



**It takes two: the role of co-regulation in building
students' self-regulated learning skills**

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Abstract

Self-regulated learning occurs when a learner sets a goal and activates cognitive, metacognitive, behavioural, and motivational processes to reach that goal. Prior research has shown that self-regulated learning makes a positive contribution to learning. Therefore, this research project aimed to investigate *how sources of contextual regulation affect first-year university students' participation in co-regulation of learning and self-regulated learning*. This study was guided by theories on situated cognition and co-regulated learning, thus positioning the research within a social constructivist theory of learning, suggesting learning is situation-specific and context-dependent.

A design-based research approach was adopted to bridge educational research and educational practice. The research instruments used to collect the data consisted of a pre-test and post-test questionnaire, learning diaries, and a focus group interview with the teaching team. The results indicated that the intervention positively affected students' self-regulatory skills, self-efficacy, and controlled motivation. In addition, students made use of the sources of contextual regulation offered through the intervention. This research study demonstrates that the intervention in the form of offering sources of contextual regulation embedded within students' learning environment increases students' propensity to engage in self-regulated learning in the specific context of their own subject. In addition, the results indicated that students engaged with the sources of contextual regulation in different ways.

The research study confirmed that an intervention programme that involves collaboration between a researcher and lecturers enables students to apply self-regulated learning processes and strategies in context. The outcomes of this research project resulted in: (1) the answering of the research question, (2) an empirically underpinned innovative intervention to solve the educational challenge observed in practice, and (3) a set of design principles, deepening theoretical understanding about the role of co-regulated learning in fostering self-regulated learning.

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Chapter 1: General introduction

1.1 Introduction

The ability to monitor and productively adapt one's learning process, or 'learning to learn', is defined as a critical competence by the European Parliament (2006). Self-regulated learning occurs when a learner sets a task-specific goal and consequently activates cognitive, metacognitive, behavioural, and motivational routines and procedures that advance their attainment of those goals (Zimmerman and Schunk, 2011). Self-regulated learning is a multifaceted concept and involves regulatory processes like setting goals, planning, applying strategies, and regulatory constructs or targets: motivation, cognition, behaviour, and emotions (Hadwin et al., 2018). Prior research has shown that self-regulated learning leads to better learning performance, and it is increasingly a focal point in education. Thus, it is necessary to foster the development of learners' self-regulation. Unfortunately, students do not necessarily develop self-regulated learning skills even with instruction and support. Furthermore, research on effectively translating insights from research into fostering self-regulated learning in a higher education setting is scarce (e.g., Biver et al., 2020). This thesis thus aims to investigate how students in their first year in university can be effectively encouraged and supported in becoming self-regulated learners.

During the last decade, learning has ceased to be considered solely individual or exclusively collaborative, requiring the field of research to examine the reciprocal relationship between self-, co-, and shared regulation of learning. Therefore, this thesis examines the concept of co-regulated learning, which focuses on the shared impact on student learning of their self-regulation processes and sources of regulation within the learning environment (Allal, 2007). This study aims to investigate how sources of contextual regulation affect first-year university students' participation in co-regulation of learning and self-regulated learning.

This introduction chapter first describes the background of the research project and includes an introduction to the literature on self-regulated learning and co-regulation of learning. Then, it presents the development of the research question. Next, the research context and research design are described briefly, including the research project's scope and aims. Finally, the chapter concludes with an outline of this thesis.

1.2 The origins of the research project

Shortly after writing the research proposal for this thesis, I participated in a research project focussing on scaffolding first-year Psychology students' self-regulated learning skills. This study investigated the use of a mobile application with gamification elements, the *Ace Your Self-study App*, to support first-year university students' self-regulated learning processes. This research project was carried out under a university in the Netherlands, where I worked as a Learning and Innovation Consultant and has no connection to my thesis research. However, the involvement in this research project became conceptually and methodologically relevant to the research for this thesis.

The *Ace Your Self-study App* research sought to attain a more thorough understanding of how to encourage and support self-regulated learning in first-year university students. The participants were first-year Psychology students who use the app during self-study periods. The App itself was developed in 2018 to support students' self-regulated learning. Its design aims to help learners through three self-regulated learning phases: forethought, performance, and evaluation. In the app, learners can select evidence-based cognitive strategies, such as note-taking, summarising, concept mapping, and receive an explanation on how to use them.

The data analysis from this project in 2019 showed a significant increase in autonomous motivation, controlled motivation, and metacognitive self-regulation skills across the five-week course. Nevertheless, most students used the app only for a limited number of self-study sessions, and in contrast with the app's aim, students did not expand their repertoire of self-regulated learning strategies. To gain more insight into students' self-study behaviours, I joined the research team to conduct several focus groups. In November 2019, I became a member of the research team, and we conducted four focus group interviews with a sample of the participants. Our purpose in conducting these interviews was to understand students' limited use of the app and their reasons for not expanding their repertoire of self-regulated learning strategies beyond the two or three strategies they were already familiar with. The results indicated that if students feel they do not need support for their self-regulated learning processes during self-study, they are less inclined to use the app. Specifically, if students perceive that the strategies of choice are ineffective, they consider changing their way of studying and choosing an unfamiliar strategy (Baars et al., 2021).

The research project on the *Ace Your Self-study App* demonstrated that although self-regulated learning is essential for academic performance, it is also difficult, and most learners need guidance in developing self-regulated learning skills. Furthermore, this research project illustrated that offering educational technology like a mobile app— as a 'standalone' intervention, not embedded within a course, is insufficient to encourage students to become more self-regulated when they are engaged in self-study. The *Ace Your Self-study App* research results led me to consider that an alternative approach would be needed to encourage, support, and facilitate students becoming self-regulated learners.

1.3 Background to the thesis study

During the last thirty years, self-regulated learning developed into an important area in educational and psychological research (Panadero, 2017; Persico and Steffens, 2017; Beishuizen, 2011). An important reason for this growing interest in self-regulated learning is its impact on student learning and performance (Zimmerman and Schunk, 2011). Several studies have shown that self-regulation by learners strongly links to students' achievement and leads to more effective learning throughout life (Dent and Koenka, 2016; Donker et al., 2014; Beishuizen and Steffens, 2011; Dignath and Büttner 2008; Pintrich, 2004; Zimmerman, 2002, 1990; Zimmerman and Schunk, 1989). However, although considered advantageous to learning and performance, self-regulating one's learning is also demanding as it requires significant effort and adds to cognitive load. For example, Pintrich (1999) asserts that applying self-regulating strategies demands more time and energy than the usual engagement level. Also, without instructional support on monitoring and adapting their learning, students tend to overestimate what they understand and remember of their learning materials (e.g.,

Thiede et al., 2009). Therefore, most students need instruction and scaffolding to advance their ability to self-regulate their learning.

Hence, the emerging research on self-regulated learning aims to answer the question of how learners become masters of their academic learning and performance (Zimmerman, 2008) and has had a significant impact on research in the domain of learning and instruction (Schunk and Greene, 2018; Winne, 2005). Students who adequately regulate their learning can monitor and control their cognition, motivation, and behaviour to reach the desired learning outcome, and they use learning strategies to enhance their learning. Self-regulated learning encompasses students' proactive processes to achieve academic success (Winne and Hadwin, 1998; Zimmerman, 2008). The process begins with setting a learning objective or goal, selecting an adequate strategy to reach that goal, monitoring the progress towards that goal, subsequently reflecting on the learning process, and formulating new goals (Berkhout et al., 2017).

Research into self-regulated learning is often grounded in Zimmerman's model of self-regulated learning. In Zimmerman's seminal work (1989), self-regulated learning is defined from a socio-cognitive perspective and considered to be a socially embedded process where learners apply learning strategies to affect their learning and attain their goals. Since then, many theoretical lenses have been applied to self-regulated learning. Most models of self-regulated learning have built on Zimmerman's model, stressing a diversity of aspects enhancing students' self-regulated learning, for instance, motivational aspects and volitional components (Wolters, 2003), assessment (Panadero and Alonso-Tapia, 2013), and emotional control (Boekaerts, 2011). Although there is recognition of reciprocal influences between social and cognitive dimensions of self-regulated learning in Zimmerman's model, it stresses the unidirectional effect of social factors on individual cognitive aspects of student learning, such as strategy-use (Allal, 2018). Nevertheless, as Järvenoja et al. stress (2015), learning does not occur in a vacuum: it develops and constantly changes within dynamic contexts and conditions. Therefore, perspectives on self-regulated learning in current research (e.g., Hadwin, Järvelä, and Miller, 2011; Hadwin and Oshige, 2011) are transitioning from an "emphasis on 'self' to models describing the interdependent transactional regulation or 'co-regulated learning' between individuals" (Rich, 2017, p. 1101).

Despite three decades of research, contemporary researchers face several challenges when seeking to advance knowledge and understanding of self-regulated learning and which ways to best support it (Schunk, 2008). These are both theoretical and methodological challenges. For example, one challenge involves researchers increasingly considering how self-regulated processes are situated and context-dependent (e.g., Järvenoja, Järvelä and Malmberg, 2015). Correspondingly, present-day research requires methodological strategies to investigate how individual, social, and contextual factors interact to encourage learners' involvement in self-regulated learning behaviour (e.g., Hadwin and Oshige, 2011). Another challenge for researchers is the need to refer to self-regulated learning as a multifaceted, multi-component and integrative concept (Butler, 2015, Zimmerman, 2008). In turn, researchers pursue approaches for studying "how these multiple components co-relate dynamically to shape learning-in-action" (Butler and Cartier, 2018, p.352). In addition to these challenges, it remains demanding to mobilise the rich knowledge base on self-regulated learning to profoundly impact educational practice (Butler and Schnellert, 2012; Cartier, Butler, and Bouchard, 2010).

1.4 The present thesis

1.4.1 Development of the research question

The process of undertaking the literature review on regulation of learning and my involvement in the evaluation of a mobile application to support students' self-regulated learning informed my doctoral thesis's focus and research questions. This thesis situates the regulation of learning within a social constructivist theory of learning, considering that knowledge development occurs through social interaction and is, therefore, a shared rather than individual process (Palincsar, 1998). Consistent with social constructivist approaches to learning, this thesis examines the concept of co-regulated learning. It is informed by Allal's model (2007) of co-regulation of learning, which aims to integrate the social, contextual, and individual levels of regulation.

Crucially, I wanted to examine an intervention in which students are supplied with contextual regulation sources and explore how they regulate their learning in interaction with teachers, fellow students, learning materials, and instructional tools (Allal, 2018). Therefore, I proposed an intervention integrated into the course content of a first-term course for first-year university students. This intervention considers the "joint influence of student self-regulation and sources of regulation in the learning environment" (Allal, 2018, p.30). This is also referred to as co-regulation of learning. Hence, in this thesis, co-regulated learning is regarded as a strategy to self-regulate one's learning (Baars et al., 2020). This perspective acknowledges the role of context and external sources such as peers or teachers to support individual self-regulation (Järvelä and Hadwin, 2013). I argue that the concept of co-regulation of learning provides an instrument and an opportunity to overcome inequalities. To do so, however, students should not be assumed to carry the burden of becoming self-regulated learners individually. Instead, learners, teachers, and educational institutions should share the load and assume shared responsibility to foster self-regulated learning. The primary research question is, therefore:

How do sources of contextual regulation affect first-year university students' participation in co-regulation of learning and self-regulated learning?

Subsidiary questions designed to help answer the research question are:

1. *In which ways do students make use of the sources of contextual regulation available in their course?*
2. *How do teachers experience the sources of regulation implemented in their course, and how do they perceive their students' reactions to these sources of regulation in their course?*

1.4.2 Research context

This project's research setting is a university in a large city in the Netherlands. The intervention was developed and implemented within the course *Introduction to Human Communication* for first-year students in an international bachelor's programme in Communication Sciences. First-year students, in particular, can be overwhelmed with the higher study load and autonomy required in higher education. When the intervention was implemented, all teaching at the university was affected by Covid-19 measures. As a result, all teaching within the course *Introduction to Human Communication* had to take place online, both the lectures and the interactive small-scale tutorial groups. These

measures did not significantly influence this study's research design. However, our students' learning experiences and lecturers' teaching experiences have undergone significant changes. The research design chapter and this thesis's results and discussion section will further address these issues.

1.4.3 Research design

To address the research question and the challenge of first-year students transitioning to university studies, an intervention was developed, implemented, and evaluated in which sources of contextual regulation were embedded within the course *Introduction to Human Communication*. Two major theoretical frameworks guided this educational research project. First, situated cognition (Brown et al., 1989) provided the basis for integrating the intervention within a discipline-specific course. Second, co-regulated learning (Allal, 2007) was adopted as the framework for designing the intervention, thus positioning the regulation of learning within a social constructivist theory of learning, suggesting learning is situation-specific and context-dependent. Allal's model (2007) was adapted to fit a higher education setting and used to identify four sources of contextual regulation:

- I. The structure of the teaching and learning situation (such as the specification of learning goals)
- II. The interventions of teachers and their interactions with students (for example, elaboration on critical reading assignments)
- III. Peer interactions between students (like collaborative tasks)
- IV. Tools are sources of regulation available to students and used for instruction and assessment (such as a mobile app or a learning diary)

I applied a design-based research approach to investigate how co-regulation affects students' self-regulated learning skills. Design-based research is frequently used as a research methodology in learning sciences. It is most often used to develop a solution to an educational challenge that forms an intervention in practice and reflects on theory. The intervention I developed in cooperation with the teaching team of the course *Introduction to Human Communication* was implemented during the first term of the academic year 2020-2021. The intervention is thus 'welded into' the subject matter of a first-year course, thus providing students with the opportunity to directly apply self-regulatory processes to the learning materials in their mandatory course. The research instruments used to collect quantitative and qualitative data consisted of a pre-test and post-test questionnaire, online learning diaries, and a focus group interview with the teaching team to address the research question. As the intervention was embedded within the course, all students enrolled in the programme (N= 314) could make use of the intervention elements, but participation in the research project (collection and analysis of data) was voluntary. Participating students completed a questionnaire involving an aptitude measure of self-regulation in the first week and at the end of the course (week 8). Students reflected upon their learning process and their experiences with the contextual sources of regulation in weekly learning diaries during the course. After the course was finished, I held a focus group interview with the tutorial lecturers from *Introduction to Human Communication*.

With the pre-test and post-test questionnaires, self-report data were collected about attitudes and beliefs concerning learning, study behaviours, motivation and the strategies used when studying. The learning diaries were used to gather information about students' reflections upon their learning process and their experiences with the sources of contextual support offered in the course to foster

their self-regulated learning. The diary methodology is an online means of assessing the training effects of this intervention in an ecologically valid context, i.e., the authentic learning situation within a mandatory course (as opposed to a controlled learning environment such as a lab setting). Students keep an account of their self-regulation when they engage in self-study with the diaries. The learning diaries serve as connections between the various levels of contextual regulation; they amplify the effects of interactive co-regulation and allow for the recording of traces of student activity. Students' learning actions over a particular period of time can be researched by analysing learning diaries. Simultaneously, students' reflection on their learning activities through diaries affects their future actions. In this way, learning diaries are not merely a measurement instrument but an intervention tool simultaneously (Panadero et al., 2016). In addition to students' self-report data and self-observations, the focus group interview allowed the tutorial lecturers to describe and reflect on experiences with a co-regulated learning intervention from a teaching perspective.

1.4.4 Aims of this thesis

This thesis aims to investigate the concept of co-regulated learning and specifically how sources of contextual regulation within a course can encourage students to engage in self-regulated learning in a specific context. As the intervention was designed to foster and encourage the development of self-regulated learning, I expected that offering sources of contextual regulation within the course would be beneficial, that students would make use of these sources of regulation and that they would actively engage in self-regulated learning throughout the 8-week course.

This thesis aimed to contribute to educational research and educational practice in three ways.

1. First, by addressing the research question, it aimed to contribute to research by investigating how co-regulation of learning affects the self-regulated learning skills of first-year university students. In addition, I intended to contribute methodologically by testing the value of the weekly use of learning diaries to measure and influence self-regulation in the desired direction at the same time.
2. Secondly, this research aimed to contribute to educational practice by presenting an empirically underpinned intervention that implements sources of regulation in students' learning environment to solve the educational challenge observed in practice, where most learners need guidance in developing self-regulated learning skills
3. Thirdly, an accompanying set of design principles has been produced, serving as heuristic principles for others who wish to implement a similar intervention in their educational settings.

As both an educational researcher and educational consultant, my goal is to mobilise knowledge about the role of co-regulation in building students' self-regulated learning skills for the benefit of degree programmes, educators, and learners. The design-based research methodology fits with the three different types of contributions this research project set out above: the purpose of the design-based research approach is to advance theories and provide empirically underpinned interventions and design principles. As such, I hope the outcomes of this research project are of interest to both educational researchers and practitioners in the field of higher education.

1.5 Outline of this thesis

After this general introduction to the thesis, subsequent chapters are structured as follows: Chapter 2 forms a comprehensive literature review and is meant as a theoretical review of the field of self-regulated learning and aims to show the field within which this study is located. First, this chapter provides an overview of the evolution of research into self-regulated learning and examines theories and models of self-regulated learning as a distinctive approach to academic learning and instruction. Next, the chapter includes a discussion of critical perspectives on self-regulated learning. The chapter also portrays the shift towards self-regulation, co-regulation, and shared regulation in collaborative learning environments. Finally, chapter 2 concludes with reviewing approaches to foster and support self-regulated learning.

Chapter 3 forms a methodological review of the field of self-regulated learning. In this chapter, I outline the methodological developments of the field. Also, an overview of the commonly used instruments to measure self-regulated learning and their characteristics is provided. The chapter examines key methodological challenges in measuring self-regulated learning as well. Lastly, I will examine learning diaries as a promising, contemporary form of assessing self-regulated learning.

Chapter 4 is devoted to the theoretical framework underpinning the thesis and consists of two major sections. The first section discusses a situated model of co-regulated learning and related concepts that support the research question. The second section proposes a model of co-regulated learning for teaching and learning within higher education environments. It provides the conceptual rationale for using the proposed data collection techniques.

Chapter 5 addresses the research design, research methodology, and methods of this study. The methodology chapter will also describe my institutional context, the educational intervention, and the research instruments chosen to carry out the research project and used to evaluate the intervention and answer the research question. Subsequently, I explain my decisions about collecting, analysing, and reporting data. Finally, the ethical considerations associated with the research are also considered and discussed in this chapter.

Chapter 6 presents the study's results and significant findings. This chapter includes the results of the pre-test and post-test questionnaire comparisons, and it portrays the patterns of regulatory engagement that were found. Finally, the results of the thematic analysis of the focus group interview with the lecturers are provided.

Chapter 7 consists of two main sections. First, it provides an interpretation of the results and discusses the significance of the study and its outputs. Next, the research question is addressed, and the three forms of contributions of my study to existing knowledge about the role of co-regulation in developing students' self-regulated learning skills are detailed. Next, the validation of my contributions to educational research and educational practice are discussed. Furthermore, I address the methodological limitations of this design-based educational research project. The second part of the chapter presents the intervention and the accompanying design principles. Towards the end of the chapter, I make recommendations for further research and draw conclusions.

Chapter 2: Literature review

2.1 Introduction

In the field of research into the regulation of learning, there have been many advances in recent years, both in theory development and in educational practice. A notable development is a shift from perspectives stressing individual aspects of the regulation of learning to theories and models of self-regulation that focus on context, emphasizing collaboration and shared knowledge construction (Hadwin et al., 2018). In each perspective, various elements of self-regulated learning are accentuated. Nevertheless, there are commonalities as well. For example, all perspectives consider self-regulated learning to be dynamic and cyclical (Schunk and Greene, 2018).

This chapter provides an overview of the evolution of research into self-regulated learning. First, prominent theories and models of self-regulated learning will be discussed as an approach to academic teaching and learning. Before turning to the different perspectives on self-regulated learning, I briefly introduce the evolution of learning theory. Subsequently, self-regulated learning is defined, and I describe what characterizes self-regulating learners. Although many conceptual approaches exist to study self-regulated learning, the commonalities of these different perspectives are also presented. Next, I will describe the general categories of self-regulated learners' cognitive and non-cognitive strategies to enhance their learning and achieve their goals. Finally, this chapter pays specific attention to the shift towards self-regulation, co-regulation, and shared regulation within learning environments.

2.2 Defining self-regulated learning

2.2.1. Evolution of learning theory

Michal Fullan (2001) suggests that the 'moral purpose' of education is to make a positive "difference in the lives of students and to help produce citizens who can live and work productively in increasingly dynamically complex societies." (p. 4). Pursuing this moral purpose requires an understanding of what constitutes learning and which processes are involved. Despite the differences, many definitions of learning have two commonalities: (1) learning is viewed as an enduring change in attainment or capabilities that (2) follows from experience and exchanges with a person's environment (Driscoll, 2014). Therefore, when organizing teaching, learning, assessment and curriculum, it is essential to understand what constitutes learning, how it occurs, and how it can be facilitated. Learning paradigms represent different perspectives on the learning process. A learning paradigm provides theoretical insights and guidelines for instructional design into these questions.

Learning is generally defined from distinct theoretical viewpoints: behaviourism, cognitivism, and constructivism. The behaviourist paradigm equates learning with changes in observable performance. Learning can thus be understood in terms of observable environmental and behavioural events. The essential elements are the stimulus, the response, and the connection between them. Within behaviourism, it was professed that responses followed by reinforcement are more likely to reoccur later on. In the late 1950s, cognitive theories stressed more intricate cognitive

processes and were concerned with how information is received, organized, stored, and retrieved. Cognitive psychologists view learning as mediated by thought processes inside the learner. The ontological assumptions underpinning both the behavioural and cognitive learning paradigms are objectivistic and regard the world as external to learners. The objective of instruction then is to plot the world or environment's organisation or principles onto the learner (Jonassen, 1991b). As a reaction to this objectivist assumption, a constructivist approach to learning arose around the 1970s. Constructivism is not an entirely new approach to learning and has roots in the works of Bruner and Piaget. Piaget (1952) viewed learning as a process of adjustment to the world, requiring active learners. By contrast, constructivism as a learning paradigm suggests that knowledge cannot be transferred to the learner; instead, learners are granted agency to develop knowledge which is constructed by creating meaning from experience.

Although longstanding literature consists of learner- and learning-centred education, Barr and Tagg (1995) introduced the term learning paradigm to characterise the transition in educational institutions providing instruction into a new paradigm in which schools strive to cause student learning. When the learning paradigm is contrasted with the instruction paradigm in learning theory, a shift has occurred from regarding students as passive recipients to encouraging them to be active constructors of knowledge. The instruction paradigm was primarily designed to support teaching or the delivery of information from instructor to student. It incorporates a transmission view of the learner and is teacher-centred. The learning paradigm then emphasises learning and student discovery and knowledge-construction above the transfer of knowledge from a teacher to a student (Barr and Tagg, 1995). Learning, then, is an active and socially embedded process of knowledge construction. This requires teachers to entrust some control of learning to students, just as students need to adjust to their new role, viewing learning as an active, constructive process and approaching their academic tasks proactively. A central notion, thus, in debates about learning and instruction is that learners are no longer viewed as passive recipients of knowledge. Generally, educators shifted away from a behaviourist or transmission outlook on learning towards cognitive and constructivist notions of learning (Andrade and Brookhart, 2019). Although there are essential differences among behaviourist, cognitivist, and constructivist learning paradigms, each taking the processes of regulation into account as a pivotal element of learning (Allal, 2010), each learning paradigm includes mechanisms of regulation, ensuring adjustment of the learner's behaviour and cognition.

2.2.2 What constitutes self-regulated learning?

The capacity to self-regulate one's learning has been demonstrated to improve learning outcomes. This is the case in on-campus settings and online learning environments (Broadbent, 2017; Broadbent and Poon, 2015). Furthermore, self-regulated learning is considered a necessity for life-long learning (Dent and Koenka, 2016; Beishuizen and Steffens, 2011; Dignath and Büttner 2008; Pintrich, 2004; Zimmerman, 2002, 1990; Zimmerman and Schunk, 1989). In a world where knowledge is increasingly becoming dynamic, learning is considered an enduring process and reaches beyond learning within formal educational settings. Self-regulation theory can be employed to explain how and why people are inclined to exert substantial mental effort to develop the knowledge and skills needed to flourish during their education and throughout their entire working life (Sitzmann and Ely, 2011; Dignath and Büttner, 2008). Importantly, self-regulated learning is a collection of skills that can be developed and advanced via instructional support (Broadbent et al.,

2020). Educational systems, therefore, aim to support learners in fostering skills like goal setting, metacognition, use of strategies, and self-reflection.

