for developing and supporting the skills and characteristics that teachers need for effective entrepreneurship education. The purpose of this exploratory literature review was therefore to investigate constructive congruencies in SDL that could be utilised in support of the development of effective entrepreneurship education strategies as part of teacher education. The findings indicate that the roles of students in SDL, together with several pedagogical requirements for fostering SDL, could be utilised to support student teachers in the development of effective entrepreneurship education strategies. On the basis of the findings, recommendations are made for the structuring and pertinent inclusion of SDL in student teachers' preparation for effective entrepreneurship education.

◼ Introduction and statement of purpose

High levels of poverty and youth unemployment is an acute problem in South Africa, as is evident from the latest national statistics (Stats SA 2018), which report that 32.4% of young people

between the ages of 15 and 24 years were unemployed in the first quarter of 2018. Effective entrepreneurship education is considered one of the strategies that can contribute to reducing high levels of unemployment. For instance, the (then) deputy president of South Africa, Mr Cyril Ramaphosa, remarked that this country's government should implement entrepreneurship education in schools to 'imbue young people with entrepreneurial knowledge from a very young age' (Eyewitness News 2016). Hence, entrepreneurship education is anticipated to develop knowledge and skills that learners can utilise to create their own employment or income-generating opportunities. Entrepreneurship education can also contribute social and environmental value for learners and their communities. When social problems or issues are used as a starting point for entrepreneurship education, it will contribute positively to communities when learners apply their knowledge and skills to address those issues (Du Toit & Kempen 2018a). Similarly, in cases where entrepreneurship education revolves around developing products or services that will contribute to the sustainable and responsible use or management of resources, environmental value is created that might benefit learners and their communities (Du Toit & Kempen 2018a; Öykü İyigün 2015). The potential value that effective entrepreneurship can contribute to the lives of South African learners is therefore undeniable.

Several of the skills and characteristics that should be developed in entrepreneurship education are also seen as life skills – skills that are not only useful for employment purposes but also in the everyday lives of learners. Seikkula-Leino et al. (2015), for example, mention the development of creativity, initiative, self-directedness and problem-solving skills in entrepreneurship education, which are important for all learners, whether they become entrepreneurs or are employed by someone else in the future. Entrepreneurship education is therefore important for all learners, not only because of its potential to create employment, income-generating opportunities and social or environmental value, but also because it contributes to the development of skills for everyday life in the 21st century.

A recent study (Du Toit & Kempen 2018b), which analysed the curricula of all South African secondary school subjects, revealed that entrepreneurship education is included only in a limited and fragmented manner in this country's current intended curriculum. 'The *intended* curriculum' refers to the formal, written or ideal curriculum envisaged and 'put on paper' (Du Toit & Kempen 2018b:3). It informs and guides teaching and learning in accordance with government policies (Booyse & Du Plessis 2014), including the rationale, philosophy or vision for the curriculum (Thijs & Van den Akker 2009), together with the proposed goals, topics, sequence, methods and assessment for learning (Cai & Cirillo 2014). The finding that the current intended curriculum for secondary schools only includes limited and fragmented entrepreneurship education (Du Toit & Kempen 2018b) means that the many benefits thereof are not reaching learners.

The intended curriculum also often serves to predict how teaching and learning is supposed to happen in practice (Cai & Cirillo 2014) in the enacted curriculum. The *enacted* curriculum describes how the intended curriculum is applied, implemented, realised or enacted in practice (Du Toit & Kempen 2018b; Esene 2015) – in other words, how teaching and learning actually happens (versus how it is supposed to happen) in practice. A recent investigation into the practices of Consumer Studies teachers revealed that entrepreneurship education does not realise effectively in the enacted curriculum either (Du Toit 2018). What makes this finding particularly worrying is that Consumer Studies is the South African school subject containing the most entrepreneurship education by a large margin (Du Toit & Kempen 2018b). This means that the valuable entrepreneurship education that was intended in the Consumer Studies curriculum is also not reaching learners owing to inappropriate practices used by many teachers to implement learning.

The problem that emerged from the above-reported studies is therefore that, despite their many potential benefits for learners, neither the intended nor the enacted curriculum supports effective entrepreneurship education in our schools. If the curriculum does

not provide adequate opportunities for developing effective entrepreneurship education, other ways to foster this important learning need to be investigated. One possible avenue could be to prominently include teaching–learning strategies that will support the development and implementation of effective entrepreneurship education in teacher education with the hope that student teachers will then implement these strategies in their own practice when they enter the profession someday.

Although this sounds like a promising idea, curriculum overload in teacher education programmes is a continuing and considerable concern (Moodly & Drake 2016), implying that content regarding these pedagogical strategies could not just be added on to the existing programmes. In view of this, the teacher education programme had to be modified to include strategies that will support the development and implementation of effective entrepreneurship education, without adding additional content, though.

An initial literature review revealed that SDL is increasingly considered a suitable process to support effective entrepreneurship education. Self-directed learning for entrepreneurship education has, however, not been researched in depth, nor does it emerge frequently in the practice of teachers (Guglielmino & Klatt 1993; Löbler 2006; Tseng 2013). Balwanz (2015) and Marks (2012) furthermore mention that school-leavers in South Africa have little SDL preparation, thereby implying that student teachers find themselves in a similar situation. These preliminary findings highlighted the need to launch a focused investigation into the potential of SDL as a process to support and develop effective entrepreneurship education implementation in student teachers. As I did not want to encumber the existing programme with added content, the congruencies between SDL and entrepreneurship education had to be explored and documented as a starting point. I believed that understanding these congruencies could be utilised for the modification of the teacher education programme by including the fostering of SDL skills to support the effective implementation of entrepreneurship education.

To guide the research reported in this chapter, the question was asked, 'which congruencies exist in both SDL and entrepreneurship education that can be utilised to support the implementation of effective entrepreneurship education?' To address this problem, three aims were formulated to direct the research, namely, to (1) identify ideal pedagogies for constructive entrepreneurship education and SDL, (2) examine the congruencies between the pedagogies of entrepreneurship education and SDL, and (3) make recommendations on how SDL could be used by student teachers for the effective construction and implementation of entrepreneurship education in practice.

The purpose of this chapter is to report on the investigation into the congruencies between SDL and entrepreneurship education, with the goal of streamlining the incorporation of SDL into a teacher education programme. The remainder of the chapter explains the conceptual orientation used in the study, the methods used for the literature review and the findings of the review, and provides a discussion on the implications of the findings. Finally, conclusions are drawn and recommendations are made for the structuring and pertinent inclusion of SDL as a teaching–learning strategy in student teachers' preparation for effective entrepreneurship education.

■ Conceptual orientation

Before explaining the methods utilised for this review, clarification of the conceptual orientations utilised in this study is essential. Feiman-Nemser (1990:1) explains conceptual orientation as 'a set of ideas about the goals of teacher preparation and the means for achieving them' that will provide a 'coherent perspective on teaching, learning, and learning to teach that gives direction to the practical activities of educating teachers'. Three main concepts need to be clarified, particularly how pedagogy, entrepreneurship education and SDL were viewed in the current study.

Pedagogy was viewed as the 'methods, activities, principles or practices that best support the construction of knowledge and

skills' (Du Toit & Booyse 2015:17) in a particular topic, subject or field of education. In other words, it refers to *how* the teaching and learning of knowledge and skills are or should be constructed (Umalusi 2014). Pedagogy was further viewed as not limited to a focus on the learning of children (*who* is learning), but more importantly considering the *process* (*how*) of teaching and learning, in line with the stance of Merriam (2001).

Similarly, in this study, entrepreneurship education was viewed as a process in which learners are placed at the core of the learning process. The European Commission clearly emphasises the importance of both the learners and the process of learning in their guidelines and requirements for teacher education to promote effective entrepreneurship education (2013). Entrepreneurship education was viewed as a process that creates value when learners are learning-by-doing (Du Toit & Kempen 2018a). Furthermore, the context in which entrepreneurship education takes place affects the effectiveness and value of the learning (Du Toit & Kempen 2018a) and therefore entrepreneurship education should not be viewed in isolation.

Self-directed learning was viewed as a scaffolded process of developing particular skills or characteristics. It was regarded through the PPC Model described by Hiemstra and Brockett (2012:158), wherein the characteristics of the learner (the 'person'), all the aspects involved in the teaching–learning transaction (the 'process') and the environment in which the learning takes place (the 'context') each feature prominently.

■ Review methodology

An exploratory literature review was conducted for this investigation. As a starting point, the databases EBSCOhost, Online Research, ERIC, Sabinet and Google Scholar were combed for articles and chapters reporting on the pedagogies used for SDL and/or entrepreneurship education. These databases were selected based on the opinion that they include many high-impact, full-text journals and conference proceedings.

These key terms were used in two sequential searches; firstly, ['entrepreneurship education'] AND ['pedagog*' OR 'teaching strategy' OR 'teaching approach'] were searched, followed by ['self-directed learning'] AND ['pedagog*' OR 'teaching strategy' OR 'teaching approach'].

To ensure that the most recent research would be included, the search was restricted to articles and chapters that were published in the last decade (2008–2018). Other inclusion criteria included that the research had to be written in English and that the full text had to be available. The initial search of the five databases resulted in 6764 articles and chapters. Non-English publications, publications to which the author did not have full access, duplicate publications in different databases, non-peer-reviewed publications, unpublished research and non-text publications, such as posters or PowerPoint presentations, were subsequently excluded, as well as research that focused on SDL in computer- or online-based environments. The application of the exclusion criteria yielded a more manageable 568 publications. The titles and abstracts of these publications were then skimmed to determine the relevance of each publication to the current investigation – that is, expanding on or explaining details about the preferred pedagogical approaches for SDL and entrepreneurship education. A further 171 publications were removed during this stage of the selection process, resulting in 397 publications, which were used for the literature review.