In higher education, self-regulated learning strategies become increasingly important because students must handle more complex learning situations, and there is typically less opportunity to receive external guidance or feedback. Furthermore, there are fewer contact hours and a stronger emphasis on self-study. Thus, students need to spend more time studying and learning independently. Therefore, in transitioning from secondary school to a tertiary education context, greater reliance upon self-regulated learning emerges (Webster and Hadwin, 2015; Dresel et al., 2015; Peeverly et al., 2003). Therefore, the transition from secondary to higher education makes an intervention targeting first-year students especially relevant, such as will be focused on in this thesis.

Over recent decades, self-regulated learning developed as one of the most prominent theories in learning and instruction, and scientific research and literature have paid much attention to students' capability to self-regulate their learning and explain their academic attainment. The construct of self-regulated learning comprises several aspects of learning, like goal-orientated behaviour, task-specific strategy use, and metacognitive awareness (e.g., Panadero, 2017). Self-regulated learning is considered a principal conceptual framework to comprehend cognitive, metacognitive, behavioural, motivational, and affective facets of learning. As such, it forms an umbrella to study an extensive number of variables influencing learning comprehensively and holistically (Panadero, 2017).

Self-regulated learning incorporates many robust predictors of attainment (Dent and Koenka, 2016). A shared assumption of the different conceptualizations of self-regulated learning is that critical factors for academic accomplishment are students' self-awareness as learners and their use of diverse processes to regulate their learning (Zimmerman, 1986). Zimmerman's basic definition reflects self-regulated learning's central role in learning and performance. According to Zimmerman (2001), learners are considered to be self-regulated if "they are metacognitively, motivationally, and behaviorally active participants in their learning process" (p. 5). This approach clearly distinguishes self-regulated learning from previous outlooks on learning and performance. A self-regulated learning outlook changes the emphasis from fixed or stable learning abilities to students' individually initiated and adaptable strategies to improve their learning results (Zimmerman, 1989).

Self-directed learning

Closely linked to self-regulated learning is the concept of self-directed learning. A self-directed learner has the liberty to choose what to learn, when, where, and how to learn to achieve their goals (Knowles, 1975). Self-directed learning is a notion that originated from post-initial education in the 1970s and involves learning that takes place outside conventional school settings. Self-regulated learning is grounded in educational psychology and usually refers to the school environment. The instructor or the curriculum defines the learning tasks and goals, whereas, in self-directed learning, the learner identifies learning needs and determines learning objectives. Self-directed learning is a broader notion incorporating self-regulated learning as the self-directed learner is assumed to self-regulate, whereas a self-regulated learner is not required to be self-directed (Saks and Leijen, 2014).

As self-regulated learning is relevant to many aspects of learning, many conceptual approaches exist to study self-regulated learning. Zimmerman's definition (1986) formed the basis of several

theoretical models. Since then, an ample amount of theoretical and practical descriptions of self-regulated learning have come into being, attributed to the different research domains in which self-regulated learning is grounded, each with its paradigms (Dent and Koenka, 2016; Boekaerts and Corno, 2005). Although these models all have different foci and stress different constructs and mechanisms, a broad consensus is that self-regulated learning mediates how the educational context and student attributes affect academic performance (Dent and Koenka, 2016; Pintrich, 2000). Pintrich (2000) formulated a working definition that acknowledges the interdisciplinary nature of self-regulated learning and reconciles the many perspectives on the concept to consolidate the many conceptual approaches that emerged in the field's evolution. Pintrich (2000) defined self-regulated learning as:

"an active, constructive process whereby learners set goals for their learning and attempt to monitor, regulate, and control their cognition, motivation, and behaviour, guided and constrained by their goals and contextual features of the environment" (p. 453).

For this thesis, Pintrich's definition is adopted as he explicitly adds 'context' to his account of self-regulated learning. This is an essential addition as Pintrich (2000) observed that certain models, especially in socio-cognitive theory, presume that the (instructional) environment or context is separated from the students' 'self'. In social-cognitive theory, the environment and the individual are related yet distinct constructs (Meyer and Turner, 2002). Pintrich's definition illustrates the increased articulation of the importance of the context of the learning environment and the enactment of self-regulatory processes in authentic classroom settings.

2.2.3 Common features of self-regulated learning

Notwithstanding the theoretical diversity in self-regulated learning research and literature, there are shared features (Schunk and Greene, 2018; Dent and Koenka, 2016). As some consensus has emerged around the definition of self-regulated learning, Pintrich also defines the typical characteristics of the majority of self-regulated learning models (Pintrich, 2000). These commonalities of self-regulated learning stand out in his definition (2000, p. 453).

Learning is an active and constructive process

First, the definition by Pintrich conveys the learner's active role, and most scholars agree that learning is an active and constructive process in which students are actively engaged in their learning. This feature contrasts with previous notions of learning. Until the 1990s, conceptions of learning mainly were reproductive in which learning was conceived as equal to memorising information provided by others, whereas in contemporary views on learning, students are considered active participants in the construction of knowledge. Drawing upon prior knowledge, self-regulated learners engage in academic activities proactively, generate their personal goals for learning, apply strategies, and use cues in the learning environment to their advantage (Pintrich, 2000).

Self-regulated learners set task-specific learning or achievement goals

A second feature closely related to the first is goal orientation or the intentional focus on task-specific learning or performance goals. *Goal-setting* triggers self-regulation (Sitzmann and Ely, 2011) and is a key element of self-regulated learning (Boekaerts, 1996) because goals serve as a criterion or standard against which learners can compare and evaluate their performance and academic progress (Pintrich, 2000).

Presence of a self-oriented feedback-loop

The third shared feature of self-regulated learning models is a dynamic and cyclical process involving a self-oriented feedback loop (Zimmerman, 2001). A *feedback loop* comprises the recurring processes that self-regulated learners utilise to monitor their learning activities' effectiveness and respond to feedback. For example, when the execution of an academic task or assignment does not meet the criterion, self-regulated learners act on this self-generated feedback by adjusting their approach to the assignment (Dent and Koenka, 2016; Pintrich, 2000). Accurate self-monitoring offers student learners the awareness of what they already know of the learning materials, what they do not yet know, and in which way to enhance learning and performance (Sitzmann and Ely, 2011).

Cognition, behaviour, and motivation are all involved

The fourth commonality is acknowledging that self-regulated learning involves cognitive, motivational, and behavioural components (Zimmerman, 2001). The regulation of cognition refers to students selecting and using cognitive strategies to attain a learning goal (Pintrich, 2000; Zimmerman, 1990). The monitoring and control that characterise the feedback loop are metacognitive skills. Metacognition serves as a regulatory system enabling learners to understand and control their cognitive performance. In addition, they also facilitate the self-regulation of academic performance (Pintrich, 2000). Finally, motivation plays an essential role in understanding why students commit to self-regulating and maintaining their endeavours. Motivational aspects are essential for learning and can influence students' probability of pursuing or abandoning goals (Schunk and Zimmerman, 2008). Motivation forms both a precursor for self-regulated activity and an advantageous consequence (Zimmerman, 2001). Therefore, understanding how to enhance and maintain motivation is essential for gaining insight into what distinguishes successful students from struggling ones. Pintrich's definition (2000) does not explicitly mention emotions, but in later conceptualisations of self-regulated learning, a consensus exists about the vital role emotions play in directing self-regulation during studying, managing emotions, maintaining energy to attain goals. As a condition for learning, they influence how students engage in studying. As a product of learning, emotions result from performing learning activities or evaluating learning (Efklides, 2011).

Metacognitive processes

Metacognition is the mechanism that controls the components of self-regulated learning: cognition, behaviour, and motivation. Metacognition thus constitutes the grounding of self-regulated learning: it represents the consciousness of one's thought processes and how learners monitor and control their learning. Metacognitive regulation consists of three processes: planning how to undertake a task and selecting an appropriate strategy, performing the task while being aware of one's understanding and performance of a learning assignment, and then evaluating by appraising the outcomes of an assignment.



Figure 1: the process of self-regulated learning (based on Zimmerman, 2000)

As depicted in Figure 1, Zimmerman distinguishes three phases that constitute metacognitive self-regulatory activities: the forethought phase, in which students use goal setting and planning strategies like allocating time to carry out the learning task. These activities assist the structuring and understanding of new learning materials. Next, students use monitoring activities to check whether the materials studied are understood. This includes activities such as keeping track of one's concentration, and self-testing and self-questioning, thus helping the learner comprehend the material and incorporating it with their existing knowledge of the subject studied. In the third phase, learners use evaluation and reflection techniques to assess learning processes and outcomes. These activities can enhance performance by supporting learners in repeatedly adjusting their cognitive activities as they continue working on an academic task.

Reactivity-effect

Another commonality in the research on self-regulated learning is the inclusion of monitoring as an important aspect of the regulation process. Thus, many self-regulated learning models draw attention to the importance of being aware of distinct aspects of one's behaviour (Panadero et al., 2016). Boekaerts (2011) mentions 'appraisal' in her model, and Efklides (2011) refers to 'monitoring and control'. Pintrich (2000) refers to it as awareness for cognition, motivation, behaviour, and context, and Winne and Hadwin allude to 'control and monitoring' in their 1998-model (Winne and Hadwin). Zimmerman emphasises the effect of monitoring by including self-recording as an element in his model, and he proposes to evoke greater reactivity through self-recording (Zimmerman and Moylan, 2009). Reactivity is the effect that occurs when a learner makes changes in behaviour due to being aware of his or her actions. Hence, it is essential to encourage self-observation and reflection in students. Self-recording forms an external strategy assisting students in monitoring and improving reflection on their learning. Self-recording is known as coding actions that occur during the performance phase of learning. An example of a self-recording technique is keeping a learning diary. Zimmerman argued for the use of diaries to support the process of self-observation because of their reactivity effect (Zimmerman, 2000).

2.2.4 Self-regulated learning strategies

Most models consider strategy use as a principal aspect of self-regulated learning. Students can apply learning strategies to enhance learning and achieve their goals. Learning strategies are a form of procedural knowledge: they facilitate learning and enhance performance. The literature on learning strategies provides a more significant number of strategies which can be categorized into four broad categories: (1) cognitive learning strategies, (2) metacognitive strategies, (3) resource management strategies and (4) motivational strategies (e.g., De Boer et al., 2012; Pintrich, 1999; Boekaerts, 1997; Pintrich and De Groot, 1990).

Cognitive learning strategies

Cognition is the mental action or process of acquiring knowledge and being involved in comprehension and understanding through thought and experience. Cognitive strategies are fundamental to accomplishing learning activities and assignments. The role of cognitive strategies is to enhance information processing while learning. The application of cognitive learning strategies is domain-specific or even task-specific. Cognitive learning strategies can be used for straightforward memorisation exercises or more complicated tasks requiring an understanding of the information (Weinstein and Mayer, 1986). Three main categories of cognitive learning strategies are valuable for academic performance: rehearsal strategies, elaboration strategies and organizational strategies (Pintrich, 1999; Pintrich and De Groot, 1990). Rehearsal strategies assist learners with the storing of information by repeating the material. Highlighting or underlining a text is assumed to help students select information and maintain it actively in the working memory.

Nevertheless, these strategies do not exhibit a deep processing level (Pintrich, 1999). Elaboration strategies, however, help students establish links between new learning materials and prior knowledge and do represent a deeper processing level. Elaboration strategies facilitate understanding and the retention of the learning content and aid students to store new knowledge in their long-term memory. Examples of elaboration strategies are creating analogies, generative notetaking, and explaining ideas to be learned to someone else (Weinstein and Mayer, 1986). Additional strategies that facilitate deeper processing are organizational strategies such as identifying the principal concepts from an article and different approaches to selecting and organizing the learning materials, like making a concept map. Compared to rehearsal strategies, organizational strategies result in a more in-depth understanding of the material (Weinstein and Mayer, 1986).

Metacognitive strategies

Learners use metacognitive strategies to monitor and control their cognition. These strategies are employed to regulate the learning process and are often used simultaneously with other strategies. Metacognitive strategies are domain unspecific, and contrary to cognitive learning strategies, they are usually generally applicable. This enables the transfer of metacognitive strategies and makes them particularly significant for unstructured or novel learning situations (Schmidt and Ford, 2003; Schraw, 1998). Metacognition comprises a declarative element, or metacognitive knowledge, which involves a learner's knowledge about their cognitions. The procedural element, or metacognitive control, involves the learner's control of strategy use and learning (Flavell, 1979).

Metacognitive strategies can influence students' achievement and are used in the learning process phases, as described in Zimmerman's self-regulated learning model (2002). Within the self-regulation models, five of these metacognitive processes serve as a unifying element: goal-setting, planning,

self-monitoring, self-control and self-evaluation (Dent and Koenka, 2016; Pintrich, 2000; Zimmerman, 2000; Boekaerts, 1996). The process of self-regulated learning is initiated by setting a goal, followed by students developing a strategic plan, based on their understanding of the task and the application of their metacognitive knowledge to choose an adequate strategy to achieve the goal they have set (Winne, 2001; Pintrich, 2000). In moving from planning to performing the task, students keep track of their progress towards their goal. Self-monitoring and self-control then come into play, which are pivotal to students' self-oriented feedback loop (Pintrich, 2000). When a students' performance does not meet the standard or criterion for the task, awareness should trigger self-control, by which students change or adapt strategies to improve task performance (Dent and Koenka, 2016). Finally, self-evaluation refers to students' reflection on the outcome after completing the task and evaluating their approach to that task. The student uses this reflection to adjust and prepare for the next task; self-regulation involves a cyclical adaptation of learning.

Resource management strategies

Students' resource management strategies are strategies applied to regulate their learning environment. They are regulatory strategies for controlling non-cognitive resources and forming favourable learning conditions. Resource management strategies assist students in adjusting to their environment, but they are also used to alter the environment to fit the goals they wish to achieve (Pintrich, 1999). Resource management strategies can be directed at (1) the learner such as the application of effort management, (2) others, in the form of help-seeking behaviour, or collaborative learning, and (3) the physical environment, or study environment and choosing to study at home or the library, using a dictionary.

Motivational strategies

Motivation represents students' inclination to engage their metacognitive and cognitive abilities and put them into use for learning. Motivational strategies aim to enhance and sustain students' learning motivation (Boekaerts, 1999). Students' self-regulated learning strategies add to cognitive load and require conscious effort. Therefore, students need to be motivated to apply (unfamiliar) learning strategies and invest in self-regulated learning. Pintrich extensively researched the function of motivational beliefs in self-regulated learning (e.g., Pintrich, 1999). His work emphasised how motivational beliefs foster, sustain or facilitate self-regulated learning. There are three categories of motivational beliefs (Pintrich and Schunk, 1996): (1) self-efficacy beliefs apply to students' belief in their capability to accomplish the academic task; (2) task value beliefs concern students' views on the relevance and significance of the task and if a student considers a task to be worthwhile; and (3) goal orientations refer to the reason why a student undertakes a task, that is, whether the focus is on mastery- or whether it is performance-oriented (Pintrich, 1999).

2.3 Theoretical developments of self-regulated learning

Scholarship on self-regulated learning systematises cognitive, metacognitive, behavioural, and motivational aspects and offers a comprehensive outlook on how students perceive and pursue learning goals. To analyse self-regulated learning, theories investigate issues such as: what encourages students to self-regulate their learning, by which processes learners become self-reactive, and how they acquire the capability to become self-regulated learners? What are the key processes to reach academic goals, and what is the influence of the social environment on students'

self-regulated learning? Research on self-regulated learning has advanced due to many theoretical and methodological developments (Boekaerts, Pintrich and Zeidner, 2000; Zimmerman and Schunk, 1989, 2001). This section briefly discusses shifts in learning paradigms in the last 75 years. It then presents a brief historical overview of theories and models to understand the evolution of the field of self-regulated learning. These developments cannot be seen in isolation from the evolution of learning paradigms, which influenced conceptions and theory development of self-regulated learning.

Over the past 30 years, conceptions of self-regulation in educational settings have become increasingly broad (Paris and Paris, 2001). Authors like Zimmerman (2008) and Schunk and Greene (2018) describe how the interest in self-regulation arose from various academic disciplines and outline the development of research on self-regulated learning. Scholarly work on self-regulated academic learning originated from broader endeavours to investigate human self-control and self-regulation (Zimmerman, 1989). The impulse for studying self-regulation in educational settings emerged from activities in diverse research schools (Zimmerman and Schunk, 2001). Researchers approached self-regulation from several perspectives, described briefly in this paragraph: the cognitive-behavioural perspective, cognitive-developmental research, research on cognitive and metacognitive issues, and the social-cognitive perspective.

In the 1970s, cognitive-behavioural researchers focused on issues such as students' self-control and subsequent academic achievement. The focus of research into self-regulated learning was cognitive strategy-oriented (Paris and Paris, 2001). In this period, cognitive-behavioural methods included the use of self-reinforcement and self-instruction. Self-instruction followed by fading was demonstrated to be an effective way to promote task focus and achievement. Research into self-regulation from a cognitive development perspective included a delay of gratification, which is essential to self-regulation as it allows students to set distal goals, focusing on learning tasks while ignoring more immediate distractions. Also, from this school of research arose the conceptualisation of the zone of proximal development (Vygotsky, 1962), demonstrating how academic progress can be achieved with scaffolding (i.e., support) from others.

Another group of researchers examined cognitive and metacognitive issues of self-regulation, such as task strategies. Researchers such as Levin, Pressley and Schunk concentrated on learners' self-regulatory processes, for instance, strategy use and goal setting (Zimmerman, 2008). Studies resulting from this tradition showed that students usually enhanced their academic performance after being trained in a particular strategy. Nevertheless, teaching these strategies did not guarantee their sustained use or application outside of the experimental learning settings: the successful transfer over time and to new tasks was rare. Furthermore, it became clear that other self-regulatory processes required consideration to clarify why learners did not utilise these strategies when, for example, working at home (Pressley and McCormick, 1995). Finally, researchers explored ways to promote strategy use through metacognitive knowledge and skills instruction. They concluded that motivation is essential to encourage self-regulation apart from cognitive and metacognitive skills.

In social cognitive theory, human performance results from the interacting influence of personal, environmental, and behavioural factors (Bandura, 2001, 1986). Social cognitive researchers explore social and motivational influences on self-regulation (Zimmerman and Schunk, 2011). Bandura (1986) theorised that self-regulatory actions result from three cognitive subfunctions: self-observation, self-

judgement or self-evaluation, and self-reaction, where learners subsequently monitor their performance, compare their performance against standards, and display reaction including feelings of self-efficacy (i.e., perceived capabilities) and satisfaction (Schunk and Greene, 2018). Social cognitive researchers demonstrated that increased self-efficacy and task-motivation could be accomplished by giving learners information about their learning process, for example, with instructional strategies such as modelling (Zimmerman and Schunk, 2011).

Regardless of the diversity of this research conducted in different domains, a need arose for more integrated perspectives on self-regulation, setting the stage for researching self-regulatory processes in educational contexts in a more systemic manner. Around the mid-1980s, this need led to an inclusive definition of self-regulation of learning which focuses on the proactive utilisation of processes to advance students' academic performance. This is consistent with constructivist theories of teaching and learning that developed around that time, stressing students' agency. In this definition, learners are considered to be engaged contributors in their learning process, regulating metacognitive, motivational, and behavioural aspects (Zimmerman, 1986). Thus, throughout the 1980s, notions of self-regulated learning advanced to include students' knowledge, metacognitive skill, motivation, and cognition (Butler, 2002; Butler and Winne, 1995; Schunk, 1994). Schunk and Greene (2018) divide the time from the mid-1980s to the present into three periods, which they labelled as the periods of development, intervention, and operation, summarising each period's theoretical, empirical, and practical issues. Their description offers an accessible comprehension of the development of research on self-regulated learning and provides an overview of each period's dominant topics and issues.

Period of development

In the developmental phase of research into self-regulated learning, which commenced in the 1980s and ran into the 1990s, there was considerable interest in advancing theories to guide research and methodologies to fit educational contexts. In the 1980s, research moved from an orientation towards cognitive strategies towards experimental investigations of diverse strategy conditions with an elevated focus on learning's metacognitive aspects (Paris and Paris, 2001). Researchers started publishing articles in which they distinguished between self-regulated learning and metacognition. These publications made significant contributions to educational psychology (Panadero, 2017): theories and research methodology were refined, and research identified key self-regulatory processes within educational contexts (Schunk and Greene, 2018). During this developmental phase, research focused on the relation between students' use of self-regulation processes and how this use related to outcomes; and several instruments to operationalize self-regulation processes were developed (MSLQ: Pintrich et al., 1991, 1993; LASSI: Weinstein et al., 1987; SRLIS: Zimmerman and Martinez-Pons, 1986, 1988). Early studies frequently involved self-report measures such as questionnaires or interviews (Schunk et al., 2014), known for their ability to capture students' perceptions about their self-regulation of learning. These early studies, conducted during the development period, presented evidence that self-regulated learning was a concept of great importance (Zimmerman, 2008). The dominant research model during the developmental phase emphasized the relation between self-regulation and performance (Schunk and Greene, 2018):

Self-regulated learning → achievement outcomes

Although demonstrating that self-regulated learning was a construct with great significance warranting further research, these early studies were correlational, unable to assess causality (Pintrich et al., 1993; Zimmerman and Martinez-Pons, 1986). The conclusion, therefore, could not be drawn that self-regulation necessarily furthers achievement outcomes. Moreover, the developmental period's measurement instruments cannot capture how learners adapt and adjust self-regulation processes when learning (Schunk and Greene, 2018).

Period of intervention

The following period, characterized as the intervention period, roughly covered the late 1980s, through the 1990s and into the 2000s (Schunk and Greene, 2018). Research into self-regulation of learning focused on training students on how to self-regulate, how they use self-regulation processes, and how this influences achievement outcomes. Intervention studies typically used pre-test and post-test instruments to capture the dynamic character of self-regulation. In contrast to the previous research period, using questionnaires and interviews as measuring instruments, it became possible to infer cause, demonstrating that students' self-regulation changed due to the intervention. This causal sequence reflected the research model in which an intervention was predicted to influence self-regulation, which in turn affected achievement outcomes (Schunk and Greene, 2018):

Intervention → self-regulated learning → achievement outcomes

Nonetheless, most instruments used during this period did not yet allow for assessing real-time changes reflecting self-regulation's dynamic nature (Schunk and Greene, 2018).

Period of operation

In response to the need for effective measurement, researchers developed several methods to assess self-regulated learning from the 1990s until the present day. In this period, research aimed to explore the self-regulation processes while learners use them and connect moment-to-moment modifications in self-regulation to adjustments in achievement outcomes (Schunk and Greene, 2018). During this period of development of the field, research has focused on this causal sequence. The general research model then assumes a reciprocal relation between self-regulation and achievement outcomes:

Self-regulated learning ↔ achievement outcomes

Refined methodologies were proposed to capture self-regulation's dynamic and cyclical natures (Schunk and Greene, 2018). In addition to questionnaires and interviews, researchers developed measures like think-aloud protocols, observation, trace measures and micro-analytic methods (Schunk and Greene, 2018). In recent years, the motivational and volitional components of self-regulated learning have been accounted for (Dignath and Büttner, 2008; Boekaerts and Corno, 2005).

Today self-regulated learning has developed into a prominent research field in educational psychology (Panadero, 2017) and is closely connected with various facets of learning and development (Paris and Paris, 2001). Research is concerned with examining how students "regulate their learning activity, the instructional, social, and contextual factors that affect self-regulation, and the impact on student achievement and well-being" (Allal, 2010, p.349). By now, self-regulated

learning is also researched outside of traditional educational learning settings, and there are progressions in the instruction on self-regulated learning and interventions. Methodologies advanced, and differences in learners, contexts and cultures are investigated (Schunk and Greene, 2018). Panadero (2017) demonstrates how the field developed significantly following Puustinen's and Pulkkinen's theoretical review in 2001 when they published a comprehensive overview of the most relevant models of self-regulated learning. Since then, new models of self-regulated learning have been developed (Efklides, 2011; Hadwin et al., 2011), and three meta-analyses of the effects of self-regulated learning have been carried out (Sitzmann and Ely, 2011; Dignath and Büttner, 2008; Dignath et al., 2008). Lastly, there are now three handbooks on self-regulated learning, the first being from Boekaerts et al. (2000). A second edition of the *Handbook of Self-Regulation of Learning and Performance* by Schunk and Green appeared in 2017 (with a second edition in 2018), supplementing the first edition by Zimmerman and Schunk (2011) and providing insight into specific domains of self-regulated learning. In light of this thesis's focus, a notable development is the extension of theories and models of self-regulated learning by situated learning perspectives, emphasising shared knowledge construction and collaboration. Evolving definitions emphasise that the enactment of self-regulated learning is dependent on more than individual attributes. Instead, it is contingent on learners functioning within social contexts (e.g., Paris and Paris, 2001; Patrick and Middleton, 2002; Zimmerman, 1995). More social modes of regulation, comprising co-regulation and shared regulation, were further defined and explored in the late 1990s and early 21st century (Hadwin et al., 2018). These modes will be discussed in more detail later in this chapter.

2.4 Models of self-regulated learning

Various scholars proposed models of how learners initiate their cognition, metacognition, behaviour, and motivation to learn. Each model emphasises different aspects of self-regulated learning (Pintrich, 2000), but despite the many models proposed, they share several basic assumptions and view self-regulated learning as involving cognitive, metacognitive, motivational, and behavioural components (Zimmerman, 2001). The practical importance of self-regulated learning models is their provision of an integrative and comprehensive framework to describe how learners handle learning challenges, apply strategies, monitor performance, and interpret their endeavours' results (Underwood and Banyard, 2011). In addition to theoretical and descriptive purposes, a model provides a framework to investigate how students' self-regulated learning abilities can be enhanced (Panadero, 2017).

Winne and Perry (2000) differentiate between two types of models to approach self-regulated learning. Component-oriented models comprise elements of self-regulated learning which are conceptualised as learners' attributes for learning, regardless of the phases of the learning process in which they take place. These components relate to cognitive strategies (such as elaboration), metacognitive strategies (like monitoring) and resource management strategies (e.g., maintaining attention) (see, e.g., Pintrich, 1999). On the other hand, process-oriented models view the concept of learning as a process. These models, therefore, focus on control and regulation of learning strategies in the successive phases of the learning process (Roth et al., 2016). In turn, these different conceptualisations substantially influence the development of instruments to assess self-regulated learning.

This paragraph provides an overview of influential models of self-regulated learning, as identified in the review by Panadero (2017). Each of the six models in the review has an established theoretical and empirical grounding. These models are:

- (1) The Cyclical Phases model by Zimmerman (2000): a socio-cognitive perspective
- (2) Boekaerts' Dual processing self-regulation model (2011)
- (3) Winne and Hadwin (1998): a metacognitive perspective
- (4) Pintrich's General Framework for self-regulated learning (2000)
- (5) Efklides, Metacognitive and Affective Self-Regulated Learning model (2011)
- (6) Hadwin, Järvelä and Miller (2018, 2011): Self-regulated learning in the context of collaborative learning

(1) The Cyclical Phases model by Zimmerman (2000): A Socio-cognitive Perspective

As one of the pioneers in self-regulated learning research (Zimmerman, 1986), Zimmerman has developed three self-regulated learning models. Zimmerman was the first to depict the whole process of self-regulated learning. His dynamic Cyclical Phases model (Zimmerman, 2000) is a widely adopted theoretical model of self-regulated learning. Zimmerman's model is grounded in social cognitive theory (Zimmerman, 2013), where self-regulated learning occurs within a particular social context. His model has a triadic reciprocal orientation: the social context and the environment reciprocally affect learners and their cognition, behaviour, and performance (Zimmerman, 2000; Schunk and Zimmerman, 1996). These triadic processes form a key feature of Zimmerman's model. In social cognitive theory, self-regulated learning is an internal metacognitive capability, emphasising individual agency (Rich, 2017).

Zimmerman characterized self-regulation as cyclical, as "self-generated thoughts, feelings, and actions [...] are planned and cyclically adapted to the attainment of personal goals" (p.14). Zimmerman's model (2000) describes self-regulated learning as a recurring process with three phases in each cycle: the forethought phase, the performance phase, and the self-reflection phase. The forethought phase involves goal setting and planning (where am I going?), the performance phase is concerned with the performance of a task and self-monitoring (how am I going?), and in the self-reflection phase, students evaluate their execution of the learning task, making attributions about their accomplishment or failure. The outcome of the last phase influences the following forethought phase (where to next?), forming a feedback loop that constitutes the model's cyclical character.

(2) Boekaerts' Dual processing self-regulation model (2011)

In the late 1980s, Boekaerts was also one of the early researchers to publish on self-regulated learning (e.g., Boekaerts, 1988). Boekaerts' work focussed on explaining the role of goals and the function of positive and negative emotions within self-regulated learning (Panadero, 2017). In Boekaerts' Dual Processing model, goals guide students' behaviour. There are two pathways of goals: (1) the growth of knowledge and skills and (2) the well-being pathway. The appraisals that students make influence which goal pathway they will choose. In an expanded version of the model, presented in the Self-regulated learning Handbook (Zimmerman and Schunk, 2011), Boekaerts asserts there are three purposes to self-regulated learning: (1) students' aim to develop knowledge and skills (i.e., mastery/growth pathway), (2) their intention to preserve personal well-being (the

well-being pathway), and (3) their objective to sustain their commitment to the learning task (Boekaerts, 2011).

(3) Winne and Hadwin: a metacognitive perspective (1998)

Another widely used model is Winne and Hadwin's self-regulated learning model, which adopts a strong metacognitive perspective and is viewed as information processing oriented. The model by Winne and Hadwin is more concerned with exploring the cognitive and metacognitive aspects of self-regulated learning than other models explicitly (except for Efklides' model). The model, influenced by theories on information processing, stresses the cognitive processes during learning (Greene and Azevedo, 2007). Winne and Hadwin (1998) considered learning to occur in four repeating phases. With the acronym COPEs, the four phases are characterized in terms of the interaction of a person's Conditions (such as context, or time), Operations (cognitive processes and strategies utilised by the student), Products (e.g., new knowledge), Evaluations (internal or external feedback), and Standards: the criteria against which outcomes are monitored (Winne and Hadwin, 1998; Greene and Azevedo, 2007). Except for operations, these aspects are forms of information that a student uses or produces while learning. Specifically, their model's main contribution to understanding self-regulated learning is introducing a more detailed account of the processes fundamental to every phase (Greene and Azevedo, 2007).

(4) Pintrich's General Framework for self-regulated learning: the role of motivation (2000)

Pintrich made seminal contributions to educational psychology by integrating motivational features into self-regulated learning. Pintrich was the first to research the relationship between motivation and self-regulated learning empirically and theoretically (Pintrich and de Groot, 1990; Pintrich, 2000). His questionnaire, the Motivated Strategies for Learning Questionnaire, or MSLQ (Pintrich et al., 1993b), is still extensively applied as a self-report instrument (Roth et al., 2016). Pintrich (2000) developed a goal-oriented model of self-regulated learning. He extended the cyclical model of self-regulated learning to include four phases: (1) Forethought, planning, and activation; (2) Monitoring; (3) Control; and (4) Reaction and reflection. Combining the phases and areas for regulation provides a comprehensive account of self-regulated learning, incorporating a significant amount of learning processes such as activating prior knowledge and judgements of efficacy (Panadero, 2017).

(5) Efklides, Metacognitive and Affective Self-Regulated Learning model (MASRL) (2011)

As stated by Efklides (2011), the Metacognitive and Affective Self-regulated learning (MASRL) model is grounded in socio-cognitive theory (Bandura, 1986). The MASRL model further clarifies the relationship between metacognition, motivation, and affect through the interplay of the macro-level and micro-level (Panadero, 2017). Efklides' model is theoretically grounded in earlier self-regulated learning models (e.g., Zimmerman's Winne and Hadwin's, and Pintrich's). There are two levels in the MASRL, which constitute the model's most important feature: the person-level (or macro-level) and the person X task level (or microlevel). The first is concerned with the student's personal characteristics, such as cognition, self-concept, volition, metacognitive knowledge, and skills. At the personal level, choices about learning are made based on the relatively stable traits of the student. The interaction between the task and the student's attributes occurs at the second level. At this level, four functions are identified (Efklides, 2011): cognition, metacognition, affect, regulation of affect, and effort.

(6) *Hadwin, Järvelä, and Miller (2018, 2011): Self-regulated learning in the context of collaborative learning*

Hadwin, Järvelä, and Miller (2011, 2018) put forward the Socially Shared Regulation of Learning Model (SSRL). Within the field of self-regulated learning, 'Socially Shared Regulation of Learning' is an evolving area of research (Panadero and Järvelä, 2015). Since 2000, three modes of regulation in collaborative learning environments have been defined and conceptualised: self-regulated learning, socially shared regulation, and co-regulation (Hadwin et al., 2011; Hadwin and Oshige, 2011, Järvelä and Hadwin, 2013). The SSRL model stresses the function of context and the capability of external sources to support individual self-regulation. Co-regulation of learning happens either by exercising contextual influence or through socially shared regulated learning, where students jointly regulate as they work together on a task, activity or assignment (Järvelä and Hadwin, 2013).

2.5 Critical literature on the regulation of learning

Self-regulated learning is principally considered beneficial to student learning and performance (Zimmerman and Schunk, 2011). There is a convincing amount of research that demonstrates that self-regulation by learners strongly links to students' achievement and leads to more effective learning throughout life (Dent and Koenka, 2016; Beishuizen and Steffens, 2011; Dignath and Büttner 2008; Pintrich, 2004; Zimmerman, 2002, 1990; Zimmerman and Schunk, 1989). Therefore, researchers focus on furthering conceptualisations of self-regulated learning, measuring self-regulated learning and pedagogical models to foster the development of students' self-regulated learning. Self-regulated learning is almost exclusively considered a valuable form of engagement and a way to empower students as a process by which they take charge of their lives and studies. However, within educational psychology literature, self-regulated learning remains relatively unchallenged; articles that address critical issues concerning self-regulated learning are scant, and there is little mention of a critical perspective (Vassallo, 2015).

Indeed, this lack of consideration of the political dynamics suggests that, in general, self-regulated learning is viewed as value-free and undeniably beneficial to students. Stephen Vassallo is a notable critic of portraying self-regulated learning as a neutral form of human engagement. In his works (e.g. Vassallo 2015; 2012), Vassallo raises ethical and philosophical concerns that underpin the discourse on self-regulated learning. One of his concerns is the possibly disputable beliefs about social class, which he argues are implied by current self-regulated learning research and educational practice. Vassallo's assertion is rooted in work that credits parents with a pivotal role in advancing student self-regulated learning. Still, to encourage self-regulated learning, parents should familiarize themselves with how self-regulated learning is enacted in their children's classrooms and subsequently model this behaviour at home (e.g., Corno, 1989). Vassallo cautions that, as a result, self-regulated learning research and interventions could play a role in "reproducing inequalities and bias in schools and society" (Hadwin, 2013, p.212). In addition, he objects to the assumption implicit within the concept of self-regulated learning that the individual should be regulated and adapt to flourish in their environment, rather than altering the environment (Vassallo, 2012). This notion of adaptation is consistent with behaviourist and cognitivist paradigms, in which the world is external and needs to be 'mapped' onto the learner.

Vassallo argues that working-class parents are too preoccupied with their working lives to adequately get acquainted with the fundamentals of self-regulated learning, let alone modelling it. Presumably, Vassallo specifically refers to lower-income families, but could it be asked if this does not apply to all working parents or even all parents? The question remains how parents would be able to encourage self-regulated learning? Do parents have the opportunity, and are they able, willing, or capable even, to access school-enacted processes of regulation of learning? And then subsequently model these practices, and encourage self-regulated learning behaviours at home? Moreover, should they, or is encouraging self-regulation of learning a school's responsibility, as part of the 'moral purpose of education' (Fullan, 2001)?

In a short article, Allyson Hadwin (2013) responded to Vassallo's claim that self-regulated learning research and practice did not sufficiently consider the impact of social inequalities and differences of social class. Instead of contradicting his assertion, she argues that self-regulated learning is contextually situated and acknowledges the opportunities that life challenges and experiences offer for self-regulated learning to develop, both within and beyond educational settings. Hadwin (2013) asserts that self-regulation is ubiquitous and, "regardless of class structure, socio-economic status, or vocation" (p. 213), even day-to-day activities and chores at home include features that require self-regulated learning, such as complexity, challenge, and opportunities for help-seeking. Furthermore, even if there is a difference between the school context and home-life, varied home and school cultures create abundant conditions for students to develop regulatory behaviour. In this view, students develop and adapt their personal collection of strategies for accomplishment (e.g., Butler, 2002).

Similarly, McCaslin and Hickey (2001) warn against an uncritical adoption of political dynamics implicit within educational systems. They contend that all psychological theories are inherently political. While Vassallo aligns self-regulated discourse with neoliberal thought (2015, 2012), McCaslin and Hickey (2001) point out a potential alignment with modern school reform, where "hard work, high expectations, and higher standards are the panacea" (p. 237). They illustrate this point by discussing the potential goals of self-regulated learning research. An apparent goal might be to advance self-regulated learning, enabling students to liberate themselves from their immediate environment. A second goal "may be to free the socio-instructional environment (SIE) from responsibility for the individual: SRL suggests that learners can teach themselves" (p. 347). Another possible objective of self-regulated learning research is character-education and advocating student self-discipline and conformism (Yowell and Smylie, 1999). With these potential goals of self-regulated learning research and practice, McCaslin and Hickey argue that lecturers should be conscious of the political implications of their teaching practices. In their view, educators should be wary of decontextualization of theoretical concepts, which leads to haphazard implementations of tools in the classroom that are anything but neutral. They observe a dilution of teacher responsibility and a tendency to not assume accountability for students' learning in the name of constructivist theory as teachers concede to the narrative of intrinsically motivated students.

In the same way as practitioners, educational researchers should remain aware of the political dynamics implicit within research. From a policy perspective, a potential goal of research into self-regulated learning is knowing which learning strategies can improve student attainment. However, scholars should be mindful that solely researching the role of learning strategies in improving student achievement might disregard other factors that play a role in student achievement. Unintentionally,

the research could hence promote a culture that “frees the socio-instructional environment (SIE) from responsibility for the individual: SRL suggests that learners can teach themselves” (McCaslin and Hickey, 2001, p. 347).

Alternatively, McCaslin and Hickey (2001) present a model of co-regulated learning derived from Vygotskian theory. This theory transformed notions of self-regulated learning by incorporating the socio-instructional environment, simultaneously recognising the role of the socio-instructional environment and the individual learner. The ultimate goal of self-regulated learning research within this tradition is not “to shift to the individual the burden of pursuing his own education” (Gardner, as cited in Zimmerman and Schunk, 1989, dedication page). Rather, co-regulation of learning implies a *collective responsibility*: “the goal is self-regulation that is instrumental to socially meaningful activity that ultimately enriches the culture” (McCaslin and Hickey, 2001, p. 243).

2.6 Self-regulation, co-regulation, and socially shared regulation

Historically, models of self-regulated learning have emphasised individual agency and internal cognitive processing and metacognitive strategies (Hadwin and Oshige, 2011; Zimmerman, 1990). The social-cognitive outlook on self-regulated learning assumes a model composed of three factors that influence learning: students’ cognitions, behaviours, and environment (Zimmerman, 2000; Schunk and Zimmerman, 1996). Contrasting conceptualisations of ‘context’ and ‘reciprocity’, however, are offered by (socio)constructivist (e.g., Paris, Byrnes and Paris, 2001) and sociocultural (e.g., McCaslin and Hickey, 2001a) perspectives on self-regulated learning. These perspectives developed the concept of self-regulated learning as a social process in which learning is a process mediating between an individual and others. Autonomy is not viewed as an individual attribute but rather as a relationship (Meyer and Turner, 2002). In contemporary perspectives on self-regulated learning, the emphasis on ‘self-’ or regulation in an individual’s mind shifted to situated perspectives of learning, emphasising shared knowledge construction and collaboration (Hadwin et al., 2018). Every model stresses a particular aspect of self-regulated learning. Incorporating co-regulated and socially shared regulated learning acknowledges that “different aspects of self-regulation stretch beyond the individual and into the social realm” (Hadwin and Oshige, 2011, p. 260). In socio-cognitive models of self-regulated learning, knowledge construction is viewed as disjointed from the context and culture in which learning takes place (Martin and Sugarman, 1996). Self-regulated learning is situation-specific, and students’ self-regulatory abilities can vary significantly across tasks and domains. Therefore, within the socio-cognitive viewpoint, self-regulated learning emerges internally within a singular learner who relies on self-regulatory processes and self-efficacy beliefs. Within this perspective, students learn from modelling and are assisted through the social context, providing task modelling, guided practice, and feedback (Schunk, 2001, Zimmerman, 2000). Aspects of the social contexts are recognised in most models of self-regulated learning; nevertheless, various research designs and discussion of findings stress a unidirectional effect of social factors (such as peer feedback) on individual cognitive aspects of learning (such as the self-regulated learning strategies used) (Allal, 2019). Furthermore, although the role of environmental conditions, such as support from teachers, is acknowledged, learning in socio-cognitive models (e.g., Zimmerman, 2000, 1989) is not described as a distributed, shared, or mediated process between individuals (Rich, 2017; Hadwin and Oshige, 2011).

Early socio-cognitive conceptions evolved in situated perspectives of learning, and self-regulated learning formed the foundation for studying more social approaches to regulation. In these social approaches, self-regulated learning is assumed to be realised through social interactions. It involves various academic and non-academic outcomes which are appreciated within their context (McCaslin and Hickey, 2001a, 2001b). Currently, the three modes of regulation - self-regulated learning, socially shared regulation, and co-regulation of learning – each form a line of research that contributes to the comprehension of both individual and collective facets in the regulation of learning (Hadwin and Oshige, 2011). In their work, Hadwin and colleagues (2018) synthesised the state of research about social aspects in the regulation of learning, comparing self-regulation, co-regulation, and socially shared regulation of learning. The three primary modes are defined as follows.

Self-regulated learning in collaboration

Hadwin et al. (2018) define self-regulated learning in collaboration as “the individual learner’s deliberate and strategic metacognitive planning, task enactment, reflection, and adaptation in a joint task” (p. 86). The goal is independence in regulatory activity (Hadwin et al., 2011). A more competent other is required to provide the learner modelling, feedback, and instrumental support to foster self-regulatory learning behaviour. Research into self-regulated learning typically focuses on regulatory processes and results of the individual learner. Self-regulated learning is grounded in socio-cognitive theory and occurs in independent, cooperative, and collaborative tasks. In their 2018 revision, Hadwin et al. stipulate that individual self-regulation is essential for fruitful collaboration and sharing of regulatory processes.

Socially shared regulation of learning in collaboration

Socially shared regulation in collaboration applies to “a group’s deliberate, strategic, and transactive planning, task enactment, reflection and adaptation actions” (p. 86). It includes how groups take metacognitive control of the task together or regulate their collective activity. The purpose of socially shared regulation is for a group of ‘individually-regulated’ learners to collectively adapt and regulate collaborative processes (Hadwin et al., 2011). Joint regulation emerges through transactive exchanges amongst group members. Teams of learners then share monitoring, evaluation, and adaptation processes. Shared regulation takes place in cooperative and collaborative tasks. Research into socially shared regulated learning concerns regulatory processes and outcomes that are shared, common to all learners in a group, and co-constructed (Hadwin et al., 2011).

Co-regulated learning in collaboration

Co-regulated learning in collaboration “refers broadly to affordances and constraints stimulating appropriation of strategic planning, enactment, reflection, and adaptation,” which occurs when learners cooperate with fellow students (Hadwin et al., 2018, p. 87). Through group members’ temporary and shifting support, monitoring and regulation can be offloaded to peers or tools and educational technology. Co-regulation implies the internalisation of regulatory processes, and the shifting and temporary support enables future regulatory uptake. Research into co-regulation focuses on the altering exchanges between personal, social, and cultural influences. This research investigates the interplay between collective experiences and individual engagement and regulatory processes (Hadwin and Oshige, 2011).

Co-regulation of learning is conceptualised in different ways. For example, Allal (2018) suggests that co-regulation implies a 'bi-directional encounter' between the teacher's endeavours to supply students with resources to assist their regulation of learning and students' attempts to integrate elements of this instruction within their strategies of self-regulation (p.29). This is the perspective I have adopted for this thesis and which will be further elaborated on in chapter 4, the theoretical framework for the research project.

Co-regulation can be distinguished from self-regulation, which refers to the active monitoring and regulating of a student's own learning, and from socially shared regulation, in which various participants of similar status make sure their shared activity progresses by collective, co-constructed regulation (Allal, 2019; Hadwin and Oshige, 2011). Co-regulation takes place if affordances and constraints are appropriated by individual learners (self-regulation) or by groups (shared regulation). Co-regulatory affordances and constraints thus emerge in events of shared regulation and self-regulation.

2.7 Encouraging learning and student self-regulation

2.7.1 Promoting self-regulated learning

Various reviews and meta-analyses have demonstrated that self-regulation by learners strongly links to students' achievement and leads to more effective learning throughout life (Dent and Koenka, 2016; Beishuizen and Steffens, 2011; Dignath and Büttner 2008; Pintrich, 2004; Zimmerman, 2002, 1990; Zimmerman and Schunk, 1989). This positive effect on learning success has been established in traditional or online learning environments. The capability to self-regulate one's learning is essential for university students' academic performance, regardless of delivery mode (face-to-face or online, or in a blended or hybrid form (Broadbent et al., 2020; Broadbent and Poon, 2015). Nevertheless, distance education requires higher students' autonomy and self-direction (Alonso-Mencía et al., 2019; Broadbent 2017). Self-regulated learning is assumed to occur when students are inspired to participate in learning activities reflectively and strategically within learning environments that promote self-regulated learning (Butler, 2002). In addition, especially in transitioning from secondary school to a higher education context, greater reliance upon self-regulated learning emerges (Webster and Hadwin, 2015; Dresel et al., 2015; Peverly et al., 2003). Both conditions apply to the learners targeted in the intervention designed and developed for the current research project: it was purposefully directed at a course for first-year bachelor's students in their first term. Not intentionally but forced by Covid-19 measures in place at the time of the implementation of the intervention (fall of 2020), out of necessity, all teaching of this course had to take place online. This made the topic of co-regulation and supporting self-regulated learning behaviours even more relevant. In this thesis, I argue that developing into a self-regulated learner necessitates considerable practice and support, and the encouragement of self-regulated learning activities in students is a shared responsibility of students, teachers, and educational institutions. Self-regulated learners have built up a collection of various cognitive and metacognitive strategies and can put them into practice in a timely and successful manner. Successful self-regulation of learning is characterised by learners' deliberate adaptation when they encounter a challenging circumstance (Winne and Hadwin, 2008). When self-regulated learners stumble upon difficulties, these students will regulate their learning, and they identify ways to motivate themselves. Self-regulated learning thus makes a positive contribution to learners' study success.

How, then, can students be supported and encouraged to become self-regulated learners? Paris and Paris (2001) provide two contrasting metaphors that can guide research and practice in self-regulated learning. The first is the analogy of acquisition, of learning additional strategies and skills and applying them in a learning situation. In this view, teachers provide explicit information about and model effective strategies; they organise the learning environment to provide possibilities to apply these strategies. This metaphor is rooted in the notion of teacher control and directed instruction. A more subtle version of this transmission model is Zimmerman's (2000) social learning model (Paris and Paris, 2001). However, acquiring a strategy does not ensure that students will use the strategies or transfer to new learning situations. Therefore, the second metaphor stresses a developmental approach based on a student-centred learning model. In this viewpoint, students are assumed to develop self-regulatory behaviours through experience and practice.

Rather than a set of skills to be taught, self-regulated learning is perceived as a variety of coherent behaviours a learner displays in a particular situation. Consistent with sociocultural learning theories, self-regulated learning is not 'acquired'; rather, it is shaped and expanded through participation in 'zones of proximal development' (Vygotsky, 1978). A Zone of Proximal Development is the conceptual contrast between what a learner can accomplish without the support and what they can achieve with the support of more knowledgeable others, like a teacher (Meyer and Turner, 2002). Instructional scaffolding, a metaphor based on Vygotsky's (1978) idea of the Zone of Proximal Development, is a process in which a lecturer encourages self-regulated learning by providing supportive activities supporting students as they are led through the Zone of Proximal Development. This support is tapered off when it is no longer necessary, i.e. when learners can complete the task independently, thus assisting them in advancing their learning autonomy. Paris and Paris (2001) conclude that both metaphors provide valuable guidelines for facilitating the development of learners' self-regulation. However, developing self-regulatory skills does not happen overnight: it takes time and effort.