In line with Fink's (2014) recommendations for planning, organising and conducting research literature reviews, publications relating to pedagogies in entrepreneurship education were analysed first and separately from those relating to SDL. Each document was systematically analysed, particularly noting and copying sections specifically describing pedagogical requirements or practices. The sections on the requirements for optimal conditions for entrepreneurship education and/or SDL were analysed and coded in each document, after which the requirements were clustered into topics that emerged from

the review. Eventually, all the topics were refined into three main emergent themes:

- the roles of learners
- the roles of others in the learning process
- particular requirements to enhance the effectiveness of these pedagogies.

The findings from the thematic analysis were collated in an Excel sheet that served as a data analysis matrix to compare the congruencies between the pedagogies (methods, practices or approaches) preferred for use in SDL and entrepreneurship education.

■ Theoretical framework

Constructivism is often utilised as a lens for entrepreneurship education investigations (Frederiksen 2017; Kurczewska 2016; Marks 2012; Valliere, Gedeon & Wise 2014). A constructivist approach to the research afforded insight into the potential contribution that SDL could have in entrepreneurship education. Moreover, Verzat, O'Shea and Jore (2017) mention that several researchers promote a socio-constructivist approach to the teaching and learning of entrepreneurship owing to its consistency with the collective nature of entrepreneurship education and its focus on the progressive construction of learners' knowledge, skills and competencies.

Social constructivism has been recognised as a suitable theoretical framework for research on SDL in several studies (Kazlauskiene et al. 2013; Marks 2012; Sze-Yeng & Hussain 2010; Tseng 2013) and was thus embraced for the current research. Kazlauskiene et al. (2013:13) further explain the suitability of social constructivism for investigating SDL by referring to the 'educational process as a sociocultural, educational phenomenon' that forms part of learners' everyday life, in which knowledge development is influenced by learners' and others' values, beliefs, cultural orientation and social groups. Self-directed learners

therefore become '(inter)active creators and not only consumers' of knowledge and learning (Kazlauskiene et al. 2013). Constructivism, including aspects of social constructivism, was therefore used for this research owing to its association with both entrepreneurship education and SDL.

■ Contribution of the study

This exploratory literature review makes a theoretical contribution in that the congruencies between SDL and entrepreneurship education are documented. These insights may contribute to teachers' understanding of how these similarities can be utilised in the construction of more effective entrepreneurship education. Consequently, it can be expected that this teacher education will benefit the learners in these teachers' classrooms by empowering them with not only entrepreneurial knowledge and skills but also a valuable life and learning skill, namely, SDL.

■ The review findings and discussion

The main concepts that were used to structure the investigation comprised entrepreneurship education and ideal pedagogies for entrepreneurship education, as well as SDL and optimal pedagogies for designing and promoting SDL experiences. Subsequently, the findings from the review indicating the congruencies between the pedagogies for the processes of entrepreneurship education and SDL are described and discussed in view of the goal of streamlining the incorporation of SDL into a teacher education programme.

■ Entrepreneurship education

Education is recognised as being fundamental in the development of learners' entrepreneurial mindsets, as well as knowledge about and skills and competencies for entrepreneurship (Neck & Corbett 2018; Toutain & Fayolle 2017). Hence, learners are not necessarily born to be entrepreneurs, but their entrepreneurship

knowledge, skills and competencies can be developed through education with this particular purpose. To support the process of entrepreneurship development (in the form of education), it is important to understand what, where, how and why entrepreneurship learning takes place as well as who the learners in this process are (Huq & Gilbert 2017; Kuratko & Morris 2018; Tseng 2013; Valliere et al. 2014). Meticulous planning and structuring are therefore imperative to ensure effective entrepreneurship education (Toutain & Fayolle 2017). Current teacher education programmes at most universities already include content to support student teachers in planning and structuring learning experiences for their learners, such as learning about developing and planning lesson plans, analysing levels of cognitive demand, or planning effective sequencing and progression in topics across grades. This content is also used in and applicable to the entrepreneurship education process.

To attain the purpose of entrepreneurship education – that is, to develop learners' entrepreneurial mindsets, knowledge, skills and competencies – learners should be placed at the core of the learning process (Toutain & Fayolle 2017). Teachers and pedagogy also play a role in developing learners' entrepreneurship skills and characteristics, but these elements should be structured around the learners and not vice versa (Toutain & Fayolle 2017). Such an approach would require a shift from traditional passive, teacher-led teaching to active, learner-centred and SDL (Van der Vleuten, Sluijsmans & Joosten-ten Brinke 2017).

Active, learner-centred pedagogies put learners in situations where they must think critically and that force them to actively apply their skills and knowledge to novel situations rather than just following what the teacher teaches them (Toutain & Fayolle 2017). It is thus comprehensible that active, learner-centred pedagogies would be more suitable to prepare learners for real-world entrepreneurship (where they would have to deal with novel situations) than traditional teacher-led education. Consequently, entrepreneurship education must move beyond the teaching of mere facts to embracing metacognition and

learning how to learn, in an effort to support learners in adapting to novel situations they may encounter in their own lives, or in their future careers, be it entrepreneurial or otherwise (Celuch, Bourdeau & Winkel 2017).

Learning approaches *about*, *for* and *through* entrepreneurship are used (Sirelkhatim & Gangi 2015; Sørensen & Davidsen 2017; Tynan 2017). Education *about* entrepreneurship is content based and usually relies on traditional transmission-type, teacher-led teaching methods in which learners are passive receivers of information (Sirelkhatim & Gangi 2015; Sørensen & Davidsen 2017; Tynan 2017; Verzat et al. 2017). Education *for* entrepreneurship is based on active, learner-centred teaching–learning methods such as case studies, projects or games that develop learners' skills and competencies (Sirelkhatim & Gangi 2015; Sørensen & Davidsen 2017; Tynan 2017; Verzat et al. 2017). Education *through* entrepreneurship links learning to real life and relies mostly on experiential learning, using variations of learner autonomy in the form of either SDL or teacher-directed learning or a combination thereof (Sirelkhatim & Gangi 2015; Verzat et al. 2017). Although learning *for* and *through* entrepreneurship is frequently preferred over learning *about* entrepreneurship (Du Toit 2018; Lackéus 2015; Sirelkhatim & Gangi 2015), each of the three approaches contributes to and develops entrepreneurship education and should be incorporated in the process of developing various aspects of learners' entrepreneurship (Du Toit 2018).

■ Ideal pedagogies for entrepreneurship education

Schools should prepare learners with the skills that are needed to enable their successful navigation of life and employment in the 21st century (Nieswandt 2017). These skills include creative thinking, lifelong SDL, envisaging and implementing novel ideas, assuming responsibility, communication, creative problem-solving and effective collaboration with others – all of which are important in entrepreneurship (Nieswandt 2017). Even so, the development of these essential skills is not supported by all pedagogies, and student

teachers should be prepared in their education to recognise the need for and successfully implement the ideal pedagogies required to support effective entrepreneurship education.

Neck and Corbett (2018) state that learners' learning experiences, ownership of learning, readiness to engage and commitment to learning, together with teachers who facilitate such learning are ideal pedagogies to foster entrepreneurship education. Although teachers and the selection of effective teaching methods still contribute to the value of entrepreneurship education, learners should be taught how to become more independent as part of their preparation for their future careers as entrepreneurs or employees (Ahmadzadeh et al. 2017). In learner-centred learning, learners are required to take more control of, and responsibility for, their own learning process than what is required in more traditional teacher-led teaching (Frederiksen 2017; Kurczewska 2016). Learner-centred learning, in combination with active learning-by-doing and collaborative learning, is also acclaimed as optimal for young learners, together with an increased focus on SDL (Komarkova, Conrads & Collado 2015). The trend to include SDL as a skill that needs to be developed in entrepreneurship education is increasingly evident in the literature (Gustafsson-Pesonen & Remes 2012; Lackéus 2016; Nieswandt 2017; Piperopoulos & Dimov 2015; Valliere et al. 2014). Moreover, Tseng (2013:428) notes that 'entrepreneurs who possess the ability to direct their own learning are more likely to be successful'. Self-directed learning is not only a 'critical skill' for 21st-century students (Rashid & Asghar 2016:606) but is also implemented widely in educational fields as a teaching–learning approach (or process) (Levett-Jones 2005) to facilitate particular learning outcomes. The subsequent section therefore elucidates the concept of SDL and delineates the optimal pedagogies for designing and developing SDL.

■ Self-directed learning

Self-directed learning involves independent or autonomous learning, individually or working with others, where the learner controls and takes responsibility for the learning process through formulating

learning goals, identifying and selecting resources and learning strategies to support learning, and evaluates the outcomes of the learning process (Knowles 1975:19; Tseng 2013; Van Gelderen 2010). Transferring the responsibility for the learning process to the learner (as opposed to the teacher) requires teachers to skilfully relinquish the position they were traditionally associated with – as 'givers of knowledge' (Du Toit 2018:244; Marques & Albuquerque 2012:62) – and reflects an acknowledgement of learners' potential and capabilities to act independently (Kazlauskiene et al. 2013).

The value of SDL skills for learners is extensive. Self-directed learners become more committed to their learning, become actively involved in the learning process and persist in addressing and overcoming barriers to their learning (Lindberg et al. 2017). The effective implementation of SDL will support lifelong learning (Tynan 2017) and will help learners to cope in a world where knowledge and challenges are constantly shifting (Zabit, Omar & Karagiannidou 2017). It contributes to learners' motivation and commitment to keep on learning and adjust their learning process (Toutain & Fayolle 2017). Furthermore, combining SDL with real-world learning contributes to learners' grasp of the value of such learning and the contribution it could make to their future careers or employment (Shapiro 2017). The value that SDL can contribute to the everyday lives of learners and their future careers is clear. Because SDL is described as progressive and different from traditional approaches (Lackéus 2016), it is important to explore and understand what the optimal conditions are for designing and developing effective SDL process in order to be able to embed such learning in the preparation of student teachers.