2.7.2 Challenges in fostering self-regulated learning

Self-regulating one's learning is important, but it is also difficult, and it is a lengthy and effortful process. Students do not necessarily adopt self-regulated learning skills and strategies when instruction and support are offered in their educational programmes. Nevertheless, most students rely on passive and ineffective strategies, such as rereading, highlighting, or underlining. These strategies make studying appear more effortless; they promote surface learning instead of deep learning (Biber et al., 2020; Blasiman et al., 2017). Specifically, students have very little knowledge about study strategies in general (McCabe, 2011), they generally do not know which strategies are effective (Bjork, Dunlosky, and Kornell, 2013), and they lack information on how to use study strategies (e.g., flashcards, Bjork et al., 2013). Furthermore, students lack awareness about the strategies they already use (Dirkx et al., 2019). Without instructional support on monitoring and controlling their learning, students tend to overestimate their understanding of learning materials, such as texts (e.g., Thiede et al., 2009). Furthermore, research on effectively translating insights from research into fostering self-regulated learning in a higher education setting is scarce (e.g., Biber et al., 2020).

Several student-related factors that inhibit the uptake or development of self-regulated learning behaviours have been identified within the self-regulated learning literature. Zimmerman (1989) identified three factors in students' insufficient or absent use of self-regulated learning skills. The

first factor is that students assume that an established self-regulation process will not work for them, is not required, or is undesirable in a particular learning situation. Furthermore, students expect that they cannot carry out a helpful self-regulation response. Lastly, learners' endeavours to self-regulate their learning usually necessitate extra effort, preparation time, and attention. A specific learning goal or outcome needs to be sufficiently interesting or desirable for students to be motivated to self-regulate. Furthermore, students incorrectly believe that inadequate strategies are effective as they feel over-confident about their ability to remember their learning materials in the long term. This false sense of fluency in learning is caused by applying ineffective strategies, and ease-of-processing is thus mistaken for an indicator of long-term learning (Biber et al., 2020; Soderstrom and Bjork, 2015; McCabe, 2011). Thus, developing students' accurate metacognitive awareness is important in supporting them to become self-regulated learners and enabling them to form accurate judgements of the effectiveness of learning strategies.

Students are encouraged to plan their learning, use learning strategies, monitor their progress, and adapt their learning behaviour if needed. However, in addition to coping with the learning task itself, all phases of self-regulation use up valuable cognitive and metacognitive resources. We have limited capacity (i.e., working memory), and novel information takes up more space. Therefore, appropriating new self-regulated learning skills and behaviours is effortful and leads to increased cognitive load. This presents educational practice with a dilemma. On the one hand, cognitive overload leads to students who feel overwhelmed. This overload can occur when a new learning environment is substantially different and demands more independence and complexity. An example is students' transition from secondary to higher education. On the other hand, cognitive overload can also occur when the demands of a particular learning environment or task exceed students' zone of proximal development. The socio-instructional learning environment insufficiently supports the emergence of effective regulation. Another critical moment for cognitive load is when the transfer of learning needs to occur. In a university setting, this may occur when students work on authentic tasks where they are required to apply their knowledge to 'real-life' problems.

On the other hand, learners need to encounter real learning challenges. These challenges provoke opportunities for regulation; they are needed to initiate or prompt self-regulated learning behaviours (Hadwin et al., 2018; 2011). Academic challenges allow regulation in all three phases of self-regulated learning: the forethought, performance, and self-reflection phase (Zimmerman, 2000). Students only regulate their learning when they perceive this is necessary. When their study progress is stable, students' conscious self-regulated learning goes underground, and automaticity takes over (Winne, 2011). From this viewpoint, challenging learning situations are required to activate regulatory processes and enactment of strategy use (Hadwin, Järvelä, and Miller, 2011; Hadwin and Winne, 2012; Järvelä and Jarvenojä, 2011; Jarvenojä and Järvelä, 2009; McCardle, Helm, Hadwin, Shaw, and Wild, 2011; McCaslin, 2009). Without an appropriate level of challenge, for example, due to taking over control and monitoring from learners - also referred to as 'offloading' - learners will have reduced opportunities to activate and improve regulatory responses (Hadwin, 2013).

2.7.3 Implications for educational practice

Behaviourist, cognitivist, and constructivist learning paradigms deem the regulation processes a dominant characteristic of learning (Allal, 2010). As learning paradigms represent different perspectives on the learning process, beliefs on facilitating self-regulated learning differ accordingly.

Notable mechanisms include reinforcement in behaviourism, corrective feedback in the cognitivist paradigm, Piaget's idea of equilibration in constructivism, and social mediation in social constructivist models (Allal, 2010). Effectively fostering and enhancing self-regulated learning will depend on the learning paradigm in which the self-regulated learning model of choice is rooted. Where cognitivist models of self-regulated learning emphasize the internal processes of self-regulation and the use of cognitive strategies, (socio-)constructivist models recognize the social environment in supporting the emergence of regulation of learning.

The evolving situated perspective on the regulation of learning, with distinct perspectives on the relationship between learners and the diverse context levels, requires scholars to investigate different research questions and research these questions in alternative ways. In addition, a situated perspective challenges educational practice to explore how the promotion and support of self-regulated learning occur via the mutual interactions between individual learners and context elements. Contextualised views recognise that support is distributed amongst people, tasks, tools, and the environment. In this perspective, self-regulated learning evolves through co-regulation, which is regarded as the process whereby the environment fosters the development of regulation (Hadwin, Järvelä, and Miller, 2018; Hadwin and Oshige, 2011; Allal, 2007). In this perspective, learning is situated, and both self-regulation and contextual sources of regulation are simultaneously operational. "Student self-regulation thus develops in interaction with multiple sources of regulation in the learning environment" (Allal, 2010, p.349). Thus, promoting and fostering self-regulated learning skills becomes a topic of joint interest and importance for educational practice and educational research, requiring approaches that simultaneously deepen understanding and further practice.

2.8 Summary

To sum up, socio-cognitive conceptions of self-regulated learning focus on individual agency, cognitive processing, and metacognitive strategies. Each prominent model of self-regulated learning recognises the role others play in the individuals' development of self-regulated learning (Rich, 2017). However, the earlier models do not characterize regulated learning as the interdependent transactional regulation between individuals (Rich, 2017; Hadwin and Järvelä, 2011; Hadwin and Oshige, 2011). Contemporary perspectives consider social transactions as the core of regulated learning. In these situated perspectives, collaboration and shared knowledge construction emerge, and in the late 1990s and early 21st century, researchers started exploring two social modes of regulation: co-regulation and shared regulation (Hadwin, Järvelä, and Miller, 2018).

Chapter 3: Measuring self-regulated learning

3.1 Introduction

The growing attention paid to self-regulated learning generated increased research and, consequently, the development of many different research instruments to measure student self-regulated learning. By the 1980s, integrated models of self-regulated learning became more advanced, and the research was expanding in terms of conceptual development (Zimmerman, 1986). Since then, various methods have been used to research self-regulation, informed by diverse underlying conceptual models, and there have been several influential articles about the measurement of self-regulated learning (e.g., Zimmerman, 2008; Boekaerts and Corno, 2005; Winne and Perry, 2000).

The previous chapter of this thesis drew an overview of self-regulated learning as a multifaceted, complex concept containing cognitive, motivational, and contextual elements. I briefly discussed theoretical and methodological developments of the field. As a result of the complexity of the research field, there is ample variety in assessment methods. Self-regulated learning is an internal process that is not directly accessible, making self-regulated learning a phenomenon complicated to measure reliably and validly (Panadero et al., 2016). Within the subject of learning sciences, there is consensus that research approaches that investigate learning processes as isolated variables in laboratory settings result in an inadequate appreciation of their pertinence in more naturalistic learning situations (Barab and Squire, 2004; with reference to Brown, 1992). Measurement, therefore, is a key issue for the research field of self-regulated learning. It requires researchers to develop different means to assess it (Boekaerts and Corno, 2005), for example, by using think-aloud protocols (Greene, Robertson and Costa, 2011). Furthermore, it has become an acknowledged objective among instructors to foster students' self-regulated learning, aiming to improve their academic performance (Dignath and Buttner, 2008; Schunk and Zimmerman, 1998). Many intervention studies aimed to foster self-regulated learning that positively influenced students' academic performance and motivation (Sitzmann and Ely, 2011; Dignath and Büttner, 2008). Hence, there is a need to effectively measure self-regulated learning both from a theoretical perspective and from the perspective of educational practice.

This chapter provides a classification of the instruments that measure self-regulated learning in higher education settings and sketches their key characteristics. It will also consider the methodological challenges in measuring self-regulated learning. Lastly, it will examine learning diaries as a promising, contemporary form of assessing self-regulated learning that unites measurement and intervention on self-regulated learning within the same instrument, based on the reactivity principle. Reactivity occurs when the research instruments foster students' metacognitive monitoring; subsequently, the instruments simultaneously form an element of the intervention (Panadero et al., 2016).

3.2 Categories of instruments to measure self-regulated learning

3.2.1 Self-regulated learning as an aptitude or as an event

Differing theoretical conceptualisations of self-regulated learning influence the development of instruments to assess its efficacy: instruments can be divided into instruments that measure self-regulated learning either as an aptitude or as an event (Winne and Perry, 2000). When self-regulated learning is viewed as an aptitude, researchers attempt to identify trait-like characteristics of students using a single measurement. The items in aptitude measures aggregate self-regulatory responses over time. The early studies conducted during the development period, e.g. the 1980s to the 1990s, used instruments such as MSLQ, LASSI and SRLIS. These instruments are aptitude measures, considering self-regulated learning as an individual, stable attributes predicting students' future behaviours. On the other hand, component-oriented models of self-regulated learning typically assess learners' attributes for learning, regardless of the situation in which learning takes place. Self-regulated learning is then considered an enduring learner attribute that can be assessed regardless of time and context and is measured as an aptitude (Zimmerman, 2008). However, this view on self-regulated learning is relatively static and results in methodological limitations. Hence, as a reaction, new conceptualisations of self-regulated learning emerged.

Alternatively, during the intervention period, from the late 1980s into the 2000s, self-regulated learning became approached as an event: an occurrence delineated by a prior and a subsequent event. In a situated approach to learning, self-regulated learning is then conceptualised as an arrangement of activities determined by context. Event instruments measure students' regulation activities throughout the performance of a particular learning task. Process-sensitive instruments measure self-regulated learning as a sequence of events. Phase models of self-regulated learning (Pintrich, 2000; Zimmerman, 2000) represent an event approach, separating student self-regulation into different phases: before, during and after learning. Event-measures are suited to infer cause about real-time changes in self-regulation in authentic contexts, as they can assess the sequential dependency of responses (Zimmerman, 2008).

3.2.2 Distinction related to the moment of measurement: online and offline methods

There is also a distinction between instruments relating to the moment at which self-regulated learning is measured. Instruments intended to measure self-regulated learning can then be divided into online and offline methods. An online measure assesses self-regulated learning during students' task performance. Examples of online measures include think-aloud protocols, direct observation, eye-movement registration, and trace analysis. An offline method uses retrospective reports, measuring self-regulation separately or directly after engaging in a learning task. A self-report questionnaire is an example of an offline method to measure self-regulated learning, assessing, for example, the frequency of reported strategy-use (Boekaerts and Corno, 2005). Offline event instruments assess more implicit aspects of self-regulated learning and are often those for which students need some time to remember what precisely took place during task performance (Endedijk et al., 2016). Of these instruments, portfolios and diaries are considered the most promising and valuable instruments to conduct reliable and valid self-regulated learning measurements (Meeus et al., 2009; Zimmerman, 2008).

Methods continue to evolve, with new forms such as micro-analytic methods and educational data mining providing opportunities to measure self-regulated learning (Wolters and Won, 2017). As depicted in Table 1, Endedijk et al. (2016, p.2143) categorised the various sorts of instruments discussed in overviews by Boekaerts and Corno (2005), Van Hout Wolters (2000), Van Hout-Wolters et al. (2000), Winne and Perry (2000).

	Online measures	Offline measures
Aptitude measures		<ul style="list-style-type: none"> - Self-report questionnaires - Standardized interviews - General teacher judgements
Event measures	<ul style="list-style-type: none"> - Think-aloud protocols - Eye-movement registration - Direct observation and video registration of behaviour - Performance assessment through concrete study tasks, situational manipulations, or error detection tasks - Trace-data analysis - Micro-analytic methods - Educational data mining 	<ul style="list-style-type: none"> - Stimulated recall interviews - Portfolios and diaries, or logs - Task-based questionnaires or interviews - Hypothetical task interview

Table 1 Classification of instruments to measure self-regulated learning (adapted from Endedijk et al., 2016, p. 2143)

3.2.3 Overview of commonly used instruments

In their 2016 article on measurement of self-regulated learning, Panadero, Klug and Järvelä identified and characterised three waves in the historical development of measurement instruments. The first wave of development of measurement instruments characterises self-regulated learning as an aptitude. During the second wave, alternative measures were proposed in which self-regulated learning is conceptualised as an event.

Aptitude measures

Aptitude measures consider self-regulated learning as a disposition: a stable feature of the learner. From this perspective, measurement of self-regulated learning relies on self-report and includes instruments such as questionnaires, surveys, and interviews (Panadero et al., 2016; Zimmerman, 2008). Of the measures currently available to assess self-regulated learning, self-report instruments are often applied (Roth et al., 2016; Winne and Perry, 2000). They focus on students' perspectives and beliefs about their learning, and they measure learners' intended use of cognitive, metacognitive, and motivational strategies. Through questionnaires, surveys, and interviews, the use of self-reporting places reliance on students' perspectives and beliefs regarding self-regulated learning. These measurement forms are defined by a more static approach to self-regulated learning. Early studies – conducted during the development phase, which started in the 1980s and ran into the 1990s - frequently involved self-report measures such as questionnaires or interviews (Schunk, 2013). Well-known instruments to operationalise self-regulation processes frequently used during

this period are the MSLQ: Motivated Strategies for Learning Questionnaire (Pintrich et al., 1991, 1993) and the Learning and Study Strategies Inventory, or LASSI (Weinstein et al., 1987). A common feature of these measurement instruments is that students' self-reported, self-regulated learning form the primary data source. MSLQ is comprised of two parts: Learning Strategies and Motivation. Consisting of 81-items, learners answer questions on a 7-point scale, ranging from 'not at all true of me' to 'very true of me'. LASSI is a questionnaire with ten scales assessing skill, will and self-regulatory strategies. LASSI consists of an 80-item questionnaire of strategies used for improving study habits. Students answer questions on a 5-point scale, ranging from 'not at all typical of me' to 'very much typical of me'. The SRLIS: Self-Regulated Learning Interview Schedule (Zimmerman and Martinez-Pons, 1986, 1988). Students are asked to answer open-ended questions concerning hypothetical learning situations, like writing an essay, in a structured interview. The answers are transcribed and classified into 15 self-regulatory classes: goal setting and planning, help-seeking, and self-evaluation. Furthermore, students rate their consistency in strategy use with a 4-point scale, varying from 'seldom' to 'all the time'. Both MSLQ and LASSI are retrospective instruments; the SRLIS concerns prospective answers to hypothetical contextualized tasks and asks how students would approach these tasks (Zimmerman, 2008).

Advantages of offline self-report questionnaires include their ease of being administered to large groups and not interrupting the learning process, allowing researchers to assess a wide array of beliefs, strategies, attitudes, and behaviours. It is also possible to collect information about behaviour longitudinally and across multiple contexts (Wolters and Won, 2017). These instruments are known for their solid psychometric qualities and their ability to capture students' perceptions about their self-regulation of learning. The psychometric quality of these three instruments refers to their high external validity or generalisability of the outcomes, but the self-report method has flaws (Panadero et al., 2016).

A disadvantage associated with these - offline - measures is that learners might not be aware of the self-regulation process when engaged in a learning task since they are asked to report their strategy use retrospectively. This delay may affect their verbalisation of self-regulation processes, as their recollection of strategy was inaccurate or the ability to recognise their use of self-regulation skills was hindered. Actual learner behaviour might not correspond to learner perceived self-reports (Zepeda et al., 2015; Veenman, 2011). It also remains unclear which reference point students have for comparison and which learning situations students allude to when responding to items on self-report questionnaires (Van Hout Wolters, 2000). As self-regulated learning is an internal process, researchers face a general challenge when measuring internal, not directly accessible processes. Self-regulated learning, therefore, is a phenomenon difficult to measure reliably and validly (Panadero et al., 2016). Furthermore, self-reports focus on students' traits and are not intended to portray changes in students' strategy-use brought about by interventions (Boekaerts, 1997). Thus, these instruments are considered de-contextualised aptitude assessments, and sole reliance on these methods is criticised (Endedijk et al., 2016). Therefore, to measure self-regulated learning, self-reports used as a single instrument are not sufficient as a valid and reliable source of information (Panadero et al., 2016). However, even when self-reports might not be entirely accurate, they provide important information for measuring and interpreting learners' perceptions as a central aspect of self-regulated learning (Butler, 2002; Nelson and Dunlosky 1991). Nonetheless, understanding self-regulated learning requires a comprehension of learners' notions "in the context of those inaccurate evaluations" (McCardle and Hadwin, 2015, p.46).

Event measures

As the conceptualisation of self-regulated learning changed, Winne and Perry (2000) considered the MSLQ, LASSI and SRLIS as aptitude measures and instead proposed ways to measure self-regulated learning as an event or process. Event or process measures consider self-regulated learning as time-based and task-related to a known start and end. As opposed to aptitude-instruments, event-measures are more appropriate for identifying connections between different characteristics of actual self-regulated learning in authentic learning contexts (Zimmerman, 2008). Oft-used measurement instruments regard self-regulated learning as an event include thinking aloud protocols and observations of observable behaviour (Boekaerts and Corno, 2005; Veenman, 2011). These measures focus on following students' actual activity, examining the situated regulatory processes of learners. Some event-measures are online or 'on-the-fly' methods that aim to follow students' authentic activity when engaged in learning activities (Veenman, 2011). An example is observational methods, which involve monitoring students' behaviour within the classroom. Because online methods occur during task performance, it is possible to capture what occurs during the execution of the task, and the disadvantages of using retrospective thinking cease to exist (Veenman et al., 2006). Notwithstanding the advantages of online methods, they are critiqued for influencing or disrupting the learning process when students are prompted to think aloud (Greene and Azevedo, 2009). It is also a prerequisite to have the instrument within reach while performing the task. They are thus less suitable in workplace-based learning situations, like internships. Therefore, in the current research project, I chose the retrospective method of learning diaries to study students' situated regulatory processes during their eight-week course. Learning diaries can function as a proxy for observation during learning, and they can measure and influence self-regulated learning simultaneously. In the next section, learning diaries are discussed in more detail.

Aptitude and event instruments contribute to a more thorough comprehension of students' self-regulated learning (Endedijk et al., 2016; Winne and Perry, 2000). However, as no single instrument can capture all properties of self-regulated learning, the selection of instruments depends on the research question and the research setting (Boekaerts and Cascallar 2006; Pintrich 2004). In addition, in educational research, the influence of context in students' regulatory behaviours is increasingly recognised (Perry 2002, Anderman and Anderman, 2000; Pintrich, 1994). It is recognised that to be ecologically valid and bear relevance for educational practice, research should reflect the individual students within their contexts (Goodenow, 1992; Solomon, 1995). This recognition of the importance of context has consequences for the ways we examine self-regulated learning, requiring more contextualised measures.

3.3 Measurement as intervention plus assessment: learning diaries

In their article on the measurement of self-regulated learning, Panadero et al. (2016) propose that after a first and second movement of measurement instruments, we are currently observing the third trend in measurement, with a new variety of approaches and research instruments. Recently, instruments combine the advancement of self-regulated learning while at the same time measuring progress in self-regulated learning. Thus, instruments have been applied that, beyond their measurement purpose, function as interventions to promote self-regulated learning. Hence, measurement and intervention are merged within the same instruments (Panadero et al., 2016). An

example is using learning diaries, which students use to reflect upon their learning process. Diaries have been applied effectively as innovative self-report approaches to research self-regulated learning as an event beyond its trait-like characteristics (Schmitz and Perels, 2011). Event-focused approaches provide a qualitative perspective to comprehending how students regulate their learning (McCardle and Hadwin, 2015; Butler, 2002; Patrick and Middleton, 2002; Perry, 2002). Learning diaries served as an intervention and a measurement instrument in the current thesis. Specifically, the learning diaries assessed students' participation in co-regulated learning.

By using diaries in the context of self-regulated learning, daily or weekly events can be measured over a certain period. With the diaries, students can keep an account of their self-regulation when they engage in self-study, at home, in the library or any other environment outside of the classroom that they use to prepare for classes, study for exams or work on assignments (Schmitz and Perels, 2011; Stoeger and Ziegler, 2008; Schmitz and Wiese, 2006). Self-recording is known as coding actions that occur during performance. Therefore, students' learning actions can be researched over time by analysing learning diaries. Simultaneously, students' reflection on their learning actions through diaries affects their future actions. Particularly, diaries can foster formal self-monitoring, which involves systematically observing and recording self-regulated learning processes (Schmitz and Perels, 2011). Schmitz (2006) proposed that using diaries leads to reactive effects: the effect derived from monitoring when observed behaviour changes due to self-observation. This way forms an external tactic to monitor and reflect on learning. In this way, learning diaries are not merely a measurement instrument but an intervention tool simultaneously (Panadero et al., 2016). Hence, diaries are a method to measure and influence self-regulation simultaneously in the desired direction. Diaries inherently involve self-report data (Schmitz and Perels, 2011), which can be both an advantage and a shortcoming at the same time. Nevertheless, the ecological validity of diary measures is high, even if they depend on self-reporting (Panadero et al., 2016; Schmitz and Perels, 2011). Ecological validity examines whether the results of a study can be generalized to real-life, naturalistic settings (Van den Akker et al., 2006). Thus, when assessing changes in self-regulated learning in ecologically valid contexts, diaries have demonstrated equally or even higher sensitivity than pre-test and post-test measures (Zimmerman 2008).

When used as a research tool, diaries can be considered a self-administered questionnaire. Within the context of self-regulated learning, diaries serve as an instrument for measuring learning processes for a specific duration. Students complete the learning diaries in their natural learning environment over a particular time, thus allowing the researcher to observe student learning unfolding over time. They serve as a proxy for observation, as it is impossible to directly observe students' development of self-regulated learning in personally managed contexts. Schmitz (2006) argued that diaries lead to reactive effects: the effect derived from monitoring when observed behaviour changes due to self-observation. In his research, Schmitz made comprehensive explorations of producing the reactivity-effect through the measurement method of diaries (Schmitz and Wiese, 2006). In his approach, structured learning diaries are used as tools for self-monitoring, and data collected with the diaries are utilised to conduct time series analysis (Schmitz, 2006; Schmitz, Klug, Schmidt, 2011). Structured diaries can contain one item that should be answered regularly, for example, asking students daily how much time they were engaged in self-study. Alternatively, the relative presence of an event can be measured over time with a rating scale, such

as students' levels of anxiety. Furthermore, complex constructs can be measured with diaries consisting of pre-studying and post-studying questions, recording several items.

3.4 Summary

Despite three decades of research into self-regulated learning, contemporary researchers face several challenges. First, they face theoretical and methodological challenges when seeking to advance understanding of self-regulated learning and how to encourage and support it (Schunk, 2008). One challenge for researchers is that self-regulated learning has been recognized as a multifaceted, multi-component and integrative theory (Butler, 2015, Zimmerman, 2008). In turn, researchers pursue approaches for studying "how these multiple components co-relate dynamically to shape learning-in-action" (Butler and Cartier, 2018, p.352). In addition to this challenge, it remains demanding to mobilise the rich knowledge base on self-regulated learning to profoundly impact educational practice (Butler and Schnellert, 2012; Cartier, Butler, and Bouchard, 2010). Another issue involves researchers increasingly considering how self-regulated processes are situated and context-dependent (e.g., Järvenoja, Järvelä and Malmberg, 2015). Correspondingly, present-day research pursues methodological strategies that enable the investigation of the interaction of individual, social, and contextual factors in encouraging learners' engagement in self-regulated learning (e.g., Hadwin and Oshige, 2011).

Despite advancements in theoretical framing, there are limited methods available to make the mental processes and the social and contextual aspects of self-regulated learning processes observable. Different measurement instruments provide a diversity of results, and instrument choice is an issue of debate in the field. For example, there are opposing views regarding offline or online measurements (Winne and Perry, 2000). Self-report questionnaires have long been the most common instrument to measure self-regulated learning. However, self-report instruments are considered incomplete indicators of actual regulation activities (Veenman, 2011; Boekaerts and Corno, 2005). Nonetheless, MSQ and LASSI are valuable means to measure students' self-regulation capacity and general motivation (Endedijk et al., 2016; Zimmerman, 2008; Pintrich, 2004). Furthermore, an advantage of the reliance on self-report instruments is that reliable measures have been established and widely used to operationalize aspects of self-regulated learning, such as the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991, 1993). Self-report measures combined with other instruments allow for data triangulation (Panadero et al., 2016; Dresel et al., 2015; Panadero et al., 2012). Instead, the viewpoint that self-reports can merely measure a static view of self-regulated learning has altered, and self-reports are currently applied in more contextualised measurement instruments, such as diaries.

Chapter 4: Theoretical framework

4.1 Introduction

The importance of social context in the self-regulation of learning changed during the last three decades. Emerging perspectives of self-regulated learning propose increased attention to clarifying the influences of context and social factors on self-regulated learning. In addition, learning has ceased to be considered solely individual or exclusively collaborative. The field of research is now challenged to overcome this dichotomy and examine the interplay between the three modes of regulation: self-regulated learning, socially shared regulation, and co-regulation of learning.

The purpose of this chapter is to discuss the concept of co-regulation of learning and the specification of the framework I have chosen to organise to support the research question of my thesis. Furthermore, it aims to provide the conceptual rationale for the research design and the proposed data collection techniques for this research project. After discussing critical perspectives on self-regulated learning, I introduce a model (based on Allal, 2007) of co-regulated learning, established in a situated perspective on classroom learning and its underlying conceptions. Finally, as self-regulated learning in this thesis is considered situated and context-dependent, I propose an adapted model for the classroom intervention implemented as part of this research project in the last section of this chapter. This enables researching co-regulation of learning within a first-year course for university students as the process whereby social environment assists the development of regulation, appreciating that support is distributed amongst people (rather than one or more capable others), task, tools, and environment (McCaslin, 2004).

4.2 A situated model of co-regulation of student learning

4.2.1 A social-constructivist perspective on learning and teaching

Learning is increasingly seen as a situated activity: “the way students come to understand theory, content, learning strategies, and themselves as learners is deeply rooted in the contexts in which they learn” (Hadwin and Oshige, 2011, p.241). Social constructivism proposes that knowledge is situation-specific and context-dependent. Social factors play a fundamental aspect in learning, and the collaborative nature of much learning is emphasized. Situated cognition – as a constructivist learning theory - stresses that students’ knowledge is created within and is inseparable from the activity, context, and culture in which they learn (Brown et al., 1989). Rather than viewing learning as a mere accumulation of knowledge, it is perceived as an increasingly effective performance across situations. Students learn by trying out learning strategies to carry out learning activities and assignments. They then appraise and adapt those study approaches for new learning situations and contexts (Hadwin and Oshige, 2011; Brown and Duguid, 1993).

This thesis situates the regulation of learning within a social constructivist theory of learning. Constructing new knowledge occurs within constructivist views on learning by actively connecting new information with prior learning. In addition, in social constructivist learning theories, knowledge develops through social interaction and is, therefore, a shared, rather than an individual, experience (e.g., Palincsar, 1998). Zimmerman’s cyclical phase model of self-regulated learning (2000) is

expanded with the notion of co-regulation of learning to include regulation by others, including teachers, peers, tasks, and instructional materials. Teaching and learning thus form interconnected elements of education and self-regulation learning by students, and sources of regulation in the learning environment are reciprocal. Following critical notions of self-regulated learning, I assert the regulation of learning in a university setting to be a shared responsibility. Both students, teachers, and the educational institution play a role in the 'moral purpose of education' and contribute to "making a positive difference in the lives of students and to help produce citizens who can live and work productively in increasingly dynamically complex societies" (Fullan, 2001, p. 4). Given the importance during formal education and beyond throughout life, I consider regulating one's learning an essential skill. Rather than reproducing inequality (e.g., Vassallo, 2015; 2012), I argue that the concept of co-regulation of learning offers an instrument and an opportunity to overcome inequalities. To do so, however, students should not be assumed to individually carry the burden of becoming able to regulate their learning. Instead, the socio-instructional environment should share the load and assume shared responsibility.

Researching the interplay between cognitive and social processes related to learning continues to be a challenging endeavour. Within the socio-cognitive perspective on self-regulation of learning, the emphasis remains on the learner's cognitive processing and skills acquisition. Self-regulation develops within the individual and is assisted externally through teacher modelling and peer feedback. Within this perspective, the contextual and the social dimensions of learning (i.e., observation, interaction, feedback) are considered independent or intervening variables that influence students' cognition. Nevertheless, as Järvenoja et al. (2015) stress, learning does not occur in a vacuum: it develops and constantly changes within dynamic contexts and conditions. Although there is recognition of reciprocal influences between social and cognitive dimensions, socio-cognitive oriented research in self-regulated learning typically stresses a unidirectional effect of social factors on individual cognitive aspects of student learning, such as strategy-use (Allal, 2018). Allal's framework (2007) aims to integrate the social, contextual, and individual levels of regulation in classroom settings, and she defines co-regulation as the "joint influence of student self-regulation and sources of regulation in the learning environment" (Allal, 2020, p.7).

4.2.2 A model for co-regulated learning

Allal's co-regulation model of student learning (2007) offers a starting point for conceptualising this shared responsibility. Allal (2018) suggests that co-regulation implies an interplay between the teacher's efforts, whether deliberate or unintentional, to supply students with resources to assist their regulation of learning and students' attempts to integrate elements of this instruction within their self-regulation strategies (p.29). Allal's model (2007) provides a high-level overview of key components built into a situated model of regulation of learning. The model (Figure 2) identifies sources of regulation at three levels, present in any teaching and learning situation. A further source of contextual regulation is represented in tools: sources of regulation that link each level of the model and are used for instruction and assessment.

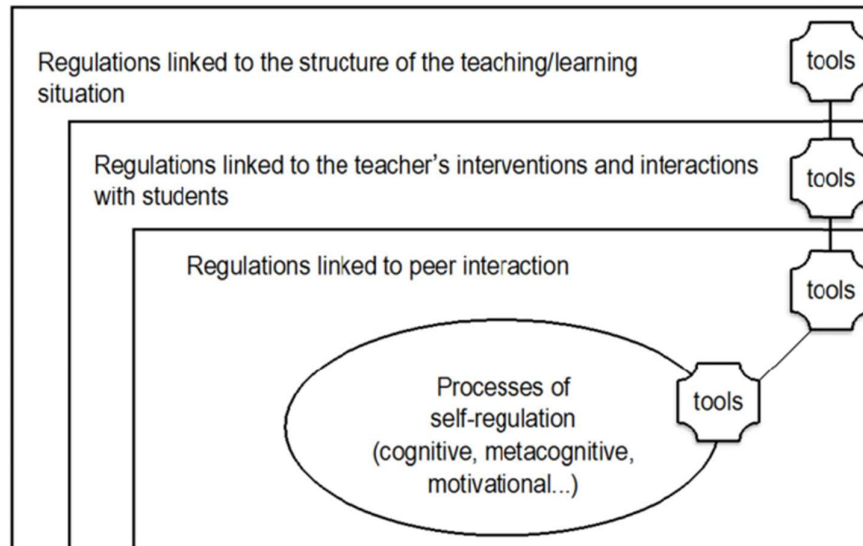


Figure 2: a model of co-regulated learning (Allal, 2007)

At the heart of Allal's nested model are the key self-regulated learning processes as they occur when students engage in a teaching and learning situation. The model identifies different sources of regulation linked to contextual factors:

1. The way the teaching and learning environment is structured, referring to the curriculum, the specification of learning goals, the genre of readings to be studied, the sequencing of lectures, tutorials, and individual work.
2. Teachers' interventions and their interactions with students; explicit instruction in self-regulated learning focussed on reading academic texts, whole-class discussions: elaboration on critical reading assignments, interactive revision of writing tasks.
3. Peer interactions between students, including collaborative tasks like the joint reflection on course materials.
4. Tools serve as linkages between the different levels of the model; they amplify the effects of co-regulation and allow recording traces of student activity. Tools can take the form of instructional materials, cultural artefacts such as dictionaries, technology-enhanced learning environments, mobile apps, and assessment instruments.

Co-regulation of learning, then, is regarded as the process whereby the social environment supports the emergence of regulation. It recognizes that support is distributed amongst people (rather than one or more capable others), tasks, tools, and environment (McCaslin, 2004). In this perspective, learning is situated, and all learning within a classroom is considered co-regulated. Even if it is of differing significance, whenever regulation of learning occurs, both self-regulation and contextual sources of regulation are simultaneously operational. As Allal states: "This means that student self-regulation develops in interaction with multiple sources of regulation in the learning environment and, at the same time, contributes to the deployment and exploitation of these sources in the learning activities undertaken in class" (2010, p. 349). The sources of contextual regulation can either foster or hamper students' self-regulation of learning. Conversely, students' self-regulated learning strategies can strengthen or hinder the sources of contextual regulation (Allal, 2018).

The nested structure is an essential element of Allal's model (2007). The sources of regulation are hierarchically embedded within the learning environment, and students' self-regulatory processes are positioned at the heart of the model (Allal, 2019). The interactions depicted in the model occur within the structure of the teaching and learning situation. This structure is established and outlined by the curriculum or the teacher prior to enacting the situation (Allal, 2019). Furthermore, the teacher similarly formulates and regulates a framework (the course instructional design) in which students interact. In this sense, the model can be distinguished from other conceptions of regulation emerging in social situations, which do not consider the sources of regulation embedded in the teaching and learning situation (Allal, 2019).

Allal's model places prominence on how contextual and individual processes of self-regulated learning interact and unfold dynamically over time. Similarly, Butler and Cartier (2018) present a situated model of self-regulated learning, which foregrounds how students' engagement in self-regulated learning is contingent on the context and individuals' interactions (Figure 3). Both models draw on concepts developed in work on situated learning and cognition (Brown et al., 1989). In their model, Butler and Cartier (2018) illustrate how self-regulated learning develops at a particular time and within a specific context. They consider self-regulated learning inherently social (Butler et al., 2017) and shaped dynamically and iteratively while studying alone and with others (Butler and Cartier, 2018). Students' engagement in self-regulated learning is shaped by the interplay between what students bring to the learning environment (such as their prior knowledge, work habits and metacognitive knowledge) and the opportunities and constraints presented by the contexts in which students are living and learning, as depicted in the outer layer of the model. Within the (primary and secondary) school environment, Butler and Cartier identified two types of contextual influences on self-regulated learning: (i) teaching and learning activities, designed to foster self-regulated learning, and (ii) dynamic supports provided to students, both in the classroom and during homework. Furthermore, the model implies that whether students engage in self-regulated learning depends on their appraisal of the value and relevance of the activities and context and their emotions and motivation. At the centre of the model, students' engagement in the iterative cycles of planning, monitoring, and reflecting is depicted.

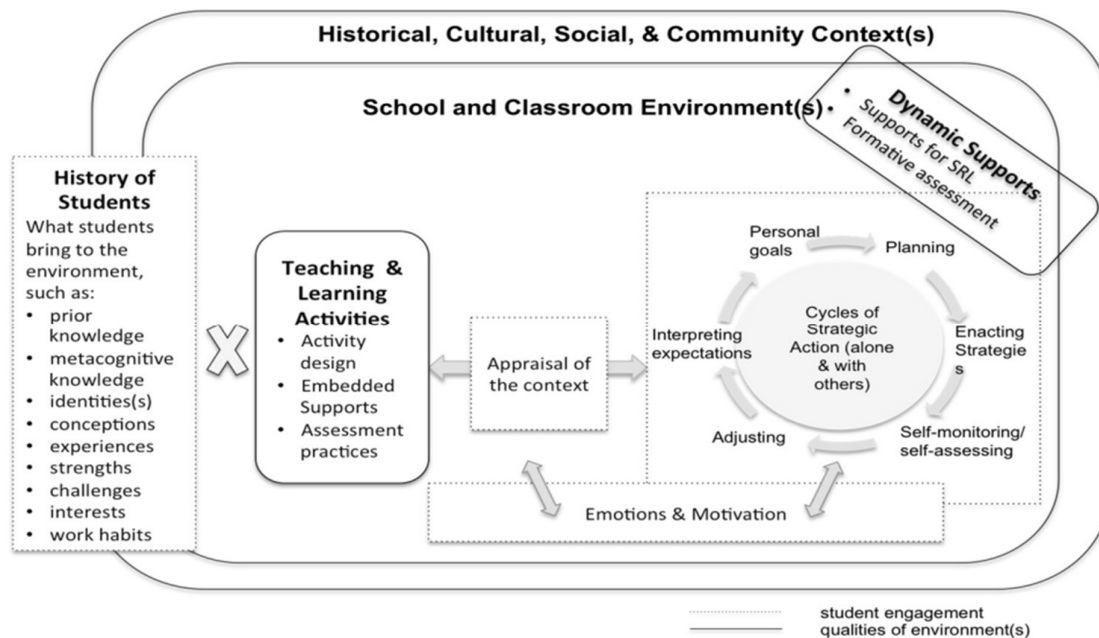


Figure 3: A model of self-regulated learning as situated in context (Butler and Cartier, 2018)

The theoretical underpinnings of both Allal’s model of co-regulation of learning (2007) and Butler and Cartier’s situated model of self-regulated learning (2018) influenced the design of the intervention I undertook in this thesis, aiming to encourage first-year university students to engage in self-regulated learning. The primary influence on my intervention is Allal’s model (2007), which stresses the concept of co-regulation of learning. However, Butler and Cartier’s situated model of self-regulated learning suggests a broader conceptualisation of context than merely what takes place within the classroom. Their model foregrounds that students’ engagement in self-regulated learning is affected by their individual histories and how they interact within contexts. This element is missing in Allal’s model (2007). Although Allal aims to integrate the social, contextual, and individual levels of regulation in classroom settings, her model (2007) focuses on students’ attempts to incorporate components of the teacher’s instruction within their self-regulation strategies (p.29). The intervention I proposed in this thesis is primarily based on Allal’s conceptualisation of co-regulated learning but has undergone slight modifications to fit with a university setting. Furthermore, consistent with the model by Butler and Cartier (2018), it takes into account students’ varying histories and what they bring into the learning environment, and which influence their ability and perhaps readiness to engage in progressing forms of self-regulated learning.

4.2.3 Conceptions of co-regulated learning underlying Allal’s model

The model of co-regulation developed by Allal (2007) draws on conceptualisations of situated learning and cognition. Within a situated view on teaching and learning, a fundamental assumption is a notion that knowledge is formed within and connected to the activity, context, and culture in which it is acquired: ‘how’ something is learned is integral to ‘what’ is learned (Brown, Collins and Duguid, 1989; Allal, 2018). Two conceptualisations of situated learning and cognition influence Allal’s work, particularly her co-regulation model (Allal, 2018). The first source refers to a Vygotskian conception of social mediation. Allal considers appropriation during interactions between learners and teachers as bi-directional: “as the learner appropriates new skills under the teacher’s guidance and

scaffolding, the teacher also appropriates aspects of the students' actions into his or her ongoing system of instruction" (Allal, 2019, p. 28). The second source refers to the evolution of taken-as-shared, meaning the aims and tasks to engage in when teachers lead interactive exchanges with an entire class. A significant notion developed by Cobb et al. (1997) is that meaning is never identical in the minds of all participants in the teaching and learning situation within classroom interactions. Allal (2019) provides an example of how this works: the learning goals of a course are detailed by the curriculum or teacher, but they are subjected to interpretation, explicated, or re-articulation during classrooms interactions.

Self-regulated learning is the opposite of external- or 'other-regulation'. External regulation is linked to regulation in the learning environment, like scaffolding, scripting, or structural features that offer support, such as the structure of tasks. 'Other-regulation' involves interventions by more proficient others, such as a teacher or more advanced peer, who are temporarily guiding joint activity. Rather than conceptualising co-regulation as a mechanism or regulation, among others, Allal (2016, 2007) identifies co-regulation as a concept that integrates the social and individual elements of student regulation, which are considered mutually constitutive, in classroom settings. This interpretation differs from the formulations of Hadwin and Oshige (2011), Volet et al. (2009), and Andrade and Brookhart (2019). When Hadwin and Oshige (2011) distinguished three types of student regulation of learning (i.e., self-, shared-, and co-regulation of learning), they characterised co-regulation as the intermediary process in the learner's acquisition of self-regulated learning strategies as a result of the interaction with one or more capable others (a teacher or a more advanced peer). This definition is consistent with a Vygotskian perspective, as developed by McCaslin and Hickey (2001). This Vygotskian viewpoint means that by scaffolding in the learner's zone of proximal development, learning strategies will be adopted, incorporated by the student as self-regulation strategies. This approach's similarity to Allal's model lies in the shared role in student learning of the individual processes and the socio-instructional environment. Volet et al. (2009), on the other hand, used the term 'co-regulation' as any socially negotiated regulation by either more proficient others or others with equal status. They recognize the interdependence and reciprocal influence but maintain the differentiation between self-regulatory and co-regulatory mechanisms. Likewise, Andrade and Brookhart (2019) acknowledge the interrelationship between self-regulation and co-regulation, but they characterize co-regulation of learning as 'other regulation' by teachers, peers, instructional materials, and assessment practices.

Co-regulation is also regarded as a transitional process with the appropriation of self-regulated learning as the desired outcome (Hadwin and Oshige, 2011). In this perspective, the objective of education is to support students in becoming independent, self-regulated learners, and co-regulation or socially shared regulation is the method to attain this goal. Allal, on the other hand, proposes that co-regulation is the way of advancing learning and the (evolving) result: self-regulated learning does not occur as an independent concept (Allal, 2019). In Allal's model, all student learning in the classroom is co-regulated instead of self-regulated. She cautions, however, that despite the prominence of co-regulation, this does not detract from the prominence of the processes of student self-regulation, which are located at the heart of the model. Sources of regulation in the learning environment are characterised by affordances. These affordances do not guarantee that students regulate their learning; teacher interventions, assessment, peer interactions, and tools are only effective if the learner acts upon them. "How and when the affordances of a contextual source of

regulation become operant depends on learner agency” (Allal, 2019, p. 10). In her model (2007), co-regulation is not a transitional mechanism towards autonomous self-regulated learning or independent practice. Learners do, supported by sources of regulation in the educational setting, appropriate regulatory strategies and expand their repertoire of self-regulated learning strategies. However, the continued application of a strategy always depends on the new teaching and learning situation of a subsequent course, where the contextual factors influence the activation of strategy use and its transfer to subsequent learning situations (Allal, 2019). For Allal, the fundamental objective of education is not independent self-regulated learning; instead, the aim is to achieve active student engagement in more and more progressive forms of co-regulated learning (Allal, 2019; 2018).

4.3 A model of co-regulated learning in a university-setting

Self-regulated learning forms a component of Allal’s proposed model of co-regulated learning (2007), but, as she declares, self-regulation of learning always operates within a setting of co-regulation of classroom learning (Allal, 2018). However, Allal researched co-regulation mainly in the context of elementary schools or secondary education. Therefore, for the research context of this thesis project, a redefinition of both classroom learning and the ultimate aim of co-regulation of learning is needed. I, therefore, propose an adaptation of the model Allal (2007) to fit the perspective of teaching and learning in a university setting.

In university, greater reliance upon self-regulated learning emerges. Learning in a university setting differs from classroom learning in primary or secondary education. Learning situations become more complex within the university, and instead of showing understanding and application of learning content, students are required to demonstrate higher-order levels of thinking like synthesis, evaluation, and creation (Bloom, 1994). There is typically less opportunity to receive external feedback (Peverly et al., 2003), and there are fewer contact hours. This results in a stronger emphasis on independent self-study outside of the classroom. Learning within a university setting takes place within and outside of the classroom. The classroom situation can be either on-campus or facilitated online or through a hybrid format. Sources of contextual regulation, then, are only partly available to the student, and the student becomes more dependent on her or his capacity to self-regulate learning.

When researching co-regulation of learning in a university context, the outcome alters compared to primary or secondary education. As Allal herself asserts, in a school setting, the outcome is not self-regulated learning. This changes in a university setting, where students are not merely prepared for the next level in the educational setting, but for life outside of and beyond the educational system and the classroom walls. Self-regulated learning strategies and skills thus help to prepare learners for life-long learning. Learning beyond university requires more self-directed forms of learning, where an adult learner is at liberty to decide what to learn, when, where, and how to learn to achieve their goals (Knowles, 1975). Being able to self-direct one’s learning requires self-regulated learning abilities. Using contextual sources of regulation, such as utilizing tools like a mobile app to scaffold learning or asking for help from a more experienced co-worker, can be viewed as forms of adult learners’ participation in co-regulated learning. This co-regulation then is self-organised and can be supplied as a tool like a dictionary or offered through a learning environment (such as a MOOC on a

platform like Coursera). When considering the university teaching and learning setting, I propose the model as shown in Figure 4 below as a co-regulation model that fits an intervention for first-year university students.

The socio-instructional environment forms the unit of analysis, and just like Allal’s model (2007), it encompasses all elements within the teaching and learning environment. In Allal’s model, student self-regulation is influenced by the regulatory activities associated with and encouraged by the learning environment or curriculum, teacher activities and interactions with students, peer interactions, tools used for instruction and assessment. Other than Allal’s model (2007), the characteristics of students entering the learning environment, such as existing study behaviours or metacognitive knowledge, are specifically considered. The focus of the adapted model is on the teaching and learning situation at a course level within the university and how self-regulated learning can be encouraged and supported through co-regulation. Nevertheless, consistent with Butler and Cartier (2018), students’ characteristics or what students bring to contexts are also taken into account. Learners bring knowledge, beliefs and mental models of the self, task, and domain to a learning situation (Hadwin et al., 2018). Students’ study behaviours, metacognitive awareness, motivation, and perceptions of self-efficacy beliefs bi-directionally influence the context of the teaching and learning environment. Students need to coordinate multiple worlds, expectations, and goals within the socio-instructional environment. As McCaslin and Hickey describe it: students’ primary task is “to learn ‘goal coordination’ to identify and evaluate the array of goals and tasks they engage in, their interrelationships, and strategies to prioritize and optimise among them” (2001, p. 242). This goal-coordination is learned, and within the teaching and learning environment, teachers have a task in promoting “student mediation processes of motivation, enactment, and self-evaluation” (McCaslin and Hickey, 2001, p. 243).

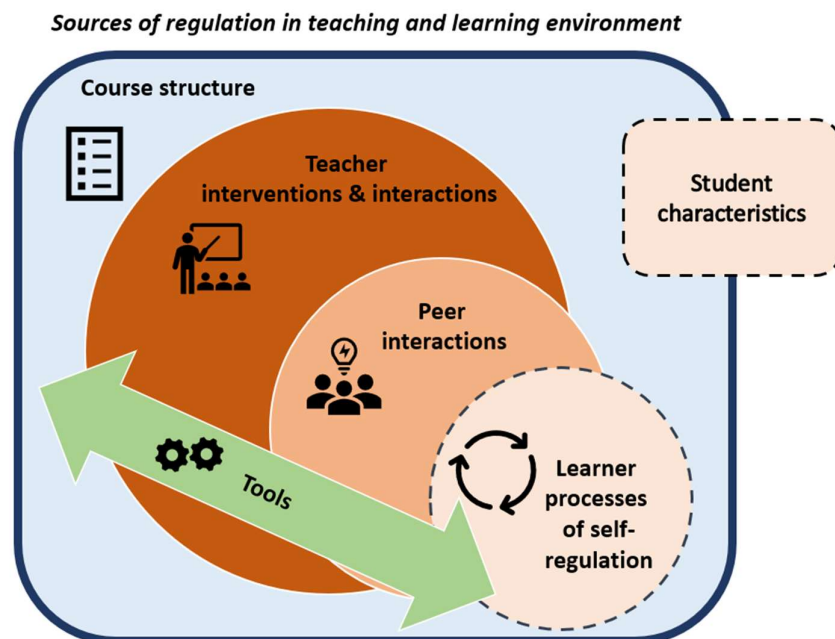


Figure 4: Model for co-regulation of learning in a university setting (adapted from Allal, 2007)

Sources of contextual regulation: Course structure

Where Allal (2007, p.16) depicts the outer layer of the model as “regulations linked to the structure of the teaching/learning situation”, I chose the term “Course structure”. Teaching and learning in a subject in primary and secondary schools usually spans an entire school year; in university, the academic year is often divided into terms, such as trimesters. Students follow courses that generally span a specific period within the academic year. These courses have a demarcated starting point and an end. The term ‘course structure’ refers to the course instructional design, which is defined prior to enacting the teaching and learning situation. It forms a framework and structure for the actions and interactions of the participants within the course: the teacher(s), the students, and the individual learner. The course structure includes the learning goals, structure, type and sequencing of tasks and activities, and time and location in the instructional setting.