Implementing the process of SDL into any learning programme to foster the development of particular skills or characteristics requires adaptation and careful scaffolding of the pedagogies utilised in the programme (Du Toit & Pool 2016; Sze-Yeng & Hussain 2010). According to Rashid and Asghar (2016), carefully designed pedagogies support learners' engagement in the learning process as well as their self-directedness, which, in turn, could increase their academic performance.

■ Optimal pedagogies for developing self-directed learning

From the literature, it is clear that the learner is the key in the SDL process. However, two additional aspects that impact SDL repeatedly emerged in this investigation, namely, the roles that teachers fulfil and the scaffolding of the learning process.

□ Teachers

As an alternative to the traditional role of 'transmitter of knowledge' or 'giver of knowledge', teachers in SDL are seen as the creators of opportunities or providers of back-up for facilitating the learning process (Gustafsson-Pesonen & Remes 2012:12; Lindberg et al. 2017:770; Powell 2013:104; Van Gelderen 2010:714). When teachers guide (instead of leading) the learning process, learners learn to adapt to changing conditions and apply their learning rather than uncritically imitating examples (Powell 2013). This requires teachers to utilise pedagogies that are different from traditional teacher-led teaching, instead requiring them to implement active, learner-centred pedagogies that incorporate creative problem-solving, calculated risk-taking, learning from mistakes, learning-by-doing and interacting with the real world (Lindberg et al. 2017; Silén & Uhlin 2008). However, such learning does not just happen; it requires careful planning, and therefore teachers (and by implication, student teachers) need to be educated or prepared so as to enable them to approach teaching and learning in a manner that will support learners to become self-directed learners (Komarkova et al. 2015; Nieswandt 2017). By implication, teachers should have a sound understanding of the value of SDL in order for them to be able to explain it to learners in a way they will understand. Also, teachers should design, develop and create learning plans and environments that are different from traditional teaching and classrooms, which will support learners to become more self-directed (Hiemstra & Brockett 2012; Lindberg et al. 2017). Student teachers will therefore need to be educated in their unique roles to facilitate SDL (Guglielmino 2013).

☐ Scaffolding of self-directed learning

Like teachers, learners must be prepared and taught as to how to optimally utilise SDL (Guglielmino 2013; Tynan 2017). Learners who are used to traditional teaching–learning pedagogies might find the shift towards SDL difficult (Täks et al. 2014). Consequently, the SDL process should be more scaffolded in the beginning, when learners are not used to this approach, to help structure their learning experience (Tynan 2017; Van Gelderen 2010). Guglielmino (2013:10) refers to 'transition structures' that are required to help learners to 'understand both the reasons for the new approaches and their roles' in becoming self-directed learners. In this regard, Neck and Corbett (2018) describe four stages of becoming self-directed learners – from a dependent learner, to becoming an interested learner, developing into an involved learner and finally, becoming a self-directed learner. The teacher can reduce the degree of scaffolding as learners become used to this type of learning. In addition, certain learners might prefer more structure and guidance than others, and teachers need to be perceptive to these differing needs (Guglielmino & Klatt 1993). This careful balancing of scaffolding independence and providing structured guidance is not something that should be approached using trial-and-error but rather something that student teachers should be educated about. The scaffolding of the SDL process is not only the responsibility of the teacher; it is also affected by support from learners' peers (Täks et al. 2014).

Contrary to Tseng's (2013) statement that SDL is an individual activity (learning on one's own), several other authors (Alvi & Gillies 2015; Kazlauskiene et al. 2013; Lackéus 2016; Neck & Corbett 2018; Täks et al. 2014; Verzat et al. 2017; Zabit et al. 2017) explain the importance of collaboration in developing knowledge in and scaffolding the SDL process. Examples of collaboration in SDL include learners solving problems in groups, sharing resources or brainstorming ideas (Lackéus 2016). Collaboration in the SDL process develops learners' ability to acknowledge, consider and appreciate others' opinions and evaluate and incorporate that as part of their learning, thereby expanding their

own knowledge (Kazlauskiene et al. 2013). Therefore, the construction of learning through social interaction plays an important role in the SDL process.

After the sequential analysis of the pedagogies preferred for entrepreneurship education and those required in SDL, the two sets of data were compared to determine what congruencies exist between the two sets of pedagogical approaches.

◼ Congruencies between entrepreneurship education and self-directed learning

The investigation showed that SDL is coupled with entrepreneurship education in countries across the globe – for example, the United States of America (Guglielmino & Klatt 1993), Ireland (Tynan 2017), Canada and Germany (Valliere et al. 2014), the Netherlands (Cremers et al. 2014), Lithuania (Kazlauskiene et al. 2013), Estonia and Finland (Täks et al. 2014) and other European countries (Komarkova et al. 2015).

Numerous congruencies between the preferred pedagogies for the processes of entrepreneurship education and SDL were identified. These similarities are presented in Table 10.1 and are grouped according to the three main themes that emerged, namely, the roles of the learner, the roles of others in the learning process and particular requirements to enhance the effectiveness of these pedagogies. Topics or elements in each theme are listed alphabetically in the table.

☐ Learners' roles

The roles the learners are expected to fulfil are congruent in the entrepreneurship education process and SDL process (Table 10.1). Motivation to learn, and to keep on learning, is crucial and is supported when learners are committed to their own learning (Toutain & Fayolle 2017). Self-reflection on the learning content and the learning process contributes to learners' understanding of what could be done differently to improve their chances of

TABLE 10.1: Congruencies between the preferred pedagogies for entrepreneurship education and SDL.

Roles	Preferred pedagogies
The roles of the learner	Actively involved in own learning process
	Commitment to learning contributes to learning motivation
	Independent learning
	Self-reflection on content and the learning process is crucial
	Take ownership of, or responsibility for, learning
The roles of others	Interactive and collaborative learning required
	Feedback from experts, teachers and peers are important to support the learning process
	Co-creators of knowledge and learning
	Teachers act as facilitators and guides, not 'givers of knowledge'
Requirements	Different environment from traditional teacher-led environments, which allows freedom to work independently
	Early implementation (at a young age) preferred
	Focus on learning rather than teaching
	• Learning emphasises both content and method
	• Learning from mistakes is seen as an opportunity for learning
	• Linking learning with practical, real-life application thereof
	• Problem-solving and creative thinking are essential skills to support effective learning
	Adaptation of learnt knowledge and skills to novel or changing contexts and environments is vital
	Learning is scaffolded, increasing in autonomy as learners become more self-confident in their own learning process

success in future scenarios (European Commission 2013; Michalsky & Schechter 2013; Tynan 2017; Van der Vleuten et al. 2017).

In line with this finding, Tseng (2013) mentions that SDL characteristics and skills are key in helping entrepreneurs cope with change. Such change includes that knowledge is constantly changing and expanding and that challenges are constantly shifting (Zabit et al. 2017). Learners are expected to be actively involved in the learning process, take ownership for their own learning and learn independently to a large extent (Kapasi & Grekova 2018; Lindberg et al. 2017; Tseng 2013; Tynan 2017; Verzat et al. 2017). Learners therefore take ownership of their learning process from start to finish, including reflection

about what they have learnt (content) and how they learnt it (process) and how they might improve or adapt their learning in future, or in novel contexts, for both entrepreneurship education and as part of the SDL process.

However, the processes of entrepreneurship education and SDL involve more than only independent individual learning, and it emerged that the pedagogies utilised in both require some collaboration and interaction with others as part of the learning process (Table 10.1), indicating social construction of the knowledge and learning process.

☐ The roles of others

Social constructivism highlights the need for and importance of social interaction and collaboration as part of the learning process (Beckers, Van der Voordt & Dewulf 2015; Bhattacharjee 2015). Hiemstra and Brockett (2012) note that this social interaction with others, or the social context of the SDL process, impacts both the learner and the teaching–learning process. Others are therefore co-creators of learning in that they contribute to the knowledge and learning process. The 'others' who can contribute to the learning process include learners' peers and the teacher (Alvi & Gillies 2015; Bhattacharjee 2015; Kapasi & Grekova 2018; Kazlauskiene et al. 2013; Michalsky & Schechter 2013; Tynan 2017; Van Gelderen 2010). In addition, the so-called experts – who have extensive experience and/or knowledge of entrepreneurship or the SDL process – can contribute meaningfully to the learning content and learning process. The roles of experts are especially valuable as many teachers have limited or no experience or training in entrepreneurship education or the process of SDL (Kurczewska 2016; Lindberg et al. 2017; Marques & Albuquerque 2012; Silén & Uhlin 2008; Sze-Yeng & Hussain 2010). Experts can assist in linking learning to real-life experiences and by providing feedback and subsequently, both learners and teachers will gain valuable insights from the experts' mistakes and experiences (Cremers et al. 2014; Francom 2010; Somby & Johansen 2017;

Wilson et al. 2009). When learners collaborate with their peers, they are exposed to alternative viewpoints to their own and will benefit from the shared knowledge, resources, skills and ideas (Bhattacharjee 2015; Val et al. 2017). Teachers fulfil a similar role in entrepreneurship education and in fostering SDL skills, particularly that of facilitator and motivator, which differs from traditional teacher-led pedagogies (Frederiksen 2017; Golightly 2016; Lindberg et al. 2017; Täks et al. 2014; Toutain & Fayolle 2017; Van der Vleuten et al. 2017; Verzat et al. 2017).

Regrettably, several studies have reported that teachers are not implementing these preferred pedagogies effectively (Koekemoer & Booyse 2013; Powell 2013; Sørensen & Davidsen 2017) and are not frequently collaborating with experts (Du Toit 2018), which will diminish the value of this learning for learners. Related to this finding, it emerged that numerous studies recommend that teachers must be specifically trained to support their implementation of the specific and preferred pedagogies for entrepreneurship education (David et al. 2018; Du Toit & Gaotlhobogwe 2018; Koekemoer & Booyse 2013) and for the SDL process (Golightly 2016; Guglielmino 2013; Michalsky & Schechter 2013). Consequently, there is a real and immediate need to include the value and effective application of these pedagogies in the education of student teachers. David et al. (2018) further recommend that entrepreneurship education should form part of both initial teacher education and teachers' continuing professional development so as to ensure that they are enabled to effectively implement the pedagogies preferred for such learning. In other words, teachers are required to become lifelong learners to help them keep abreast of transformations in these pedagogies and learning contexts.

Formative feedback and suggestions from others, such as alternative points of view, solutions to problems or suggestions for learning, are vital to support learners' learning process (Cremers et al. 2014; Täks et al. 2014; Tseng 2013; Van Gelderen 2010; Zabit et al. 2017). Learners who want to impress their peers (or teachers) are more motivated to excel and work harder in the

learning process (Verzat et al. 2017). This will contribute to learners' preparation for adapting to changes and new situations and exposes them to options they might not have considered.

□ Pedagogical requirements

Several pedagogical requirements that are congruent for both entrepreneurship education and SDL emerged from the investigation (Table 10.1). These requirements involve an assortment of pedagogical elements, including the learning environment, the emphasis on the learning (rather than teaching) process, and learning strategies such as problem-solving, learning from mistakes, and preferred scaffolding of the learning. These and other requirements that came to light during the investigation (see Table 10.1) are discussed in the subsequent paragraphs.

Toutain and Fayolle describe learners as 'social actors who show initiative and interact with their environment' (2017:1000), supporting Tseng's (2013) view that learners are deeply and mutually interdependently involved with their learning environment. Hence, Tynan (2017) suggests that innovative and creative learning environments will foster SDL. Lindberg et al. (2017:775) recommend that learning environments should be designed to be 'democratic, flexible, challenging, and, most importantly, non-threatening' to support the independent learning required for entrepreneurship education and the SDL process (Hiemstra & Brockett 2012). Teachers are therefore required to design and *create learning environments* that will support active, independent and collaborative learning (Table 10.1). This is a particular skill that student teachers will have to be educated about.

Numerous studies have found that learners' entrepreneurial intentions are formed at a time when they are at school age, which may be difficult to change if not established early in their educational path; therefore, entrepreneurship education should be started early as part of school education (Falck, Gold & Heblich 2017; Kirkley 2017; Marks 2012). Similarly, if effective SDL can be

incorporated early in learners' schooling, it will benefit them for a longer period. Including the preferred pedagogies for entrepreneurship education and SDL early in learners' educational path will foster the development of such ideal learning processes (Table 10.1), which learners can continue to utilise and develop as they progress through school and later in their careers. Hence, educational curricula should be structured in a manner that will support the implementation of the pedagogies that enhance entrepreneurship education and the development of SDL characteristics *early in learners' school careers* – at a young age or lower school levels.

The emphasis in both entrepreneurship education and the SDL process should be on *learning rather than on teaching* (Table 10.1), which necessitates modifications to the way education is approached (Kirkley 2017). These modifications include that teachers become facilitators rather than transmitters of knowledge (Lindberg et al. 2017), which will contribute to helping learners become more autonomous, creative, responsible and cooperative in their own learning process (Toutain & Fayolle 2017). In addition, this emphasis on learning will enhance learners' willingness to take calculated risks and to become more confident in novel and changing situations (Lindberg et al. 2017; Toutain & Fayolle 2017), which are imperative skills for success in entrepreneurship. Student teachers' education will have to include how they could sanction learners to be (or become) more autonomous in their learning and, at the same time, not fully exiting the process but still contributing to learners' knowledge and development in their role as an effective facilitator.

Learning should not focus only on *content* ('what' should be learnt) but also on *the process of learning* (Table 10.1) – 'why' and 'how' learning is constructed by learners, individually and collaboratively, are therefore equally important (Frederiksen 2017; Kazlauskiene et al. 2013). To promote learners' involvement in the learning process, teachers should choose active and learner-centred methods (Lindberg et al. 2017:6; Sørensen & Davidsen 2017). In this regard, Ahmadzadeh et al. (2017)

recommend methods such as class discussions and group work to support learners in an independent learning process. Lindberg et al. (2017:770) additionally advise that 'learning by doing, experiments, positive mistake-making, calculated risk-taking, creative problem-solving and interaction with the outside world' are required to enhance the processes of entrepreneurship education and SDL. Student teachers have to be taught about the value of effective collaboration with 'the outside world' as part of the social construction of knowledge and learning because such external collaboration enriches learners' learning experience and contributes to teachers' own lifelong learning (Du Toit 2018). Developing and fostering such connections will additionally create opportunities for teachers and learners to implement their knowledge and learning in their communities, which adds even more value to this learning (Du Toit & Kempen 2018a).

Mistakes are viewed as an opportunity to contribute positively to the learning process (Table 10.1) rather than being a threat to it (Tseng 2013). Toutain and Fayolle (2017) describe mistakes as challenges (not obstacles) to learning. Cremers et al. (2014) note that learners' levels of responsibility and self-direction increase when they are afforded opportunities to make (and learn from) mistakes. Makonye (2016:202) goes as far as calling mistakes, errors and misconceptions 'milestones in students' learning'. When Guglielmino (2013:11) provides guidelines for the implementation of the SDL process in the classroom, she prominently states that such mistakes or errors should be viewed as 'a starting point, an opportunity for new learning — not a stop sign'. The feedback from and on mistakes contribute to making learning more authentic (European Commission 2013; Sze-Yeng & Hussain 2010; WEF 2009). Learners should also be afforded opportunities to identify and correct or address their peers' mistakes (Alvi & Gillies 2015), which will require higher levels of cognitive demand and will further contribute to deeper and more meaningful learning. Authentic experiences in which mistakes can (and will) happen during the learning process therefore need to be created (Cremers et al. 2014), requiring that learning be

linked to real-world contexts. De Beer and Gravett (2016) describe how case-based learning in particular, which includes learning from mistakes and links learning to real-life experiences, helped student teachers to feel better prepared for the profession.

Linking learning to the real world makes the learning content and process more meaningful to learners and contributes to their motivation to learn (Golightly 2016; Lindberg et al. 2017). Engaging students in authentic, real-world tasks results in DL (De Beer & Gravett 2016) and improves learners' self-evaluation and self-directedness (Bagheri et al. 2013). Real-life learning experiences help to close the gap between what is learnt and what happens in the real world (European Commission 2013; Piperopoulos & Dimov 2015). Sirelkhatim and Gangi (2015) explain the closing of this gap as helping learners to be entrepreneurs rather than them pretending or only trying to be entrepreneurs. Real-life learning allows learners to take risks, manage the outcomes and learn from the process and results (Ndedi 2012). Learning is often structured around real-world problems in PBL (Bagheri et al. 2013).

To enable effective utilisation of real-life learning and making mistakes as learning opportunities, *problem-solving and creative thinking* (Table 10.1) are much-needed skills that learners should develop in the processes of both entrepreneurship education and SDL (Guglielmino & Klatt 1993; Seikkula-Leino et al. 2015; Silén & Uhlin 2008; Zabit et al. 2017). Action-oriented learning, experiential learning and PBL (learning by solving problems) are all active, learner-centred constructivist approaches to teaching and learning that are effectively used in entrepreneurship education (Du Toit 2018; Kurczewska 2016). Paloniemi and Belt (2015:265) state that the implementation of PBL, SDL skills and creativity learning will bring 'curricula closer to reality'. PBL would therefore be an especially useful method to enhance both entrepreneurship education and SDL skills. Problem-solving and creative thinking skills are also valuable in the world of work and are considered as essential life skills that learners should develop (Nieswandt 2017).

Creativity or creative thinking is often associated with novel ways of thinking, novel solutions to problems, or novel products (Shrader & Finkle 2015). Thinking in novel ways will help address longstanding problems or issues. The processes for both entrepreneurship education and SDL should be implemented or applied in the real world to be meaningful, implying that learners should be able to adapt what they have learnt (both knowledge and skills) to the changing circumstances and challenges they encounter in the real world. The learning approaches and skills associated with such learning will contribute to learners' adaptability in a changing world and their competency to implement learnt knowledge, skills and processes in *novel contexts or challenging circumstances* (Table 10.1) (Nieswandt 2017; Toutain & Fayolle 2017; Zabit et al. 2017). It is vital that 21st-century learners are able to adapt to the changing world (not only technology but also changes in social and other structures) and act with confidence in challenging and uncertain situations and that the teacher, as well as the teaching approaches used, play important roles in developing this capacity in learners (Toutain & Fayolle 2017).

Last but not least is the requirement that the learning process needs to be planned and *scaffolded* from a more structured process (Table 10.1) to gradually become less structured, more learner-centred and autonomous (Cremers et al. 2014; Guglielmino 2013; Michalsky & Schechter 2013; Powell 2013; Van der Vleuten et al. 2017). Because the pedagogies required for entrepreneurship education and the SDL process differ from traditional teaching and different learners have different needs for the amount of structuring in learning (Guglielmino & Klatt 1993; Guglielmino 2013), learners need to be eased into the preferred learning processes gradually (Tynan 2017). As learners become more acquainted with this type of learning, they will need less guidance and need to take more control of their own learning. Student teachers should be taught why this careful consideration of the construction of this learning is so important as well as how to effectively implement it in practice.