Sources of regulation: Teacher interventions and interactions

In Allal’s model (2007), the sources of regulation available at the layer of the ‘Teacher interventions and interactions’ represent the classroom setting where the teacher enacts the instructional situation. Teachers’ interventions and interactions include whole-class discussions to prepare or follow tasks, the interaction with small groups and individual students (Allal, 2018, 2007). In Butler and Cartier’s model, this element is referred to as ‘Teaching and Learning activities’, which includes how learning design and supports for self-regulated learning within the classroom are constituted within activities (Butler and Cartier, 2018). Within a university setting, a course can have multiple lecturers teaching the course, and the course can consist of multiple modes of facilitation. The teachers’ interventions and interactions with students can vary per the mode of facilitation and lecturer. For example, in the context of the department in which the course *Introduction to Human Communication* is offered, the course coordinator delivers the course lectures to the whole cohort of students. These lectures are usually more focused on content delivery and less on the interaction between lecturer and students. Smaller-group tutorials facilitated by other lecturers follow the whole-group lectures. These tutorials are typically oriented to a deeper processing of the course content and characterized by more active and engaged learning by students and more teacher-student interactions and collaboration between students. The classroom-setting refers to the joint enactment of all teaching within a particular course, whether online, in a hybrid format, or face-to-face, on-campus.

Sources of regulation: Peer interactions

Peer interactions as a source of regulation refer to the interactions between students. This can include group discussions during collaborative tasks in class, peer review or joint reflection on learning materials. It also refers to informal exchanges between students (Allal, 2018; 2007). Regulatory engagement and expertise are distributed and shared across students in group work. When students work together on a task, socially shared regulation of learning emerges, which involves a group of students taking metacognitive control of a task together. Planning, monitoring, and evaluation are shared amongst students to elicit adaptations in learning and approach of the task (Hadwin et al., 2018). In this way, co-regulation affords a shift or internalisation of regulatory processes (Hadwin et al., 2005). In Allal’s model (2007), peer interactions entirely occur within the classroom setting. Many of the peer interactions occur within the classroom setting within a university setting but not exclusively. Small-group work also takes the form of independent study without the presence of a teacher, for example, when students write a group paper or prepare a

presentation. Therefore, in the adapted model, peer interactions are partly positioned outside of the classroom.

Sources of regulation: Tools

Tools are sources of regulation that link every layer of the model and incorporate instructional materials, educational technology, and assessment instruments (Allal, 2019). Tools serve as connections between the various levels of regulation; they amplify the effects of interactive co-regulation and allow the recording of traces of student activity. For example, an assessment rubric containing performance criteria forms part of the course instructional design. During the enactment of the teaching and learning situation, the rubric can be discussed and specified during a class discussion to prepare for a learning task (linkage). This discussion of the rubric can make learning goals or objectives for a specific task more explicit (amplification). Students can subsequently use the rubric during self-study to monitor and evaluate their performance of this task. Alternatively, the rubric can be used as a student checklist for peer assessment of other students' work (recording of traces). The teacher can use this for deferred regulation. The information can be used to identify difficulties that students experienced in performing a task and prepare new teaching activities to assist students in overcoming these challenges and reaching their learning goals (Allal, 2020).

Learner processes

In Allal's model (2007), the cognitive, metacognitive, behavioural, and motivational self-regulation processes are positioned at the heart of the nested structure. These self-regulation processes occur when the learner takes part in the educational setting. In my adaptation, these self-regulation processes are still central in the nested structure model. However, in university, these learner processes occur both within the classroom setting and outside of the classroom during self-study. The instructional method of independent study typical to university study is long-studied and delegates the primary responsibility for learning to the student (e.g., Felder 1964). Learning outside of the classroom can either be during group work with peers or individual self-study, at home or in the library. The sources of regulation present within the teaching and learning environment are affordances that provide possibilities for action by the student. Whether the learner identifies and uses these affordances depends on students' appraisal of the learning situation (e.g., Boekaerts, 2011) and on learner agency: the purposeful and goal-directed initiative by the learner (Reed, 1996). In the adapted model, this is depicted by a dashed line around the learner: how, when, and even *if* the affordances of co-regulation become operant is influenced by the student's agency (Allal, 2019; Hadwin et al., 2018). In addition to Allal's model, students' characteristics form a part of the adapted model. These characteristics, referred to as the history of students by Butler and Cartier (2018), are brought to the teaching and learning environment. Students do not enter the context of a course as blank slates: they acquired previous learning experiences (e.g., in secondary education), study habits, conceptions about learning and their abilities (e.g., Butler and Cartier, 2018; Järvenoja et al., 2015). These characteristics bi-directionally influence the context of the teaching and learning environment on the one hand and their propensity to engage in self-regulated learning in the context of the specific course. Thus, in the adapted model, students' characteristics consist of their study behaviours, metacognitive awareness, motivation, and perceptions of self-efficacy beliefs. Especially during independent self-study, it might take more effort for the learner to use the sources of regulation within the classroom setting. Without the presence of a teacher and peers and away from the classroom setting, the learner takes additional effort to transfer self-regulation processes to

independent study tasks. This demonstrates that, within a university setting, the objective of providing contextual sources of regulation is not merely students' increased participation in co-regulated learning but also preparing students for life-long learning after they graduate.

4.4 Summary

In this chapter, I discussed the concept of co-regulation of learning and the specification of the framework I have chosen to support the research question of my thesis. Then, I introduced two models of self-regulated learning developed based on a situated perspective on learning and its underlying conceptions (Butler and Cartier, 2018; Allal, 2007). In the last section of this chapter, I proposed an adapted model (based on Allal, 2007) for the classroom intervention implemented as part of this research project. This enables researching co-regulation of learning within a first-year course for university students as the process through which the social environment supports the emergence of regulation, acknowledging that support is shared amongst people (rather than one or more capable others), tasks, tools, and environment (McCaslin, 2004). This *model for co-regulation of learning in a university setting* provides the conceptual rationale for the research design and the proposed data collection techniques for this research project. These will be discussed in chapter five.

Chapter 5: Research design

5.1 Introduction

This chapter aims to justify the research methodology and research methods. The chapter specifies the intervention and the specific methodology and methods chosen to carry out the research project. A design-based research design was used to investigate how contextual sources of regulation can encourage students to participate in co-regulation of learning and engage in self-regulated learning. A classroom intervention study was carried out during the first term of 2020-2021. The research instruments used to collect quantitative and qualitative data consisted of a pre-test and post-test questionnaire, structured learning diaries, and a focus group interview with the teaching team to address the research question. The diary methodology will be explained and justified as an approach that can be implemented online to encourage regulation of learning and record traces of participation and engagement in the regulation of learning.

The current chapter first elaborates on the relationship between educational research and educational practice and continues with a statement of the researcher's positionality when conducting the educational research for this thesis project. The chapter then describes the methodological approach and the data collection techniques chosen for this research project. Furthermore, a detailed description of the co-regulated learning intervention developed and implemented is given. Next, the data collection methods and the method of data analysis will be explained, and finally, the ethical considerations of my research will be discussed in this chapter.

5.2 Educational research and practice

An important question in the literature is the relationship between educational research and educational practice. Educational research has been critiqued for its inability to address complex problems in educational practice (e.g., Slavin, 2002, 2004; Biesta, 2007). The assumed chasm between research and practice then refers to the assertion that the knowledge produced by educational researchers does not (sufficiently) find its way into educational practice, i.e., practitioners do not apply it. However, there are various ways in which educational research might be of practical significance and different ways in which this knowledge might be used in practice (Biesta, 2007). When discussing the knowledge produced by educational research, it is often the 'technical' or 'instrumental' knowledge that is referred to. This technical role of educational research (De Vries, 1990) stems from the idea that to be of use, research should provide practitioners with scientific knowledge that describes 'what works' (e.g., Slavin, 2002; 2004; Biesta 2007). Generally, technical knowledge indicates what to undertake to reach a specific result, such as effective teaching strategies or assessment strategies (Biesta, 2007). In addition, teaching and learning can also be improved by providing contrasting understandings of educational practice, i.e., what De Vries (1990) called the 'cultural role' of educational research. Biesta (2007) depicts this cultural function as follows: "To see a classroom through the lens of behavioral [sic] objectives or through the lens of legitimate peripheral participation can make a huge difference, not only in that we can see things differently but also in that we may be able to see problems where we did not see them before. As a

result, we may see opportunities for action and improvement where we did not see them before.” (Biesta, 2007, p. 296).

From this perspective, the purported chasm between research and practice concerns educational research’s technical role and largely disregards its cultural role. A different picture can be painted when including the cultural role of research. Biesta (2007) refers to the effects of constructivist notions on educational practice as an example of how educational research has had an enormous impact on what takes place in classrooms and schools. Hence, the technical and cultural roles represent how research can benefit educational practice. It nevertheless raises the question of why educational research is perceived to be unsuccessful in producing technical educational knowledge, the ‘what works’ sort of knowledge (Biesta, 2007). The Design-Based Research Collective (2003, p.5) contends that “educational research is often divorced from the problems and issues of everyday practice”. In this view, educational research investigates trivial matters from a practitioner’s perspective, leading to ineffective exchanges between practice and research. However, to generate ‘what works’ knowledge, a causal relation is assumed between educational processes, like teaching and their learning outcomes. If learning is viewed as a symbolically mediated action, teaching only influences learning because students interpret and attribute meaning to what is taught. Seen in that light, the lack of production of the ‘what works’ sorts of knowledge might be less problematic.

All in all, the purpose of education is not to simply condition students’ behaviour. Again, referring to Fullan (2001), if we aspire to prepare our learners for ‘increasingly dynamically complex societies’ and live up to the ‘moral purpose’ of education, the focus should shift from an instructional paradigm to a learning paradigm. Teaching is not merely applying academic knowledge and applied skills or the haphazard application of evidence-based guidelines. Rather, it requires educators’ professional judgment, requiring expert knowledge, and fitting each educational situation’s specifics (Smith, 2008). In this perspective, the role of educational research and its outcomes is to assist professional judgement and action rather than prescribe what should be done. Van den Akker (1999, p.2) argued that many conventional approaches to educational research, such as experiments, surveys, or correlational analyses, emphasise description. He claims that the educational reforms worldwide require systematic research warranting development and implementation in diverse settings. When educational research and policy lack theoretical grounding and are detached from the insights of social science theory, they overlook the origins of the problems they aim to attend to, hence contributing to ‘reform without change’: changes in the curriculum or pedagogies that are neither structural nor effective.

5.3 Researcher positionality and reflexivity

My role at the university at the time of the research project was threefold: (1) I advised teaching staff and School management about opportunities for educational innovation, (2) I worked in close collaboration with lecturers to design, develop and implement educational interventions aimed at improving educational quality, and (3) I researched the pedagogical value added to learners’ experiences as a desired result of the implemented interventions. As an educationalist with 20 years of experience in various education sectors, the motivation for my work lies, in large part, in responding to the needs of educational practice, in particular: students, teachers, and educational institutions. At the same time, I shy away from the ‘pragmatic solutions in a hurry’ sometimes asked

for by practitioners and school management. Therefore, in addition to answering the question 'was it effective', this thesis aims to shed light on questions like 'how did it work', 'why did it work' and 'what have we learned'?

As both an educational consultant and educational researcher, my epistemological perspective is interpretivist, thus accepting the idea that reality is subjective and knowledge is constructed based on personal experiences and culture. Hence, context, values, beliefs, and meaning can all be studied and are central to understanding aspects of teaching and learning. This thesis, therefore, situates the regulation of learning within a social constructivist theory of learning, which suggests that knowledge is situation-specific and context-dependent. Within social constructivism, "the actions to be regulated and the goals to be pursued are specified by particular social roles and situations" (Paris et al., 2001, p. 255). The social environment has a crucial role in learning, and the collaborative nature of much learning is emphasized. As a constructivist learning theory, situated cognition emphasises that students' knowledge is constructed within and is inseparable from the activity, context, and culture in which they learn (Brown et al., 1989). As adopted in this thesis, the view that student learning is situated or contextualized has implications for the way we consider self-regulated learning (Paris et al., 2001). Quantitative perspectives on self-regulated learning offer important insights but need to be supplemented with qualitative, context-sensitive methods that allow for rich descriptions. Subsequently, as I would like to address the "what, how, why, and when questions surrounding self-regulated learning" (Paris et al., 2001, p. 255), qualitative and mixed-method approaches are needed to answer my research questions.

Educational research, to me, is not just research *about* education but invariably inquiry *for* education as well. In addition, accepting that context is important in educational research means that the educational researcher inherently has a 'transformative agenda'. Although my research makes an effort to connect educational research and educational practice, I am also aware that keeping a critical distance between one and the other is essential. In this design-based research project, my role is a dual role - an educational designer and a researcher, which means I was involved in the research as an 'insider'. A potential difficulty of design-based research is that the researcher must critically evaluate the design and, at the same time, be the developer of the intervention and have a role in convincing lecturers and students of the worth of the design (Dolmans and Tigelaar, 2012). Therefore, it is essential to remain aware that the researchers' biases might more easily influence the findings of design-based research studies. To prevent bias of findings, triangulation of data is essential (McKenney et al., 2006). As described in this chapter, the application of mixed methods allows for triangulation: the use of various methods can compensate for each method's bias and, to some extent, the researcher's bias. The strengths of an added method can compensate for the flaws of another. Therefore, mixed methods can offer more robust evidence because of confirming evidence (Johnson and Onwuegbuzie, 2004). Furthermore, adopting an approach of research reflexivity and transparency is considered fundamental. In this thesis, principles of reflexivity are applied by articulating these principles in both research and writing. Reflexivity is provided to readers by giving clear information to readers about my professional background and role and my assumptions and lenses through which my study was conducted. Research transparency is achieved by a clear description of theoretical underpinnings and a transparent way of analysing the results. This is accomplished by offering a complete account of the procedures used to collect my data and providing a full account of how I drew inferences from the data. Providing reflexivity and

transparency about the research can enable the reader to critically interpret the study's results (Bunniss and Kelly, 2010).

5.4 Methodological approach

5.4.1 The research question and the conceptual framework

Several critical aspects influence the research design when measuring self-regulated learning (McCardle and Hadwin, 2015). First, as opposed to an aptitude, self-regulated learning is considered a process or event, implying that regulation unfolds over time (Winne and Perry, 2000). Next, what students learn and how they learn depends on contextual conditions. Thus, the regulation of learning is context-sensitive (Winne and Hadwin, 1998). Thirdly, students' learning strategies are task-dependent and differ from goal to goal. As a result, self-report questionnaires concentrate on learners' learning strategies. In addition, the measurement of self-regulated learning should focus on the regulatory processes that learners engage in: planning, monitoring performance, and reflection. Finally, aiming to gain a rich understanding and explanation of how co-regulation occurs and how it influences self-regulated learning, it affects the choice of measurement design and instruments. Thus time-sensitive, task-sensitive and measures sensitive to metacognitive regulatory processes are required, and research on the regulation of learning should occur within meaningful, authentic learning situations, presenting students with genuine challenges.

The process of engaging with the literature on regulation of learning and my involvement in the evaluation of a mobile application (Ace Your Self-study App) to support students' self-regulated learning led me to propose an intervention that was integrated into the course content of a first-term course for first-year university students. In this intervention, co-regulation of learning is considered (Allal, 2007). The thesis examined how co-regulation moderates changes in students' self-regulated learning. In addition, it aimed to research the concept of co-regulated learning and specifically how sources of contextual regulation within a course can encourage students to engage in self-regulated learning within a specific context. As the intervention was designed to foster and encourage the development of self-regulated learning, I expected that offering sources of contextual regulation within the course would be beneficial, that students would make use of these sources of regulation and that they would engage in self-regulated learning throughout an 8-week course. The primary research question is, therefore:

How do sources of contextual regulation affect first-year university students' participation in co-regulation of learning and self-regulated learning?

Subsidiary questions designed to help answer the research question are:

- (1) *In which ways do students make use of the sources of contextual regulation available in their course?*
- (2) *How do teachers experience the sources of regulation implemented in their course, and how do they perceive their students' reactions to these sources of regulation?*

The conceptual framework shown in Figure 5 identifies and diagrams the key elements in the research question and the key relationships between those elements.

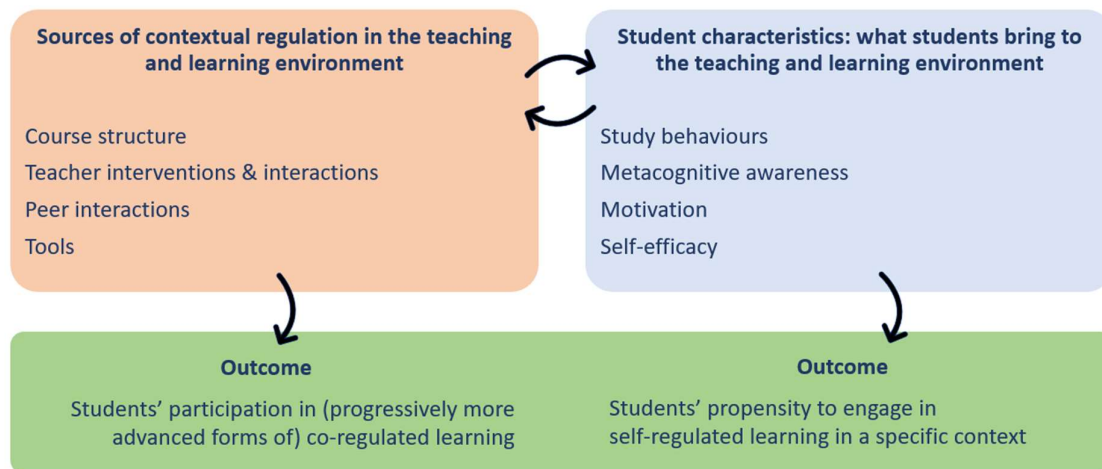


Figure 5: Conceptual framework

5.4.2 Research strategy: design-based research

In this study, co-regulation is conceptualised as “the joint influence of student self-regulation and sources of regulation in the learning environment” (Allal, 2018, p.30). Building on and intending to further the theoretical principles of self-regulation and co-regulation of learning, I undertook a design-based research project to investigate the interplay of theoretical principles with educational practice. This study aimed to bridge the gap between research and practice by investigating the nature of co- and self-regulated learning occurring within an authentic learning environment.

Education is multifaceted and comprises many interacting variables (Berliner, 2002). In addition, education is very context-specific. Educational design research is relatively new and has been proposed as an approach that is able to address complex educational challenges (Bakker, 2018; Anderson and Shattuck, 2012). These complex educational challenges, which currently lack validated principles for design and development, form the starting point for design-based research (Plomp and Nieveen, 2010). Therefore, design-based research could offer a way forward to improve educational practice by involving all stakeholders in each phase of the research process. In addition to its aim to further practice, educational design research also intends to advance our understanding; thus, theory-building and practice improvement are interconnected processes (Dolmans, 2019).

Features of design-based educational research are described by Dolmans and Tigelaar (2012) and by Van den Akker et al. (2006, pp. 5).

- (1) First, design-based research aims to design interventions in naturalistic settings, where learning usually occurs.
- (2) It is iterative and cyclical in nature, incorporating repeated design, evaluation, and redesign cycles.
- (3) Design-based educational research intends to test and refine theory and advance practice. Mixed-methods studies are applied to research in which quantitative and qualitative methods are used in a single research study.
- (4) Researchers and practitioners collaborate, and there is the active involvement of stakeholders in each stage of the research.

(5) Lastly, design-based research focuses on improving interventions. The quality of a design is evaluated by its practicality for users within authentic educational settings. A conceptual framework and theoretical propositions underpin the design of the intervention, and the evaluation of successive prototypes of the intervention furthers theoretical refinement.

Design-based research distinguishes itself from other forms of educational research, aiming at hypothesis testing. Reeves (2000) clearly distinguishes between educational research carried out with traditional empirical goals and design-based research aiming to connect educational research and educational practice (Figure 6). Predictive research aims at hypotheses testing by conducting an experiment where reality is manipulated and particular variables are isolated. The theory under construction is confirmed if hypotheses are confirmed. Theory and practice are separated: practitioners are left with the interpretation of the test results of predictive research – that is: if they have access to scientific research - and judge if and in which form these results have relevance and significance to their educational contexts. On the other hand, design-based research is inspired by educational challenges and conducted by intervention development, building theories and refining design principles, producing a set of design principles (Van den Akker et al.,2006).

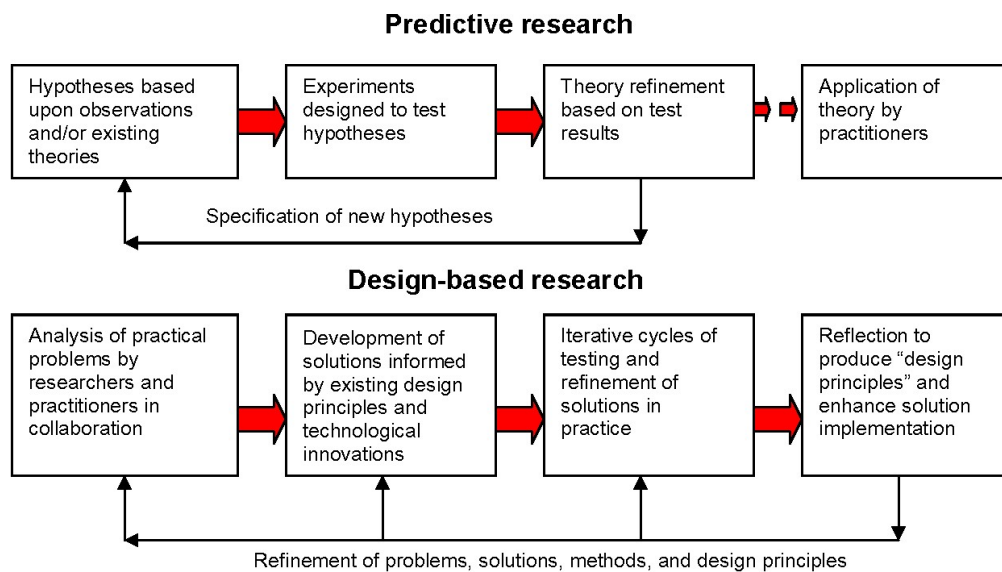


Figure 6: Predictive research versus design-based research (Reeves, 2000)

There are parallels between design-based research and action research: they both identify real-world educational problems they aim to improve and involve practitioners in the research process. Nonetheless, design-based research is different in two important respects: its objective and the position of researchers and practitioners in the research process. For example, the primary goal of design-based research is to generate theory to solve authentic educational problems, whereas the primary goal of action research is to improve practice by reflection. Furthermore, in design-based research, the researcher generally initiates the research and assumes the role of both researcher and educational developer, whereas, in action research, it is usually the practitioner initiating the research, and often the lecturer who is both researcher and teacher (Reeves, Herrington and Oliver 2005; Wang and Hannafin, 2005).

The characteristics of design-based research guided the design of my research project. Therefore, the intervention is not researcher-led nor entirely teacher-led: the researcher and teaching team co-created the intervention. Both myself, as the researcher, and the teaching team expected the strength of the intervention developed as part of this research project to be found in its situatedness by fully integrating the intervention within the course content. Educational design research is an activity a researcher cannot carry out in isolation from educational practice. Design research does not research isolated variables but instead aims to study interventions as integral and meaningful phenomena. The use of multiple methods affords an understanding of how different variables interact. Outcomes and the underlying processes of the research project are emphasised to clarify whether and how an intervention is able to address the educational challenge (Dolmans and Tigelaar, 2012). Educational design research is focused on ‘discovery’ instead of ‘verification’ (Kelly, 2012). Therefore, the design-based approach ties together my work as an educational consultant and as an educational researcher and is consistent with the context-bound nature and situatedness of the regulation of learning.