The findings from this literature review support the notion that the pedagogies required for the SDL process are closely aligned to and will support entrepreneurship education. The congruencies between the preferred pedagogies for entrepreneurship education and SDL (Table 10.1) indicate that it should not be arduous to implement the SDL process in entrepreneurship education. However, the structured, planned and social constructivist nature of the SDL process, which deviates from traditional teacher-led education, suggests that student teachers should be trained to enable them to effectively implement this type of education. The challenge now will be to integrate the process of SDL carefully and thoughtfully to support student teachers in their development and implementation of entrepreneurship education. Social constructivist principles need to be considered and adhered to when developing such an integrative process so as to allow for the valuable co-construction of knowledge and learning, which will enable student teachers to experience and appreciate the value of such collaboration in the process. If this can be done successfully, student teachers will develop as self-directed learners, which include SDL skills and characteristics that they can implement in their everyday lives and, more importantly, also use or teach in their classrooms one day.

■ Limitations of the study

Despite this investigation being part of a larger, ongoing study, there are limitations associated with literature reviews. Working as a solitary researcher, co-coders or external researchers were not utilised for the verification of the coding of the literature in the present study, and subsequent investigations can increase the validity and reliability of research through expanding the number of researchers collaborating on the investigation, for example, developing and using a shared codebook. Furthermore, using only English literature excluded much valuable and probably relevant research from this overview and future studies should consider literature reviews on research reported in

multiple languages. Similarly, using only literature sources that I had access to means that numerous relevant studies might have been excluded from this literature review. Time constraints, however, prevented the long waiting periods often associated with requesting and lending literature from other libraries.

■ Recommendations for enhancing self-directed learning process in entrepreneurship education

Informed by the findings of this explorative investigation, the following recommendations are made for the implementation of SDL process in entrepreneurship education. The learner should be placed at the core when planning the SDL process and entrepreneurship education experiences, while at the same time keeping in mind the prescribed roles for learners in such situations. Active learning methods, which explicitly include self-reflection, feedback from others and insights gained from mistakes that were made, should be used to facilitate the learning (rather than teaching) of content and the process of learning. The learning process should include problem-solving and creative thinking skills, be implemented in environments that will support independent learning, link the newly acquired learning with real-life and real-world applications, and should enable learners to apply their knowledge and experiences in novel situations. Finally, it is recommended that the SDL process should be scaffolded to become more autonomous as learners develop more independence and become more used to this manner of learning. Future research should investigate how the SDL process can be developed as part of teacher education or professional development for teachers and particularly in combination with their preparation to effectively implement entrepreneurship education.

■ Conclusion

The potential contribution of entrepreneurship education to addressing the high levels of poverty and youth unemployment,

as well as its potential value to solve social and environmental issues experienced in South Africa, is indisputable. Purposefully implementing and embedding strategies to foster SDL in entrepreneurship education will further enhance the entrepreneurial development of learners and will contribute important constructive skills that learners can use in their everyday lives and future careers. The congruencies between the preferred pedagogies required for entrepreneurship education and the SDL process – such as independent learner-centred learning; collaboration with others and utilising the feedback from others; learning from mistakes; and applying problem-solving and creative thinking – indicate that implementing SDL process in entrepreneurship education should not be difficult. The potential value of entrepreneurship education – supported by SDL skills – to help South African learners break free of the chains of poverty and youth unemployment, however, imposes a responsibility on teachers and teacher education establishments to address this as an issue of urgency.

Participative assessment practices and its contribution to the development of self-directed learning skills

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■ Abstract

This chapter reports on the contribution of participative assessment practices (PAPs) towards the development of students' SDL skills. We used an existing undergraduate Life Sciences module where standard end-point testing was replaced with PAP. A turn-around test, a memo–peer test, a peer-individual-peer and self-reflection (P-I-P&S) test, as well as reflective instruments were implemented during an 11-week semester in a large class. Qualitative feedback was obtained through an open-ended questionnaire. Students' responses indicated the development of SDL skills as a result of the implemented assessment practices. Qualitative analysis revealed that the ability to formulate learning goals, taking responsibility for learning, selecting appropriate learning strategies, diagnosing learning needs, motivation to learn, seeing peers as resources, as well as effective social skills are developed as a result of the assessment practices that students were involved with. The value of immediate feedback towards diagnosing learning needs was specifically highlighted by respondents. The findings suggest the need to reconceptualise pedagogy and assessment as an integrated dialogic process, which in turn will promote the development of SDL skills that is vital for the 21st century.

■ Introduction

According to Boud (2007):

> [*T*]he fundamental problem of the dominant view for assessment is that it constructs learners as passive subjects. That is, students are seen to have no role other than to subject themselves to the assessment acts of others, to be measured and classified. (p. 17)

It is therefore not surprising that Gibbs and Simpson (2004:11) state that assessment is not only disliked by lecturers and students but is also mostly unsuccessful in supporting students' learning. Contributing to the ineffectiveness of assessment in supporting learning is the use of summative testing for rote

learning (Brevik, Blikstad-Balas & Engelien 2017). Even though empirical evidence indicates that feedback also aids student learning (Nicol 2010; Sutton 2012), the fact that feedback has become increasingly time-consuming for lecturers (Boud & Molly 2013; Nicol 2010) contributes to the neglect of using feedback to improve student learning (Kvale 2007). McMorran, Ragupathi and Luo (2017) state that students perceive the relationship between assessment and learning as coming down to a single aspect, namely, a grade. Meanwhile, in an ever-changing world, characterised by globalisation and a rapidly growing knowledge economy (Mok 2009), the need for self-directed learners who can assess their own learning gaps, being an evaluative and reflective practitioner, having the ability to think critically and manage information effectively, is becoming increasingly important in the 21st century (Patterson, Crooks & Lunyk-Child 2002). Current 'forms of educational assessment foster other-directed learning' (Kvale 2007:66), while assessment from a social constructivist approach is a social process (Gipps 1999).

For the purpose of this chapter, PAPs will be defined as group activities, grounded in social constructivism, with a strong focus on self- and peer assessment. Within these social groups, student learning can be deepened when students regularly assess their own and their peers' work (Race 2015). According to Seifert and Feliks (2018), self- and peer assessment activities enable students to comprehend the importance of assessment as a meaningful learning process.

This chapter reports on the contribution of PAPs towards the development of students' SDL skills. Firstly, the conceptual–theoretical framework, consisting of a brief overview of peer and self-assessment, SDL, as well as the skills associated with being self-directed in one's learning, is discussed. This is followed by an outline of the research method and data collection. An evaluation of qualitative feedback from students is presented and discussed. Following a discussion of results, conclusions are drawn and implications for higher education are stated.

■ Conceptual–theoretical framework

The active role of students and their ability to take responsibility not only for their own learning but also for their assessment is pointed out by Reddy et al. (2015). The use of peer and self-assessment is believed to improve pedagogy because of the shift away from 'exclusive instructor assessment practices' (Brew & Riley 2011:34). Boud and Soler (2016) and Smith et al. (2013) stated that Assessment as Learning (AaL), explicitly implementing AaL activity, will enable students to improve future work through the development of their assessment literacy. According to Earl and Katz (2013), lecturers have a specific role to play when taking an AaL approach, namely:

- demonstrating and teaching self-assessment skills
- providing systematic and thought-provoking opportunities to practice so that students are able to develop into confident and skilled self-assessors
- guiding students in goal setting and monitoring their progress towards reaching these goals
- working with students in developing clear criteria of good practice
- providing exemplars and models of good practice
- guiding students in developing self-monitoring mechanisms
- monitoring students' metacognitive processes as well as their learning, and providing detailed feedback
- creating an environment in which students feel safe enough to take chances and where support is readily available.

When considered from a social constructivist perspective, assessment is a social process (Gipps 1999), and therefore traditional individual end-point testing and grading need to be replaced with assessment practices that will enable students to engage with one another and with the content. Students furthermore need to be engaged in ongoing dialogic feedback (McLean 2018). Self- and peer assessment methods, which yield rich dialogic feedback, are examples of PAP. Participative assessment is not a new endeavour in higher education (Brew & Riley 2011) and not only involves reflection and monitoring of

own work (Brown & Harris 2013) but also descriptive and evaluative factors (Brown, Andrade & Chen 2015). Self-assessment prompts students to continually ask reflective questions regarding their own learning process (Reddy et al. 2015). The 'self-feedback' generated during self-assessment will enable students to diagnose their learning needs (Reddy et al. 2015:51). Brown et al. (2015) point out that self-assessment takes on different formats, for example, estimating total scores before or after an assessment opportunity, and evaluating the correctness of an answer. When designing and implementing self-assessment practices, Brown et al. (2015) highlight that self-assessment is a skill that needs to be acquired and requires explicit instruction and opportunity to practice. According to Bloxham and Boyd (2007), peer assessment will result in students:

- understanding:
  - the academic standards of the particular module
  - assessment criteria and how to apply it
  - alternative strategies to learning tasks
- developing:
  - the ability to make judgements and to justify a point of view
  - the ability to provide constructive feedback
- being able to monitor their learning progress.

In addition, participative assessment not only enables students to become lifelong learners (Boud & Falchikov 2007) but also promotes active learning and involvement (Rodríguez-Gómez, Quesada Serra & Ibarra-Sáiz 2016). Enabling students to learn how to give and receive criticism (Topping 1998), improving negotiation and diplomacy skills (Dochy, Segers & Sluijsmans 1999), developing critical thinking skills (Hanrahan & Isaacs 2001), as well as being able to self-regulate one's learning (Nicol & Macfarlane-Dick 2006) are all benefits of participative assessment. Furthermore, Ljungman and Silén (2008), as well as Seifert and Feliks (2018), state that participative assessment enables students to take responsibility for their own learning, while having a

positive effect on their performance and academic achievement (Sluijsmans 2002).

An important aspect of participative assessment methods is the provision of immediate feedback. According to Kvale (2007:58), 'the more immediate and precise the feedback is, the stronger the effect on learning'. Well-structured feedback has the potential to increase student engagement and restructure current understanding, as well as to help students in selecting alternative strategies for improved understanding (Earl 2013). Even though well-crafted feedback assists students in monitoring and regulating their own learning (Nicol 2010; Sutton 2012), feedback is primarily a post-submission summative event (Beaumont, O'Doherty & Shannon 2011) and therefore has become an increasingly time-consuming activity for university lecturers (Boud & Molly 2013; Nicol 2010). Making matters worse is the fact that lecturers' feedback is often in vain as students tend to ignore feedback when it is perceived as being 'too late to be applied to the ongoing assessment' (Beaumont et al. 2011:684). Moving away from the understanding that feedback is only 'something that is given' to students (Ajjawi & Boud 2017:253) is essential. Furthermore, Ajjawi and Boud (2017) state that feedback is a social activity and discourse, while Nicol and Macfarlane-Dick (2006) state that dialogic feedback also supports the development of students' self-assessment skills. There are thus more advantages to feedback linked to participative assessment methods rather than traditional individual end-point testing and grading. In this chapter, we will indicate that participative assessment methods also contributed to the enhancement of SDL.

Self-directed learning and its well-known seminal definition by Knowles (1975) are cited in the majority of SDL literature. Knowles' (1975:18) definition of SDL, as well as other densely-packed definitions of SDL (e.g. Brockett & Hiemstra 1991; Brookfield 2009; Ellinger 2004; Gibbons 2002; Kasworm 1983; Nepal & Stewart 2010),

is a clear indication of the complexity of SDL. Scholars regard SDL as a process where students:

- take initiative
- formulate learning goals
- take responsibility for their own learning
- select own learning resources
- evaluate learning experiences
- do not work in isolation.

Knowles' (1975) definition of SDL furthermore acknowledges that SDL is influenced by both external and internal factors and is not simply a linear process:

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

A self-directed learner should possess numerous skills, and according to Knowles (1975) and Guglielmino (1978), this would include the following abilities, namely, to:

- relate collaboratively to peers
- see peers as resources
- give assistance to and receive assistance from peers
- determine their own learning needs
- translate learning needs into learning goals
- identify human and material resources
- take the initiative in making use of the identified resources
- select appropriate and effective learning strategies
- take initiative in their learning process
- persist in learning
- accept responsibility for own learning
- be self-disciplined
- be curious
- take joy in the learning process
- have a tendency to be goal-oriented
- have a tendency to view problems as possible challenges.

Even though several active student-centred teaching–learning strategies (e.g. CL, PBL and project-based learning) have proved to enhance students' self-directedness in learning (Golightly 2018; Havenga 2015; Lubbe, Mentz & Petersen 2016), assessment remains the independent variable across all educational programmes and institutions. As long as assessment practices rely on memorisation and feedback is based merely on providing the correct answers by the lecturer, no active student-centred teaching–learning strategy will fully support the enhancement of SDL. Assessment therefore needs to be 'connected with the overall learning and teaching environment' (Lau 2016:523) conducive to the enhancement of SDL.

Alvin Toffler states that 'all education springs from some image of the future' (Toffler 1974:3). It is therefore not surprising that students must be prepared for the 21st century and its ever-increasing knowledge base with the necessary SDL skills (Guglielmino 2013). According to Dynan, Cate and Rhee (2008), there is an explicit, if not critical, role to be played by lecturers to facilitate strategies that promote SDL. Candy (1991) notes that the intentional alignment of teaching and assessment to (1) support learning, (2) provide students with reflective opportunities, (3) use formative feedback to inform the learning progress and process and (4) use understanding rather than rote learning are factors that encourage a deep approach to learning, which could ultimately foster SDL skills.

■ Research method

■ Research design and methodology

The study was designed to explore the contribution of participative assessment methods to the development of SDL skills of first-year Life Sciences students. A basic qualitative design was used, which sought to 'discover and understand a phenomenon, a process, or the perspectives and world views of the people involved' (Merriam 1998:11). An open-ended questionnaire was

used to collect data to give students an opportunity to answer honestly and in as much detail as possible. According to Maree and Pietersen (2016), open-ended questions furthermore reveal the thinking process of the respondents even though analysing these types of questions is difficult.

■ Participants

The research was set in a South African university, and the case study was designed around the first-year Life Sciences module (LIFE 122) in the Faculty of Education. The study investigated the key research question, *what is the contribution of participative assessment methods on the development of SDL skills?* The study had university ethics approval and involved one Life Sciences lecturer (also the researcher), and non-randomised sampling was used for the class of 99 first-year students. Because the implemented participative assessments formed part of the lecturer's teaching and learning strategy for the Life Sciences module, no student who did not sign the informed consent form was at a disadvantage. All students who registered for the LIFE 122 module were exposed to the participative assessments. Permission to use the collected data was provided by means of an informed consent form. Sixty-seven first-year Life Sciences students completed the informed consent form and therefore the open-ended questionnaire.

■ Intervention

The lecturer implemented three different types of tests as assessment instruments, each of which made use of self- and peer assessment methods. An AaL approach was followed, and test results were aimed at both forms of assessment (summative and formative). The three tests 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 tests is presented in Figure 11.1 and is discussed subsequently.

1

Turn-around test
- Individual test (35 marks)
- Groups of two students compile a faults and fixes table (25 marks)
- Students' test score: (35) + (25)
- Post-assessment reflection done online after receiving test results before writing the next test

2

Memo–peer test
- Individual test (60 marks)
- Memorandum compilation in groups of two students
- Peer assessing each others individual tests using compiled memo
- Students' test score: (60) of individual tests
- Post-assessment reflection done online after receiving test results and before writing the next test

3

Memo–peer test
- Individual test (60 marks)
- Memorandum compilation in groups of two students
- Peer assessing each others individual tests using compiled memo
- Students' test score: (60) of individual tests
- Post-assessment reflection done online after receiving test results and before writing the next test

FIGURE 11.1: Outline of the implemented assessment instruments.

☐ Turn-around test

During the turn-around test, students first wrote an individual test and were instructed to stay seated after the elapsed time. The questions in this test covered the protein synthesis study unit in the particular Life Sciences module, and constituted 35 marks. 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. Each group then received a copy of a memorandum of the individual test.

Some of the answers within the memorandum were correct, others were incorrect and some other answers were incomplete. The pairs had to work through the memorandum, discussing and considering their own answers from the individual tests, to compile a faults and fixes table. The faults and fixes table had to consist of all the incorrect and incomplete answers in one column, and the correct answers in another column, and counted 25 marks. 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 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 Appendix A). 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 achievement. No additional marks were allocated for the completion of this reflective activity.

☐ Memo–peer test

During the memo–peer test, students again first wrote an individual test and were unaware of the participative test they were going to write. The questions in this test covered the cell division study unit in the particular Life Sciences module and counted 60 marks. Once again students were instructed to stay seated after finishing their individual tests until the set time had run out. One student per group table (the venue consisted of detached desks arranged in such a manner that a maximum of six students were seated at a group table) were then instructed to collect the individual tests and place them face down in the middle of the group table. After students had been instructed to work in groups of two students, a blank copy of the same test was handed out to each pair. Students then had to compile a

memorandum by writing the answers they deemed correct on the blank test. Students had the opportunity to make use of additional resources. Once all the students 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 test by making use of the memorandum they had compiled. After the peer assessment stage, students had to complete a reflection document for the person whose test they had assessed (see Appendix B). The individual tests, which were peer assessed, the compiled memorandums, as well as the reflection documents were submitted to the lecturer. The lecturer assessed the individual tests with the aid of a memorandum. The final test score consisted of the lecturer's assessed individual test mark. Once students had received their final test score, each student had to complete an online self-reflection activity called the 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 Appendix A). 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 achievement. No additional marks were allocated for the completion of this reflective activity.

☐ P-I-P&S test

Students once again were not briefed about the participative test they were about to write. They were instructed to sit in groups of two and each pair received a copy of the test. The questions in this test covered the histology study unit in the particular Life Sciences module and counted 40 marks. Students were instructed to stay seated once they had finished the test. The lecturer collected the tests after the elapsed time and students were informed 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 multiple-choice questions was changed. This was done to minimise the possibility that under-prepared students had memorised some of the answers. Once the individual tests had been written and submitted to the lecturer, students were prompted to have a brief, 5-min discussion 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 has 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 particular module, the lecturer used a self-reflection document (see Appendix C) instead of the usual online P-A-R. The lecturer assessed the peer and individual tests with the aid of a memorandum and analysed the self-reflections. The final test score consisted of all three components of the P-I-P&S test and was calculated using the formula: 40% of the peer test mark out of 40, plus 60% of the individual test mark also out of 40, plus 10 marks for the self-reflection activity.

The implementation of the AaL instruments (turn-around test, memo–peer test, P-I-P&S test, as well the reflective instruments used) was carefully planned to ensure that students retain their individual accountability.

■ Measuring instrument

During the last class for the semester, students completed an open-ended questionnaire aimed at exploring the first-year students' insights into the assessment practices they had experienced in the particular Life Sciences module. In an attempt to identify possible evidence of SDL skills development, the open-ended questionnaire consisted of the following questions:

- **Q1** – What is, according to you, the purpose of assessment in LIFE 122?

- **Q2** – Please explain the role that assessment played in your learning process throughout the LIFE 122 module.
- **Q3** – In which way did the assessment practices used in LIFE 122 influence your learning throughout the semester?
- **Q4** – In which way did the assessment practices used in LIFE 122 influence your preparation for the exam?
- **Q5** – What is your general feeling regarding the assessment practices, which were implemented in LIFE 122?

The open-ended questions enabled the respondents to give detailed, honest answers in the spaces provided. Information regarding the respondents' thinking processes, related to the participative assessments to which they had been exposed, was revealed using thematic analysis (Maree & Pietersen 2016).