5.4.3 A generic model for conducting design-based educational research

Conducting design-based research encompasses educational design processes and can be depicted in various ways. Generally, design-based research pursues the following process: prior research and a literature review inform researchers and collaborating practitioners in designing and developing interventions by evaluating these interventions in their intended contexts. Finally, they reflect on the research process and its outcomes to generate design principles (Plomp and Nieveen, 2010). Building on previous models and frameworks for educational design research, McKenney and Reeves (2012) have visualized the overall research process as follows (Figure 7):

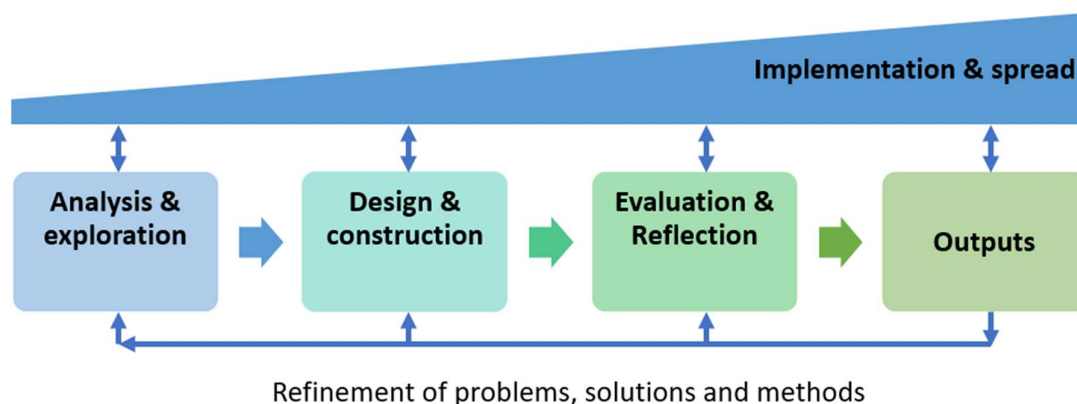


Figure 7: Generic model for conducting design research in education (adapted from McKenney and Reeves, 2012)

In this model, the features of design-based research are visible. First, design research is cyclical and iterative in nature and usually goes through the stages or phases of (i) analysis and exploration, (ii) design and construction and (iii) evaluation and reflection.

The integrated research and design processes and theoretical and practical outcomes emphasise the dual focus on theory and practice. Finally, the model indicates how design-based research is use-

inspired: by planning for implementation and spread from the start of the research project, frequent interaction with practice, and contextual responsiveness. In line with the model in Figure 4, educational design research consists of three main phases. Making use of the McKenney and Reeves (2012) model set out above, I portray the process of my research project on co-regulated learning as follows:

Analysis and exploration phase

In the analysis and exploration phase, the preliminary research takes place. During this phase, the researcher and practitioners collaborate to identify and analyse the educational problem to better understand the challenge, context, and stakeholder needs. The goal of the analysis during this phase is the problem definition. In addition, a literature review is carried out to assess if the problem is researchable, and the results of the literature review inform data collection efforts and help build frameworks for interpreting the findings. In the exploration stage, similar problems and their solutions are explored. The practical output of this phase is an in-depth understanding of the educational challenge and its origins. The theoretical result is a descriptive and analytical understanding of the given subject within the specific context (chapters 1, 2, and 3 of this thesis).

Design and construction phase

The design and construction phase involves a deliberative process that results in a well-considered intervention intended to form a solution to the educational problem. Ideas on addressing the educational challenge are likely to start broad and become more precise and operationalized during this phase. The work in the design and construction phase and the resulting intervention are grounded in both theory and the reality of educational practice. This phase does not involve empirical data collection. The design and construction phase produces practical results: the solution or intervention is designed. The developed intervention can be represented in a tangible form (e.g., a teacher handbook, an educational app) or a process (e.g., guidelines for a particular teaching model or approach). The theoretical output of this phase is the frameworks underpinning the design and an articulation of the justification for design decisions. The construction process yields the solution itself. In this thesis, the theoretical output of the design phase is represented by chapter 4, the theoretical framework. As they form the construction phase results, the conceptual framework and the intervention are found in the current chapter.

Evaluation and reflection phase

During the evaluation and reflection phase, interventions are empirically tested. The results from the evaluation are reflected upon to refine the theoretical understanding of interventions. In design research, evaluation is intended to inform the academic community, driving intervention development. Evaluations may study different aspects of an intervention, such as soundness and feasibility. From a practical perspective, the activities in this phase lead to ideas for redesign and conclusions about a particular intervention. From a theoretical perspective, the knowledge produced in this phase contributes to a broader theoretical understanding of the effectiveness of the intervention elements. The evaluation follows an empirical cycle that starts with the research questions, research approach and methods in the current chapter, and the results will be presented and discussed in chapter 6. The outcomes of the reflection phase will be found in chapter 6, where the results are presented, and in chapter 7, which discusses conclusions, limitations, and recommendations.

Outputs of design-based research

The model depicts two key outputs from educational design research: interventions and theoretical understanding. First, design-based research results in empirically underpinned innovative interventions, like programs, products, or processes, as solutions to educational challenges. This first output stresses design research's practical relevance, also called 'socially responsible research' (Reeves, 2000; Van den Akker, 1999). Furthermore, design-based research aims to generate knowledge about whether, how and why an intervention works in a particular educational setting. This second key output of design research is formed by a set accompanying design principles (Linn, Davis and Bell, 2004; van den Akker, 1999) or intervention theory (e.g., Barab and Squire, 2004; Edelson, 2006). Design principles clarify the objective of the intervention and form heuristic statements meant to help select and apply the most appropriate knowledge for subsequent educational projects (Van den Akker, 1999). Design principles have a substantive value, describing the intervention's key characteristics and a procedural value, providing guidelines for designing the intervention. Furthermore, they provide implementation conditions for the intervention (Plomp and Nieveen, 2010). McKenney, Nieveen, and Van den Akker (2006) argued that in addition to valuable products and design principles, the third form of design research output should contribute to the professional development of the lecturers and other professionals involved in the research project. To achieve each type of output requires an iterative development approach, in which design and research activities need to be combined carefully and deliberately.

Relevance beyond the local situation

A potential shortcoming of researching within an authentic educational context is that although it may provide remarkable insights into innovation within a specific learning environment, there might be a risk that the outcomes have little value for other settings (Dolmans and Tigelaar, 2012). In other words, given the context-specific character of design-based research, the question arises if outcomes can be generalized to other contexts. However, several measures can establish a broader relevance beyond the local situation. Like case studies or experimental design, where the researcher aims to generalise results to a broader theory, in the case of design-based research, the intention should be to generalise the design principles to a broader theory (Yin, 2003). The value of the outputs from a design-based research project will be augmented when the design of the intervention is justified by theoretical arguments and uses theory to explain the findings. The outputs should also include a comprehensive description of the educational context of the research project. The final stage of each design research project in design-based research consists of a systematic reflection and documentation, generating design principles for future enhancements, which direct the development and implementation of future interventions (e.g., Van den Akker, 1999; Van den Akker et al., 2006; Reeves, 2006; Dolmans and Tigelaar, 2012).

Interaction with practice: implementation and spread

In the generic model, each of the three main research and development phases is approached from an implementation perspective. This implies that from the early start of the design-based research project, the implementation and dissemination of the intervention are considered, and the varied realities of educational contexts are taken into account throughout all phases. Consequently, the involvement of educational professionals begins early and can include various professionals from educational practice.

5.4.4 Criteria for evaluating interventions

In the context of design-based educational research, Nieveen (2010) proposed four quality criteria for evaluating educational interventions (see Table 2). Nieveen explains these requirements in this manner:

- (1) Referring to content validity, each element of the intervention should be based on state-of-the-art scientific knowledge, and
- (2) In terms of construct validity: all elements should be connected consistently. An intervention is deemed valid if it meets these conditions.
- (3) Another quality criterium is that end-users (such as lecturers and students) regard the intervention as usable and that it is easy for them to use the materials in a way that is largely compatible with the developers' intentions. If these conditions are met, an intervention is considered practical.
- (4) The fourth quality criterion is the intervention's effectiveness, i.e. it results in the anticipated outcomes.

Criterion:	
Relevance (also referred to as content validity)	There is a need for the intervention, and its design is based on state-of-the-art (scientific) knowledge.
Consistency (also referred to as construct validity)	The intervention is 'logically' designed.
Practicality	The intervention is realistically usable in the settings for which it has been designed and developed.
Effectiveness	Using the intervention results in desired outcomes.

Table 2 Criteria for high-quality interventions (from Nieveen, 2010; in Plomp and Nieveen, Chapter 5)

5.5 The co-regulated learning intervention

5.5.1 Setting

Context, programme and course

The setting for this design-based research project is a university in a large city in the Netherlands. The School's academic research and teaching are at the Humanities and the Social Sciences interface. The School offers five Bachelor programmes, three Master programmes and a Research Master. In the academic year 2020-2021, the approximately 2300 student population consisted of 57% Dutch and 43% international students. The intervention was implemented in the course *Introduction to Human Communication* from the first year of the international Bachelor's programme in Communication Sciences. The course introduces students to communication as a field of study and research. Within the course, the basic processes involved in communication are covered (e.g., listening and attention, perceiving, using verbal and nonverbal communication). Furthermore, the communication process is presented in various communication contexts (e.g., interpersonal, small group, public, organizational, intercultural). The course materials include a textbook providing a broad and accessible introduction to the field and academic articles to familiarize students with scientific research products. The didactics of the course are aimed at the active engagement and participation of students. Course activities include, for example, discussion of key issues and questions, in-class exercises, presentations by students and discussions of student assignments. The

course assessment consists of individual and group papers, peer-assessment, individual assignments, a team lecture, and a final, written exam at the end of the course.

Composition of the team and process of the design-based research project

One of the characteristics of educational design research is the collaboration between researchers, lecturers and developers, and the active involvement of practitioners in the various stages of the research. Shortly after writing the research proposal for this thesis, I participated in a research project on scaffolding first-year students' self-regulated learning skills using the *Ace Your Self-study App*. Discussing the results of this prior research with its primary researcher prompted my ideas for a more contextualised approach to fostering self-regulated learning. At that time, I intervened with the principal lecturer and coordinator of the course *Introduction to Human Communication*, who was interested in revising the instructional practices of the course. Starting our activities in April 2020, we discussed the challenges of encouraging self-regulated learning among first-year students. As a result, we decided to start a design-based research project to investigate the nature of co- and self-regulated learning as it takes place in an authentic learning environment. Soon after starting up the project, we asked one of the tutorial lecturers from the course to join.

During the first phase of the project, the team consisted of the principal lecturer, the tutorial lecturer, and the researcher. During this phase, we organised several educational design sessions and worked on a blueprint for the re-design of the course. During these sessions, we collaborated to analyse the educational problem (see section 5.5.2) to achieve a shared and deepened understanding of the challenge, context, and stakeholders needs. In this research project, the primary stakeholders were the students and lecturers of the course *Introduction to Human Communication*. In addition, the course coordinators of the two other courses in the first term and the Head of Department were consulted about the intervention. After completing the re-design of the course and developing the intervention, the other teaching team members became involved. The intervention and its theoretical underpinnings were presented and discussed with the entire teaching team, and a teach-the teacher session was held before the start of the course. The team maintained regular contact about the intervention and its implementation during the implementation period. The weekly team meetings of the teaching team provided opportunities to discuss the implementation and students' and lecturers' experiences. These conversations caused the researcher to make minor adjustments to the intervention, as needed, during the implementation period, which represents well the iterative nature of design-based research. The entire team remained involved in the project, including the evaluation and reflection phase when different aspects of the intervention, such as soundness and feasibility, were jointly investigated as well as the research outputs of the project.

The design-based research project was conducted by a faculty member with extensive subject matter expertise, proficiency in teaching and educational design, and an educational researcher with expertise in instructional design and teaching and learning. In addition, we received valuable support from an educational technologist and skilled student research assistant during the project. Furthermore, the primary researcher from the research project on the *Ace Your Self-study App* remained involved during the entire project in the role of 'critical friend'. Throughout the design-based research project, the involvement of educational practitioners included various professionals from the university. Over the academic year 2020-2021, as the researcher, I had several

conversations with colleagues within the university. Furthermore, I delivered a workshop for lecturers throughout the university and presented and discussed the project with the Community for Learning and Innovation, fellow researchers and learning and innovation consultants from other schools within the university. In this way, the implementation and spread – beyond the course the intervention was implemented -were considered, and the varied realities of educational contexts within the university were considered throughout all phases of the project.

5.5.2 Educational challenge

The educational challenge regarding self-regulated learning was identified in the first phase of the design-based research project, the analysis and exploration phase (see Chapter 1). The literature review demonstrated that although self-regulated learning is essential for academic performance, it is also difficult, and most learners need to ‘learn how to learn’ and require guidance in developing self-regulated learning skills. Although the previous research on the *Ace Your Self-study App* (Baars et al., 2021, see chapter 1) indicated that the app did not expand students' repertoire and see them adopt additional self-regulated learning strategies. Even though students had received implicit instruction in using the app, this research project illustrated that offering educational technology as a ‘standalone’ intervention is insufficient. It led us to consider adopting a different approach to support students to become self-regulated learners, in the form of co-regulation of learning, where learners regulate their learning in interaction with the learning environment. By developing an intervention based on the concept of co-regulation and by integrating it into a course, I expected that students would be stimulated to engage in self-regulated learning.

The intervention was implemented into a first-term course, *Introduction to Human Communication (IHC)*. In the context of the Introduction to Human Communication course, first-year students struggle to understand the textbook literature and scientific papers adequately and critically. The course lecturers observed that this resulted in students feeling overwhelmed during the first term of their programme during previous years. Therefore, in the redesign of the course, specific attention was focused on critically appraising academic literature. In this process, the reader moves from a superficial understanding of the text (‘what is it about?’) towards a more profound understanding (‘what does this mean, why is it significant, what are its implications?’). Self-regulation is of significance for reading comprehension: students who are capable of regulating their reading practices achieve greater comprehension (Thiede et al., 2003, Zimmerman, 1990). Specifically, students must monitor and control their reading (metacognitive strategies) to effectively comprehend texts (e.g., Cromley and Azevedo, 2007). In the dual role of educational consultant and educational researcher, in March 2020, I had several conversations with the teaching team members to discuss this educational challenge and its origins. In these conversations with the teaching team, the following challenges for students were identified: (a) they struggle with the amount of textbook literature and scientific papers they are required to read for the course, and (b) they lack awareness of how to approach the course assignments and how to study the course materials effectively. We also discussed how students were dealing with these challenges. We assessed that students had difficulties adapting their learning to the demands of studying in university. This is consistent with previous research findings (e.g., Biwer et al., 2020). Indeed, self-regulated learning skills become increasingly important in higher education due to more complex learning situations and typically less opportunity to receive external feedback (Peverly et al., 2003). Furthermore, there are fewer contact hours and a stronger emphasis on self-study. Therefore, notably in transitioning from secondary

school to a tertiary education context, greater reliance upon self-regulated learning skills emerges (Webster and Hadwin, 2015; Dresel et al., 2015; Peverly et al., 2003). These factors make an intervention targeting first-year students especially relevant. Notwithstanding the course's previous educational improvements, the challenges students and lecturers observed appeared to be persistent. For example, in previous years, students took an in-class quiz in week 5 to test their progress and monitor their comprehension. Generally, the results of the in-class quiz confronted them with the ineffectiveness of their study strategies and made them realise they generally lacked a thorough understanding of the materials they had studied. Rather than having students realise they need to adopt different study strategies mid-way of the course, the principal lecturer wanted to provide students with guidance on 'learning how to learn', which could be integrated into his course. We decided to collaborate to address the educational challenges in the course *Introduction to Human Communication*, and an intervention was collaboratively developed, implemented, and evaluated. As depicted in the co-regulated learning model, sources of contextual regulation were implemented at the teaching and learning environment levels (see Chapter 4 of this thesis).

5.5.3 Description of the intervention

In the exploratory phase of the research project, several approaches were identified to improve students' self-regulated learning (see Chapter 2). As interventions in design-based research projects are grounded in theory and educational practice, both the educational challenge identified and the outcomes of prior research into encouraging self-regulated learning were considered in the construction of the intervention. The learners' self-regulation processes are positioned at the core of the nested model of co-regulated learning. These self-regulation processes occur when the learner engages with the teaching and learning environment. The sources of regulation offered by the intervention are affordances that provide opportunities for action by the students in the *Introduction to Human Communication* course. Whether the learner identifies and uses these affordances depends on learner agency: the purposeful and goal-directed initiative by the learner (Reed, 1996).

Two approaches to foster self-regulated learning stand out and are explicitly considered in the design and construction phase of this research project:

- I. As previous studies showed, providing instruction is an effective way to promote self-regulated learning. The instruction should be aimed at teaching students how to use effective cognitive and metacognitive strategies through instruction (Broadbent et al., 2014; Dignath and Büttner, 2008). This instruction is advantageous when it (1) is based on a robust theoretical framework, (2) incorporates all elements of self-regulated learning, (3) concentrates on teaching various strategies, and (4) is spread out over more than one session (Dignath and Buttner, 2008; Reeves and Stich, 2011). In addition, (5) students need a holistic framework to conceptualise the process of self-regulated learning and to evaluate and adapt their learning strategies (Cleary et al., 2008). The framework used in our intervention is Zimmerman's Cyclical Phases Model (2000).
- II. A second approach for improving self-regulated learning is the use of learning diaries. The learning diaries increase metacognitive awareness by providing insight into how learning strategies affect students' goals by (more) planning, self-monitoring, and self-reflection (Dignath-van Ewijk et al., 2015; Dörrenbächer and Perels, 2016; Fabriz et al., 2014; Schmitz and Perels, 2011). Previous studies showed that the use of diaries led to an increase in self-efficacy, self-regulation, and metacognitive skills (Dignath-van Ewijk et al., 2015; Schmitz and

Perels, 2011). Nonetheless, learners need to understand what constitutes self-regulated learning to adequately self-monitor their learning. Diaries were therefore found to be the most effective when combined with instruction or training in self-regulated learning rather than as a separate intervention (Dörrenbächer and Perels, 2016; Fabriz et al., 2014).

To address both the research question and the educational challenge simultaneously, an intervention was developed, implemented, and evaluated based on the model of co-regulated learning presented in chapter 4. The students were instructed to use learning diaries, cognitive learning strategies, self-assessment, and peer-assessment tasks during the first term. All strategies were implemented through implicit training, included as course tasks, and practised in the domain-specific context of the course *Introduction to Human Communication*. In more detail, the intervention included the following elements:

(1) Sources of regulation: course structure

'Course structure' refers to the course instructional design. In the re-design of the course, specific attention was paid to the course assignments and the formative and summative assessments. In the assignments, the importance of deep comprehension was emphasized more prominently. If students are aware of what will be tested - such as their ability in connecting concepts throughout texts – they will read to establish these connections and accurately monitor this level of learning (Thiede et al., 2012). Test expectancy was also instilled by administering a low-stakes practice test and a quiz that mimicked the high-stakes exam at the end of the course. Finally, formative assessment furthers student learning through retrieval practice, allows learners to gain experience with the exam, and leads to optimal learning strategies (Storm et al., 2016).

(2) Sources of regulation: Teacher interventions and interactions

In the re-design of the course, we paid specific attention to the tutorial groups. In addition, in the re-design, we implemented implicit instruction in self-regulated learning focused on metacognitive and cognitive skills relevant for reading comprehension and improving monitoring accuracy (for example, by facilitating the construction of an elaborate situation model for a text and delayed retrieval attempts through the promotion of self-testing).

(3) Sources of regulation: Peer interactions

Students work on several collaborative tasks during the course, such as writing a group paper or preparing a presentation. This also includes group discussions during collaborative tasks in class, peer review or joint reflection on learning materials. In the re-designed course, peer-assessment was introduced to foster metacognitive monitoring. Peer assessment is the process where students are asked to evaluate the quality of their fellow students' work and based on the teachers' criteria. The peer-assessment tasks support co-regulation (Panadero and Järvelä, 2015), and it assists in developing students' ability to reflect and critically judge their learning.

(4) Sources of regulation: Tools

Tools are sources of regulation available at each level and used for instruction and assessment. Tools (A) serve as links between the various levels of contextual regulation in the model, (B) augment the effects of co-regulation and (C) allow recording of traces of student activity. Several tools were included in the course:

- Students keep weekly online learning diaries to keep account of their self-regulation and foster formal self-monitoring. As this is a prominent tool in the intervention, the learning diary is discussed in more detail in the next section.
- Ace your self-study app. The app is freely available to students and helps them select adequate learning strategies and to master these strategies. The app contains 22 effective strategies for learning tasks like studying texts, writing assignments, and preparing for exams.
- The self-regulated learning cycle. Students were stimulated to develop metacognitive skills using the self-regulated learning cycle (see Figure 1, chapter 2 of this thesis), offering a stepwise approach to planning, monitoring, and reflecting on their learning. The cycle was included in the supporting instructional materials and learning diaries and discussed in the first tutorial group.
- Instructional materials. Students were provided with various instructional materials to inform them about self-regulated learning and its importance. These materials included two short educational videos recorded by the researcher: one with a short explanation about academic self-regulation and the other about the tools available to them in the course to assist in acquiring cognitive and metacognitive skills. Furthermore, students received an infographic developed for this course called 'How to self-regulate your learning, in a nutshell' (see Appendix 1). Additional information and guidance were provided in the tutorial groups' PowerPoint slides and on the electronic learning environment Canvas.

Learning diaries

Learning diaries encourage self-monitoring of the learning process and, therefore, function as an intervention (Schmitz and Perels, 2011). Students filled out a learning diary each week of the course at the end of the week. The learning diaries incorporated the entire self-regulated learning cycle. They look back at the current week of studying (monitoring and reflection) and set a goal for their next week of studying for the course (forethought). Because the diaries assist students in structuring their learning sessions, they function as a self-instructional tool for self-observing and reflecting on learning. Learning diaries can enhance the effect of the co-regulated learning intervention. The questions in the diaries:

- function as an external prompt and as a reminder to regulate learning. They stimulate metacognitive thought as students are reminded to apply a strategy and ask whether and how it worked;
- mediate between and support the transfer from the classroom-based sources of the regulation (co-regulation) to the actual learning taking place at home or, during independent self-study (self-regulation);
- stimulate deliberate practice through the repeated exercise of the strategies in the diaries.

5.5.4 Participants and procedure

Participants were students in their first year of the International Bachelor programme in Communication Sciences (N= 314) and lecturers delivering the *Introduction to Human Communication* course (N= 6). All students enrolled in the course were asked to participate in this study, and all tutorial lecturers of the course were asked to take part. The International Bachelor Communication and Media is a selective programme, has an international population of students and staff, and is taught in English. Students come from various countries, so their previous secondary

education context is heterogeneous. The course took place during the first term of the academic year 2020-2021, and the research was conducted over nine weeks, from September 7, 2020, to November 6, 2020. In weeks 1 to 8, students watched pre-recorded online video lectures. Each week, students had a two-hour tutorial group with 20 to 22 fellow students, run by a tutorial lecturer. In week 9 of the course, the final exam took place and assignments needed to be handed in. Therefore, the classroom-based intervention was implemented in the tutorial groups.

During the development of the educational intervention for the course *Introduction to Human Communication*, the lecturers were informed about the research project. The week before the course started, they participated in a teach-the-teacher activity organised by the researcher to further introduce them to the subject of self-regulated and co-regulated learning and the intervention itself. During the first online tutorial group meetings, the students were informed about the study and asked for their consent to share their data for this study. The researcher and the principal lecturer also recorded a short video to introduce students to the research project and invite students to participate. This video, the participant information sheet and the consent form were provided to students in the university's Electronic Learning Environment (Canvas). All students (N=314) took part in the intervention, but participation in the research project (where their data would be analysed as part of the research) was voluntary. In the first week, students were informed about the research project and were asked to take part in the research project. Participating students (N=35) gave their consent and completed a questionnaire involving an aptitude measure of self-regulation in the first week and at the end of the course (week 8 or 9). During the course, students reflected upon their learning process and their experiences with the contextual sources of regulation in structured learning diaries. The learning diary was available to students in Canvas, their electronic learning environment. The learning diaries had to be filled in online weekly via Qualtrics.

After the course finished, a focus group interview was held with the tutorial lecturers of the course. The interview took place on 22 January 2021. The interview was recorded via MS Teams and took one hour. All six tutorial lecturers were present for the interview. During the teacher training at the beginning of September, the tutorial lecturers were informed about the research project connected to the intervention implemented in their course. Prior to the interview date, they received the participant information sheet and the consent form once more. They all gave their consent, either via e-mail or at the beginning of the (recorded) interview.