■ Data analysis

The researcher read all the completed open-ended questionnaires to obtain an overall understanding of the responses to the open-ended questions. After rereading the responses, the data were coded and the related codes were grouped into appropriate themes related to SDL. A combination of *a priori* codes (Nieuwenhuis 2016), derived from the literature and other emerging codes, was utilised in the analysis. Knowles' (1975) definition of SDL was used to identify the *a priori* codes. The coded data were validated through a peer-review strategy (Creswell & Plano Clark 2007). The findings of this analysis are presented and discussed below.

■ Findings

Table 11.1 to Table 11.4 and Box 11.1 reflect examples of participants' responses to the five open-ended questions. Also indicated are the possible links to SDL. Seven themes emerged that informed the understanding of students' perceptions of PAP, namely, formulating learning goals, taking responsibility for learning,

selecting appropriate learning strategies, diagnosing learning needs, motivation to learn, seeing peers as resources and social skills. The identified themes for each of the five open-ended questions are discussed in order to demonstrate how the participative assessment method contributes to the development of SDL skills.

■ Q1 – *What is, according to you, the purpose of assessment in LIFE 122?*

Students' responses to Q1, as well as links to SDL skills, are summarised in Table 11.1. Forty-nine (73%) of the student responses could be linked to various SDL skills, and the majority of responses (58.2%) indicated that the purpose of assessment in LIFE 122 was to enable them to diagnose their learning needs.

TABLE 11.1: Examples of students' responses to Q1 and themes related to SDL.

Number of students (*n* = 67)	Quotes	Themes related to SDL
39	'It [assessment] helped me to identify work that I still have to learn, what I already know, and what needs more attention'.	Diagnosing learning needs
4	'Identify areas which I am uncertain about, promote learning'.	Formulating learning goals
3	'To learn from my mistakes and not to make the same mistakes again'.	Selecting appropriate learning strategies
1	'I was given the opportunity to practice my knowledge and to improve my knowledge through individual and group work'.	Taking responsibility for own learning
1	'It [the assessment] provided an opportunity for further study, especially to learn from peers'.	Seeing peers as resources
1	'To not only be able to understand and interpret the work, but also apply and explain it to peers'.	Social skills

SDL, self-directed learning.

Being able to formulate their learning goals, the ability to select appropriate learning strategies, taking responsibility for their own learning, seeing peers as resources for learning, as well as being able to communicate well with peers are the SDL skills that emerged from the student responses to Q1.

■ Q2 – *Please explain the role that assessment played in your learning process throughout the LIFE 122 module.*

Sixty-six (98.5%) of the students' responses to Q2 linked to various SDL skills (see Table 11.2).

Many students (48%) indicated that assessment played a dominant role in diagnosing their learning needs. Student 6 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'. Responses further indicated that

TABLE 11.2: Examples of students' responses to Q2 and themes related to SDL.

Number of students (n = 67)	Quotes	Themes related to SDL
32	'I could see where I struggled and what I need to focus on'.	Diagnosing learning needs
12	'Always focusing, striving to reach my goals … Assessment pushed me to my fullest strength'.	Formulating learning goals
9	'Assessment helped me to improve my study methods'.	Selecting appropriate learning strategies
8	'It [the assessment] helped me to improve the work that is assigned to me'.	Taking responsibility for own learning
3	'The role of assessment is a motivation to learn'.	Motivated to learn
1	'It [the assessment] helped me to make use of various resources during the learning process'.	Seeing peers as resources
1	'It [the assessment] taught me how to interact and work in groups successfully'.	Social skills

SDL, self-directed learning.

assessment, as implemented in LIFE 122, played a role in the ability of students to formulate their learning goals, selecting appropriate learning strategies, taking responsibility for their own learning, as well as being motivated to learn. One student indicated that the assessment enabled him or her to see peers as resources, while another student mentioned the role of assessment in interacting successfully with peers. Three students specifically referred to the value of receiving immediate feedback to diagnose learning needs. The responses of students 14, 21 and 34 are presented here:

- 'The assessment provides feedback on how we are doing, it helps to identify areas with which we struggle in order for us to improve' (Student 14, undisclosed gender, date unknown).
- 'It [the assessment] gives learners the encouragement because lecturers provide positive feedback and help me see where my developmental needs are' (Student 21, undisclosed gender, date unknown).
- 'After the assessment I will know where I need to focus more, more especially after getting the feedback' (Student 34, undisclosed gender, date unknown).

■ Q3 – *In which way did the assessment practices used in LIFE 122 influence your learning throughout the semester?*

Students' responses to Q3, as well as links to SDL skills, are summarised in Table 11.3.

Most of the students' responses to Q3 indicated that, because of the assessment practices implemented, they were able to diagnose their learning needs and select appropriate learning strategies. Being able to formulate learning goals and seeing their peers as resources for learning were also highlighted by a couple of students, while one student was able to take responsibility for his or her own learning and another student reported developing social skills.

TABLE 11.3: Examples of students' responses to Q3 and themes related to SDL.

Number of students (n = 63)	Quotes	Themes related to SDL
16	'I can understand the module fully because in every written test there is feedback so it gives us an opportunity to fix our mistakes'.	Diagnosing learning needs
13	'Methods such as mind maps and tables was introduced to my study method. It resulted in me changing the way I studied, which was extremely advantageous'.	Selecting appropriate learning strategies
2	'I used the assessment to identify the work I still had to pay attention to in order to achieve the marks I strive for'.	Formulating learning goals
2	'[The assessment] was very advantageous because we can discuss some of the aspects we do not understand fully'.	Seeing peers as resources
1	'[Y]ou have to study so that you can't embarrass yourself as well as your partner'.	Taking responsibility for own learning
1	'[The assessment] taught me to accept the views of others and this enhanced my knowledge'.	Social skills

SDL, self-directed learning.

◼ Q4 – *In which way did the assessment practices used in LIFE 122 influence your preparation for the exam?*

Students' responses to Q4 and links to SDL skills are summarised in Table 11.4.

From Table 11.4, it is evident that the implemented assessment practices enabled the first-year Life Sciences students to prepare for the summative examination by enabling them to select the appropriate learning strategies, diagnose their learning needs, formulate their learning needs into learning goals and take responsibility for their own learning. One student also indicated the value of studying in groups.

TABLE 11.4: Examples of students' responses to Q4 and themes related to SDL.

Number of students (*n* = 63)	Quotes	Themes related to SDL
14	'Helped me with time management and being able to select and identify a study style that works for me'.	Selecting appropriate learning strategies
8	'[The] assessment has allowed me to see gaps between the module outcomes and put efforts on preparation'.	Diagnosing learning needs
8	'… and so I knew all that I still had to do and how long before the exam I had to start preparing'.	Formulating learning goals
5	'I have a better idea on how to prepare for the exam to do the best that I can do (my full potential)'.	Taking responsibility for own learning
1	'I started to study in groups which was very advantageous'.	Seeing peers as resources

SDL, self-directed learning.

■ Q5 – *What is your general feeling regarding the assessment practices that were implemented in LIFE 122?*

Almost all of the students' responses to Q5 were positive (Box 11.1), indicating that the implemented assessment practices in LIFE 122 were valued by students. Only one student stated that he or she preferred individualised testing to the implemented PAP, while three students did not respond to the question.

The links of students' responses to SDL are indicated in Table 11.5. Ten students' responses could be linked to the following SDL skills:

- motivation to learn
- diagnosing learning needs
- seeing peers as resources to learning
- formulating learning goals
- selecting appropriate learning strategies.

BOX 11.1: Summary of positive and negative student responses to Q5.

Positive responses	Negative responses
60 (93.7%)	1 (1.56%)

TABLE 11.5: Examples of students' responses to Q5 and themes related to SDL.

Number of students (*n* = 64)	Quotes	Themes related to SDL
4	'I'm feeling determined to put efforts due to the different techniques which were applied for assessment practices'.	Motivated to learn
2	'I liked this assessment practice because it helped me to identify what I still don't know'.	Diagnosing learning needs
2	'If you made a mistake, feedback from peers are given immediately. This ensures optimal success'.	Seeing peers as resources
1	'It [assessment] is a good thing or way of making learners understand what is needed of them to know the content'.	Formulating learning goals
1	'It [the assessment] improved my learning process and I started to do better in this module'.	Selecting appropriate learning strategies

SDL, self-directed learning.

In summary, the results revealed the contribution of the implemented assessment practices to the development of key SDL skills. The narratives gathered during the open-ended questionnaires furthermore indicated that most of the students perceived the PAP as predominantly positive.

■ Discussion

The overarching aim of the investigation on which this chapter reports was to determine the contribution of PAP to the development of first-year Life Sciences students' SDL skills. There were clear indications that the PAP enabled the first-year Life Sciences students to diagnose their learning needs and to formulate their learning goals in order to address the identified gaps in their learning. The majority of students indicated that diagnosing their own learning needs and evaluating their learning

experiences were the main purposes of the PAPs, which they experienced. Students also indicated that the aim of the implemented assessments in their learning process was predominantly to enable them to diagnose their learning needs. According to Knowles (1975), translating learning needs into learning goals is a required SDL skill.

Students furthermore indicated that the PAP enabled them to make changes to their learning strategies, helped them in learning from their peers and assisted them in developing intergroup communication skills. According to Warburton and Volet (2012), being able to adapt one's learning strategy is a key attribute of a self-directed learner. According to Wiliam (2011), students' involvement in self-assessment practices activates them to become owners of their own learning process. The ability to see peers as resources, and ultimately learning from them, is the key characteristic of an SDL situation and necessitates good communication skills (Guglielmino 1978; Knowles 1975), which might be the result of students having an opportunity to respond to and engage with the feedback given by peers. According to Mumm, Karm and Remmik (2016), meaningful feedback supports learning.

The participants' perceptions of the PAP contributed to the development of several SDL skills. Being able to formulate learning goals or objectives, diagnosing gaps in learning, selecting appropriate learning strategies, taking responsibility for one's own learning, being motivated to learn, seeing peers as resources and possessing effective social skills were skills that the first-year Life Sciences students acquired after being exposed to and included in PAP. Furthermore, these skills are attributes of a self-directed learner (Guglielmino 1978; Knowles 1975; Warburton & Volet 2012).

■ Conclusion and implications

The findings of the qualitative research revealed that students were positioned to develop several SDL skills owing to the integration of PAP as learning activities. The PAP enabled

students to formulate their learning goals, to take responsibility and ownership of their own learning, to diagnose and evaluate gaps in their learning, to see fellow class members as resources for learning, to be motivated to learn, as well as to develop social skills.

The use of PAP (e.g. self- and peer assessment rich in immediate feedback and reflection) contributes to the development of several SDL skills. More specifically, the immediate feedback contributes to students being able to diagnose and evaluate gaps in their learning. The implementation of PAP requires effort and thorough planning from the lecturer and should specifically include high participative assessment activities connected to immediate feedback and strong reflective requirements. It is also noteworthy that the abilities to reflect and to self-assess are skills that need to be developed through scaffolding; therefore, it is suggested that lecturers not only encourage ongoing assessment dialogue but also explicitly direct the assessment dialogue to improve students' understanding of assessment. Furthermore, the results of this study suggest that assessment should not be separated from the learning process, and that assessment practices should be embedded within social constructivism, with the learning process at its core. This study indicated the important contribution to SDL in higher education through different self- and peer assessment practices, as a result of the participative nature of the assessment activity, the reflective requirements of the activity and immediate feedback characteristics of the activity.

■ Appendix A

P-A-R&S 1

What is your individual mark out of 35 for Class Test ONE? / Wat is jou individuele punt uit 35 vir Klastoets EEN?

_____
_____

Give your individual mark as a percentage (e.g. 24 / 35 x 100). / Gee jou individuele punt as 'n persentasie (bv. 24 / 35 x 100).

_____
_____

What was your turn-around test mark out of 25 for Class Test ONE? / Wat was julle 'Turn-around' toets se punt uit 25 vir Klastoets EEN? _____
_____

Give your turn-around test mark as a percentage (e.g. 19 / 25 x 100). / Gee julle 'Turn-around' toets as 'n persentasie (bv. 19 / 25 x 100). _____
_____

Is your individual mark less or more than your turn-around test? / Is jou individuele punt minder of meer as jou 'Turn-around' toets?

_____
_____

Briefly give a possible reason for your answer to the question above. / Verskaf kortliks 'n moontlike rede vir jou antwoord in die vraag hierbo. _____
_____
_____

Briefly describe the way in which you prepared for this class test. / Beskryf kortliks die wyse waarop jy vir hierdie klastoets voorberei het. _____
_____

_____
_____
_____

Is your final mark for Class Test ONE a true reflection of your level of effort (time spent studying)? Briefly explain your answer. / Is jou finale punt vir Klastoets EEN 'n ware refleksie van die mate van inspanning (tyd wat jy studeer het)? Verduidelik kortliks jou antwoord. _____
_____
_____
_____
_____

One aspect that I would like to improve on before Class Test TWO is … / Een aspek waarop ek graag wil verbeter voor Klastoets TWEE, is … _____
_____
_____
_____

Did you experience the turn-around test as a valuable learning opportunity? / Het jy die 'Turn-around' toets as 'n waardevolle leergeleentheid ervaar?

_____
_____

Briefly explain your answer above. / Verduidelik kortliks jou antwoord hierbo. _____
_____
_____
_____

What, in your opinion, are the positive aspects of the turn-around test? / Wat is, volgens jou mening, positiewe aspekte van die 'Turn-around' toets? _____
_____
_____
_____

What, in your opinion, are the negative aspects of the turn-around test? / Wat is, volgens jou mening, negatiewe aspekte van die 'Turn-around' toets? _____
_____
_____
_____

P-A-R&S 2

What is your final mark for Class Test TWO? / Wat is jou finale punt vir Klastoets TWEE? _____
_____

Briefly describe the way in which you prepared for this class test. / Verduidelik kortliks die wyse waarop jy vir hierdie klastoets voorberei het. _____
_____
_____

Is your final mark for Class Test TWO a true reflection of your level of effort (time spent studying)? Briefly explain your answer. / Is jou finale punt vir Klastoets TWEE 'n ware refleksie van die mate van inspanning (tyd wat jy studeer het)? Verduidelik kortliks jou antwoord. _____
_____
_____
_____

During the P-A-R&S done after Class Test ONE, you had to identify one aspect that you would havee liked to improve on before writing Class Test TWO. Would you say that you improved on the identified aspect? Briefly explain your answer. / Jy moes gedurende die P-A-R&S na Klastoets EEN, een aspek identifiseer waarop jy graag wou verbeter voordat jy Klastoets TWEE skryf. Sou jy sê dat jy op hierdie aspek verbeter het? Verduidelik kortliks jou antwoord. _____
_____
_____
_____

Two aspects that I would like to improve on before Class Test THREE, is … / Twee aspekte waarop ek graag wil verbeter voor Klastoets DRIE, is … _____
_____
_____

■ **Appendix B**

*Please complete the following reflection document as <u>carefully</u> and in as much <u>detail</u> as possible **after you've assessed your group member's test. /** Voltooi asseblief die volgende refleksie dokument so <u>sorgvuldig</u> en so <u>volledig</u> as moontlik **nadat jy jou groepslid se toets geassesseer het**.*

Details of the student whose test you assessed: Details van die student wie se toets jy geassesseer het:		
Mark out of 60 and % Punt uit 60 en %		
Breakdown of marks per question / **Uiteensetting van punte per vraag**		
Question 1 / **Vraag 1 [20]** cell cycle / selsiklus		
Question 2 / **Vraag 2 [20]** mitosis / mitose		
Question 3 / **Vraag 3 [20]** meiosis / meisose		
Therefore, it seems that the following study unit outcome(s) were NOT mastered: **Gevolglik blyk dit te wees dat die volgende leereenheid uitkomste(s) NIE bemeester is NIE:**		
Aspects of the study unit that still needs attention: **Aspekte van die leereenheid wat nog aandag benodig:**		
Positive feedback: **Positiewe terugvoer:**		

■ Appendix C

POST ASSESSMENT REFLECTION
POST ASSESSERING REFLEKSIE

Answer the following questions as detailed as possible. / Beantwoord asseblief die onderstaande vrae so gedetailleerd as moontlik.

• *What do you think your individual test mark will be? /* Wat dink jy gaan jou Individuele toetspunt wees?
• *Do you think that your pair's test mark will be higher or lower than your individual test mark? Please explain your answer briefly. /* Dink jy julle Portuurtoets se punt gaan hoër of laer wees as jou individuele toets se punt? Verduidelik asseblief kortliks jou antwoord.
• *Have you adjusted or refined your study techniques for this class test, following previous class tests? Please explain your answer briefly. /* Het jy, na aanleiding van vorige klastoetse, jou studietegnieke vir hierdie klastoets aangepas of verfyn? Verduidelik asseblief kortliks jou antwoord.
• *Briefly explain how you experienced the pair testing (in groups of 2). /* Verduidelik kortliks wat jou ervaring van die Portuurtoetsing (Pair Testing – in groepe van 2) was.
• *Please explain your experience of the peer processing after the individual test briefly*. / Verduidelik asseblief kortliks wat jou ervaring van die Portuur Prosessering na afloop van die Individuele toets was.
• *Any additional comments and suggestions with regards to the P-I-P&S test: /* Enige addisionele kommentaar en voorstelle ten opsigte van die P-I-P&S toets.

■ Acknowledgements

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Chapter 1

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Chapter 5

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Chapter 9

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Chapter 10

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Chapter 11

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Index

The book contributes to the discourse on the quality of education in the 21st century and adds to the body of scholarship in terms of self-directed learning, and specifically its role in Higher Education. Although all chapters in the book directly address self-directed learning (SDL), different foci and viewpoints are raised which allow the book to form a rich knowledge resource on self-directed learning. It presents a conceptual overview of SDL, that is, the approach to education where students take responsibility for their own learning process. The book discusses the most influential models for the implementation of SDL, fostering critical thinking and the creative competency to transfer knowledge from a known situation to a new. Multiple outcomes resulting from cooperative learning that increase the effectiveness of self-directed learning are also discussed.

The Person-Process Context model for SDL is used as framework to explore the important role of context in SDL, and indigenous knowledge is suggested as a tool with which to contextualize a Western science curriculum for diverse learners. Through the use of Open Education Resources, self-directed learning can be supported. This can be done by including multiliteracies. The body of scholarship on technology-supported cooperative learning to enhance SDL indicates that facilitators need to be present in space to guide students by means of comments and prompts. The technology chosen to support cooperative learning should incorporate the five elements. In the book, applied competence regarding teacher understanding, practice, motivation and a shared professional vision is grounded in reflective learning. Socratic questioning and adaptive learning in various settings are explored. The book reflects on teaching and learning where cooperative learning and Socratic questioning were employed to promote SDL. The book illustrates the correlation between the online learning design and self-directedness in learning. This book explains how problem-based learning as an online teaching and learning strategy can successfully be applied to foster self-directed learning skills. Entrepreneurship education is crucial in empowering learners with knowledge and skills they need to overcome the high levels of poverty and youth unemployment experienced in South Africa. SDL enables teachers to effectively plan and implement learning as a life skill. Finally, the importance to reconceptualise pedagogy and assessment as an integrated dialogic process and to promote the development of SDL skills – vital for the 21st century – is emphasised.

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