5.5.5 Ethical considerations

This research project was given ethical approval by the University of Sheffield's Ethics Review Panel. Because the research project was implemented at a university in the Netherlands, the Ethics Review Board of the School involved was informed about the approval of Sheffield's Ethics review Panel. In an early stage of the research project, the researcher and the principal lecturer reached out to both the School's Ethical Review Board and the Head of Department to inform them and coordinate at which university the ethical review of the research project needed to take place. The School's Ethical Review Board indicated no need to review the research project. As the thesis supervision was taking place at the University of Sheffield, they merely wanted to be informed about the decision by Sheffield's Ethics Review Panel. The researcher informed the School's Ethical Review Board about Sheffield's approval and provided the participant information sheets.

From all participants in this study, written informed consent was obtained. All the participants in this study received a participant information sheet and consented to participate in the study. Any information that might have helped to identify the participants was removed before the analysis of the data collected. Their participation in the study was voluntary, and participants were assured of confidentiality.

Students were invited to participate in the study and were asked for their consent to share their data for this study. They received the participant information sheet and the consent form in an online form. It was explained to students that participation in the research project was voluntary: their decision to participate in this study or not, would have no impact on their grades or study progress in any way. During the teach-the-teacher activity prior to the course, the tutorial lecturers were invited to participate in the study and asked for consent to share their data for this study if they decided to participate. They received the participant information sheet and the consent form online during the teach-the-teacher activity. It was explained to lecturers that participation in the research project was voluntary: their decision to participate in this study or not, would have no impact on the evaluation of their teaching performance.

Both students and lecturers were informed that if they decided to take part and later change their minds, they were free to withdraw from the research at any time without providing a reason and without any negative consequences. In this case, their data will be removed from the dataset. One student indicated they wanted to withdraw in the second week of the course, and their data were taken out of the dataset.

Because the intervention was designed within a mandatory course, it was explicitly made clear to students in advance that not taking part in the study would have no detrimental consequences on their academic results or otherwise. Completing the weekly online learning diaries was a course task, but the responses were not evaluated. All students enrolled in the course *Introduction to Human Communication* received information and support on self-regulated learning without differences in instructions. This allowed all students to use the intervention, regardless of their participation in the research project. It was made clear to participants that the information they provided in the learning diaries would not be used to judge them or their study behaviours and would not affect their grades or study progress in any way. This was clearly stated in the participant information sheet. During the course, this was also explained by the tutorial lecturers.

All information collected was used only for the purpose of this research project. All data was collected and stored digitally on the University of Sheffield's Google Drive; no hard copies were used in this research project. Data gathered will, in any case, be destroyed one year after the research and analysis are complete. However, other researchers may find the research data useful in answering future research questions. If this is the case, participants will be asked for explicit consent for their data to be shared for this purpose. All the information collected during this research was kept strictly confidential and was only accessible to members of the research team. All data were digitally stored and password protected. The collected information was stored anonymised; participants' names were not collected, and each participant included in the data analysis was assigned a random number. Therefore, participants could not be identified in any reports or publications.

5.5.6 Influence of Covid-19 measures on the intervention

Due to the pandemic outbreak of Covid-19 and the subsequent measures to prevent further spreading, all teaching at the university from March 2020 onwards needed to be delivered in an adapted form. For the course 'Introduction to Human Communication', it was decided to deliver the course in an online-only format, which meant that all teaching within the course had to take place online, both the lectures and the interactive small-scale tutorial groups. Hence, the research project also needed to be conducted off university premises. All data, therefore, were collected online and taking part in this research did not require students, lecturers, or the researcher to be physically present on campus or elsewhere.

Luckily, the teaching team did not resort to so-called 'emergency remote teaching' for this course. We started early enough with the re-design of the course to implement the co-regulated learning intervention in time. During the first design-meeting, we discussed the possibility of facilitating the course online. Early in the design- and development process, the principal lecturer and coordinator of the course decided to go for an online-only format. This meant we could integrate the online facilitation mode into our course re-design. In the online format of the academic year 2020-2021, the pre-recorded web lectures focussed on content delivery without direct interaction between lecturer and students. On the other hand, the smaller-group tutorials facilitated by lecturers are now oriented to a deeper processing of the course content and characterized by more active student learning and more interactions between teacher and students.

The decision to teach in an online-only format did not significantly influence the design and development of the intervention itself nor this study's research design. However, our students' learning experiences and lecturers' teaching experiences have changed significantly. From the perspective of student learning, self-regulated learning instantly became more important. Regardless of the form of delivery, whether face-to-face, hybrid, or online, higher self-regulatory behaviours are essential for university students' academic success (Broadbent 2017). Online courses especially require students to exercise more autonomy and self-direction and call for targeted resources to support self-regulated learning (Alonso-Mencía et al., 2019; Dabbagh and Kitsantas, 2004). The online-only format affected the lecturers as well. The plenary lectures went from 2-hours intensive lecturing sessions to a series of short web lectures. Preparing these web lectures and recording them in the studio required numerous hours of work for the principal lecturer. The tutorial groups consist of weekly three-hour sessions in the regular face-to-face format. We decided three hours of online sessions were too demanding for students in the online only-format. Therefore, the sessions were reduced to 2-hour sessions but the same number of materials and content to be covered. This meant that concerning the implementation of the intervention, there was less time available within the tutorial group sessions to pay attention to the intervention.

5.6 Methods of data collection

5.6.1 Overview of methods

To investigate how sources of contextual regulation affect first-year university students' participation in co-regulation of learning and engagement in self-regulated learning, the following research instruments were used. Design-based research is characterised by a mixed-methods approach in which quantitative and qualitative approaches are used in a single study.

In Figure 8, the research instruments to collect the data are mapped onto the conceptual framework of the research project (seen above in Figure 5):

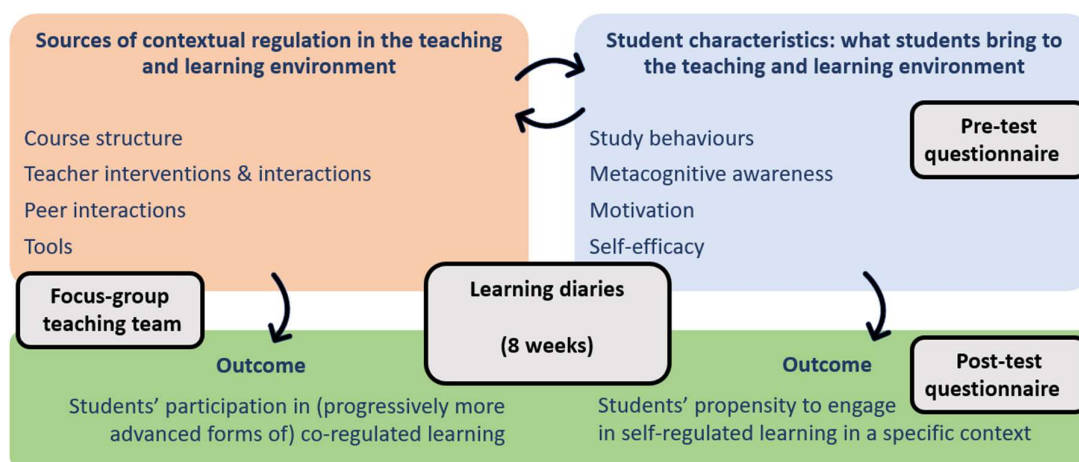


Figure 8: The conceptual framework and the research instruments

In this research project, the following instruments were used for data collection:

A. *Pre-test and a post-test questionnaire:*

Students who participated in the research project filled out a questionnaire in week one and the end of week eight of the course Introduction to Human Communication. With the pre-test and post-test questionnaires, self-report data were collected about study behaviours, motivation and the strategies used when studying, and students' self-efficacy.

B. *Weekly online learning diaries:*

As an assignment for the *Introduction to Human Communication* course, students kept a learning diary each week at the end of each week. If students chose to take part in the study, their diaries were used to collect information about their reflections upon their learning process and their experiences with the support offered in the course.

C. *Focus group interview with teaching staff:*

At the end of the course, a focus group interview was held with the teaching staff of the tutorial groups to elaborate on their experiences with co-regulation of learning.

Next, these research instruments will be discussed in more detail.

5.6.2 Pre- and post-test questionnaires

Students who participated in the research project filled out a questionnaire in week one and at the end of week 8 of the course Introduction to Human Communication. The following scales and items were included in the questionnaire at the beginning of the study and the end:

1. Learning strategies: Motivated Strategies for Learning Questionnaire, MSLQ (Pintrich, Smith, García and McKeachie, 1991, 1993), and the adjusted scale Metacognitive self-regulation-revised (i.e., MSR-R) (Tock and Moxley, 2017).
2. Motivation: academic self-regulation scale (Vansteenkiste, Simons, Lens, Sheldon, and Deci, 2004)
3. Self-efficacy: indication of the degree of confidence (Bandura, 2006).

The following items were added to the questionnaire at the end of the study:

4. Satisfaction related to the learning process.
5. Satisfaction related to the support on effective study behaviours offered in the course.

An overview of the pre-test and post-test questionnaire questions can be found in Appendix 2, and Table 3 provides an overview of the scales and subscales included in the pre-test and post-test questionnaire.

Cognitive scales (9 items):		
	Rehearsal	MSLQ
	Elaboration	MSLQ
	Organization	MSLQ
Metacognitive scale (9 items):		
	Metacognitive self-regulation	MSR-R
Resource management strategies (14 items):		
	Time and study environment (TSE)	MSLQ
	Peer learning	MSLQ
	Help-seeking	MSLQ
Motivation (16 items):		
	Autonomous	Academic SR
	Controlled	Academic SR
Self-efficacy (1 item):		Confidence

Table 3: Scales and subscales included in the pre-test and post-test questionnaire

1. Learning strategies

The Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, García, and McKeachie, 1991, 1993) is a self-report instrument we used to assess students' use of different learning strategies for a course. The complete instrument consists of 81 items divided into 15 scales, with Cronbach's Alpha coefficients ranging between .66 and .90. The scales are designed modularly and can be used together or singly, depending on the researcher's needs. The following scales for Learning strategies from the MSLQ were used for this research project. The items were measured on a five-point Likert scale. The MSLQ is an aptitude measure of self-regulated learning (Zimmerman, 2011), assessing students' propensity to engage in self-regulated learning within a specific educational setting (Jackson, 2018). The learning strategies section of the MSLQ includes cognitive, metacognitive, and resource management strategies.

From the cognitive strategies, the use of the following strategies was measured: rehearsal, elaboration, organization, and metacognitive self-regulation (MSR-R). The adjusted scale Metacognitive self-regulation-revised (i.e., MSR-R) (Tock and Moxley, 2017) is used and comprises nine items. Metacognitive self-regulation measures the use of strategies to control and regulate cognition. Planning, monitoring, and regulating make up metacognitive self-regulatory activities. Examples of items included in the pre-test and post-test questionnaire are: *“When studying for this class, I read my class notes and the course readings over and over again”* (rehearsal), and *“I try to understand the material in this class by making connections between the readings and the concepts from the lectures”* (elaboration). In addition, metacognitive self-regulation was assessed with questions, like *“When I study for this class, I set goals for myself in order to direct my activities in each study period.”* (Pintrich, Smith, García, and McKeachie, 1991, 1993).

From the category of resource management strategies, I measured the use of the following strategies: time and study environment management (TSE), peer learning and help-seeking. Examples of items included in the pre-test and post-test questionnaire: *“I make sure I keep up with the weekly readings and assignments for this course”* (TSE), *“When studying for this course, I often try to explain the material to a classmate or a friend”* (peer learning), and *“I ask the instructor to clarify concepts I don't understand well”* (help-seeking) (Pintrich, Smith, García, and McKeachie, 1991, 1993).

2. Motivation

Motivation was measured using a 16-item task-specific version of the academic self-regulation scale (Vansteenkiste, Simons, Lens, Sheldon, and Deci, 2004), for which students must indicate why they engaged in studying in general. The scale consists of four subscales: (i) external (e.g., *“because I am supposed to do so”*), (ii) introjected (e.g., *“because I would feel guilty if I did not do it”*), (iii) identified (e.g., *“because I could learn something from it”*), and (iv) intrinsic motivation (e.g., *“because I found it interesting”*). In addition, items will be measured on a 5-point Likert-type scale ranging from 1 (not at all true) to 5 (totally true).

3. Self-efficacy

To measure self-efficacy, students indicated the level of confidence in their ability to succeed in self-studying the learning materials offered in this course, with a number ranging between 0 and 100 (Bandura, 2006).

The following items were added to the questionnaire at the end of the study:

4. Satisfaction related to the learning process

This is measured using two items in which students were prompted to rate their satisfaction with their learning process during their self-study.

5. Satisfaction related to the support

To measure students' satisfaction with the support on effective study behaviours offered in the course, five items were used to score the experienced effectiveness and benefit of the four sources of regulation.

5.6.3 Learning diaries

The learning diaries served both as an intervention and a measurement instrument. Specifically, we used the learning diaries to assess the learner's cognitive, metacognitive, and motivational strategies and their participation in co-regulated learning. In addition, the learning diaries provided insight into students' reflections upon their learning process, and their experiences with the sources of contextual support offered in the course, aimed at fostering their self-regulated learning. The learning diaries were composed with the following requirements in mind: they should portray the whole self-regulation cycle and provide an opportunity for students to use metacognitive strategies. Furthermore, the use of the learning diaries should be feasible for the students during their studies. After studying for the course, students completed the diaries once a week. To enhance acceptance, we chose a weekly frequency for the learning diaries to ensure embedding into the structure of weekly learning activities common in a university setting. A complete overview of the questions in the learning diaries can be found in appendix 3.

The learning diaries contain a selection of items about learning strategies and self-efficacy from the pre-test and post-test questionnaires. Additionally, they received short information or reminders about cognitive and metacognitive strategies as an introduction to the diary of that week. Students also answered questions tailored to the *Introduction to Human Communication* context course. In the learning diaries, we asked students to define a learning goal for the week, monitor their learning and strategy use during the week, and evaluate the achievement of their learning goal at the end of the week. They also reflected on what went well and were asked what they could improve next week's course. For example, they answered questions like: *When studying this week, I planned my tasks before I began working on it; How much time have you spent this week studying for Introduction to Human Communication; How successful were you in achieving your learning goal this week, and What can you improve next week, when studying for IHC?* A complete overview of questions in the learning diaries can be found in Appendix 3.

Students also reflected on their strategy-use, linked explicitly to the course assignments of the week, and answered questions such as: *Which strategy did you use to prepare for this week's writing assignment (group paper) for Introduction to Human Communication?* They were also asked about the strategy's usefulness chosen for the particular task. Furthermore, the diaries contained questions about students' motivation for studying for the course, such as *I was studying this week because I think the topic of the course is interesting.*

5.6.4 Focus group interview with teaching staff

In addition to students' self-report data and self-observations, the focus group interview allowed the tutorial lecturers to reveal and explain experiences with a co-regulated learning intervention from a teaching perspective. At the end of the course, a focus group interview was held with the teaching staff of the tutorial groups to elaborate on their experiences with co-regulation of learning.

The one hour-interview took place on 22 January 2021 and was conducted online. All six lecturers took part in the interview. After a brief introduction, the researcher gave a short recap of the educational innovation and the research project to the lecturers to freshen their memory. Subsequently, to guide the conversation, 13 questions were asked. The topics discussed included the purpose and perceived outcome of the intervention, the support directed to the students, and the

support directed towards the teaching team. After explaining the procedure, 13 questions were asked to guide the conversation. The complete overview of the interview questions can be found in appendix 4.

The following topics were discussed during the interview. As an introduction, the tutorial lecturers were asked if the purpose of the innovation, in general, was clear. They were also asked if, in their opinion, students' self-regulated learning skills were enhanced because of the educational innovation. We then focussed on the sources of contextual support the intervention consisted of and discussed if the intervention was complete, motivating, relevant and feasible for students. Subsequently, we talked about the support directed towards the teaching team. Finally, we spoke about the lecturers' experiences with implementing the intervention and their thoughts on the researcher's support. They were also asked if they thought the quality of the teaching and learning in this course improved because of the intervention.

In Figure 9, the research instruments used to collect data are mapped onto the course structure:

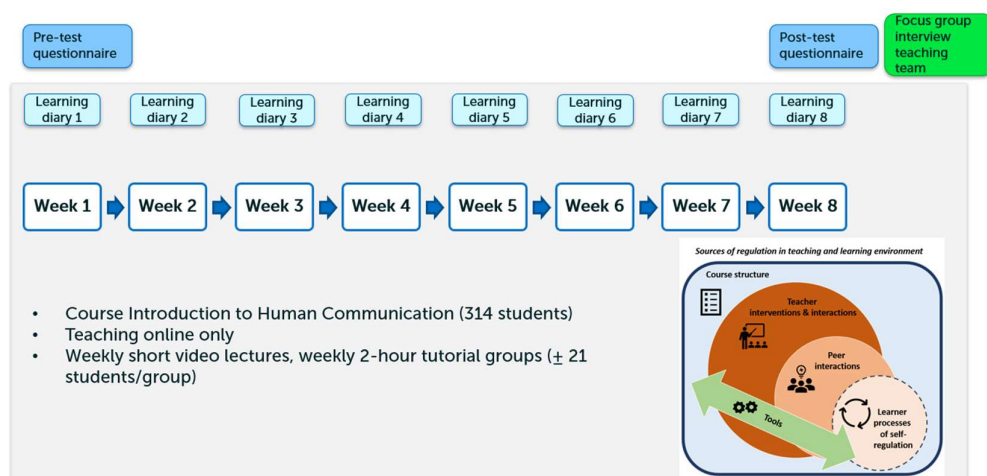


Figure 9: The research instruments mapped onto Introduction to Human Communication 2020-2021

5.7 Summary

This chapter provided a comprehensive overview of the research design chosen for the research project. First, the researcher's positionality was explicated, and the chapter provided a rationale for the methodological approach and the proposed data collection techniques. Next, the co-regulated learning intervention was described in detail. Subsequently, an overview and the measures used to collect data were described. Finally, the ethical considerations of this research project were covered in this chapter as well. The next chapter will describe the data analysis, and the results will be presented.

Chapter 6: Data analysis and results

6.1 Introduction

This chapter is dedicated to the findings of the research project. It provides an account of how the data analysis was approached and presents the results. The intervention in this research project was designed, developed, implemented, and evaluated using a design-based approach, providing sources of contextual regulation to encourage first-year university students to participate in co-regulation of learning and to engage in self-regulated learning. In this intervention, self-regulated learning is viewed as situated in context and a series of events. Therefore, in this research project, self-regulated learning is documented as it occurs in a particular course, context, and study period. I examined the following primary research question, divided into two subsidiary questions:

How do sources of contextual regulation affect first-year university students' participation in co-regulation of learning and self-regulated learning?

Subsidiary research questions are:

1. *In which ways do students make use of the sources of contextual regulation available in their course?*
2. *How do teachers experience the sources of regulation implemented in their course, and how do they perceive their students' reactions to these sources of regulation?*

To answer the primary research question, I combined the quantitative and qualitative data generated with the pre-test and post-test questionnaires, students' weekly learning diaries and the focus group interview with lecturers. To address the first subsidiary research question, I investigated how student engagement in both self-regulation and co-regulation unfolded over time and in context. Self-regulated learning is considered as an event, which means that student self-regulation is documented as it happens in a specific task, context, and study episode (Patrick and Middleton, 2002). However, self-reports provide an account of learners' perceptions, which are vital in understanding students' adaptations while studying. Therefore, to understand co- and self-regulation as it develops over time, this study used two measures to capture how students are affected and make use of the sources of contextual regulation available in their course. This study applied a self-report and a diary measure that served as an intervention and a measurement instrument. These instruments were used for capturing changes or adaptations of the learners' use of self-regulated learning strategies and processes over time, stressing the importance of self-regulated learning in context. In addition to students' self-report data and self-observations, the focus group interview allowed the tutorial lecturers to reveal and explain experiences with a co-regulated learning intervention from a teaching perspective. This data investigates teachers' perceptions of the intervention and students' reactions, thus addressing the second subsidiary research question.

This chapter aims to present the findings in light of the primary research question. The first section of this chapter presents the quantitative patterns of regulatory engagement which emerged across the course *Introduction to Human Communication*. The second section presents the patterns which appeared when quantitative and qualitative data from the pre-test and post-test and the learning diaries were combined. Finally, the third section presents the results from the qualitative analysis of

the focus group interview held with the teaching team, revealing teachers' experiences and perceptions of students' engagement in self-regulation and co-regulation during their course. The results from all three sections will be discussed in the Discussion chapter of this thesis (chapter 7).

6.2 Overview of the collected data

Pre-test and post-test questionnaire

All students in the course *Introduction to Human Communication* (N=314) were invited to participate in the research project. Of the 314 students, 83 students gave consent to share their data for this study and filled in the pre-test questionnaire in week 1. Initially, one additional student gave consent but decided to withdraw from the study and was removed from the dataset. Out of these 83 students, 35 students also filled the post-test questionnaire and were included in the dataset to compare the pre-test and post-test questionnaires. They all completed at least 90% of each questionnaire.

Learning diaries

Regardless of their participation in the research project, all students were required to complete the weekly learning diaries, as this was one of the course tasks. Many students filled out the learning diaries in the course: 294 in the first week, which gradually declined to 119 in week eight. For this research project, however, only the data from the learning diaries of students who gave their consent to participate were collected and analysed. The learning diaries from the 35 students who filled out both the pre-test and post-test questionnaires were included in the analysis. Of those 35 students, 11 students filled out 4 or 5 of the learning diaries; 24 students filled out 6 to 8 of the learning diaries.

Table 4 presents an overview of the data collected and used for the analysis through the pre-test and post-test questionnaire and the learning diaries.

Completed:	Number of students:
Pre-test questionnaire (consent given) ¹	83
Both pre-test and post-test questionnaires ¹	35
4-5 learning diaries ²	11
6-8 learning diaries ²	24

¹Completed at least 92%, ²Completed at least 71%

Table 4 Overview of the data collected and included in the analysis

The age of the 35 participants ranges between 17 and 22 years- old (mean = 18,77). Of the 35 participants, 29 identified as female, five as male, and one participant indicated 'other'.

Focus-group interview

The tutorials for the course *Introduction to Human Communication* were delivered by six tutorial lecturers whom all had several tutorial groups with, on average, 21 students. All tutorial lecturers consented to share their data for this study and participated in the focus-group interview.

6.3 Quantitative patterns of regulatory engagement

A pre-test questionnaire (week 1) and a post-test questionnaire (week 8) were used to collect self-report data about study behaviours, students' self-efficacy, motivation and the cognitive, metacognitive and resource management strategies used when studying. The data of the 35 students were used for descriptive analysis of the pre-test and post-test questionnaire, comparing the mean scores before and after the intervention. Additionally, data from the pre-test and post-test questionnaires were analysed to identify quantitative profiles of students' regulatory engagement.

6.3.1 Comparison of the pre-test and post-test questionnaire

The pre-test questionnaire represents Time 1, and the post-test questionnaire represents Time 2 (see table 5). Participants who had complete data at both time points (N= 35) were included in the analysis. Means for each scale were created for Time 1 and Time 2.

To identify how the sources of contextual regulation affect students, I examined the patterns of regulatory engagement that emerged across the course. Therefore, the self-regulatory skills, motivation, and self-efficacy of the sample of 35 students before and after completing the intervention are measured, and the differences are analysed using a paired sample T-test. A paired-samples T-test is a statistical technique used to establish whether differences between two groups (measured in means) could have occurred by chance. Each participant is measured twice in a paired samples T-test, resulting in pairs of observations.

In this research project, the paired measurements represent the measurement taken at two times, e.g., the pre-test and post-test score with the intervention implemented in the course. The paired-samples T-test compares the means of two measurements taken from the same individual and demonstrates how significant the differences between groups are. The larger the t-score, the more difference between groups and the more probable the results can be repeated. When the paired sample T-test outcomes are interpreted, the statistical significance is determined by the p-value. The p-value of .01 indicates there is just a 1% probability that the results from an intervention occurred by chance. A p-value of 0.05 (5%) is accepted to indicate that the data is valid. Therefore, paired-samples T-tests were conducted to examine whether students' self-regulatory skills (cognitive, metacognitive and resource management strategies), motivation, and self-efficacy changed after the eight-week course, indicating significant changes on some scales and non-significant differences on others.

First, the descriptive data of the pre-test and post-test measures (self-regulated learning skills, motivation, and self-efficacy) are displayed in Table 5, providing the mean scores and standard deviations at Time 1 and Time 2.

Scale and subscales:			Time 1		Time 2	
			M	Sd	M	Sd
Cognitive scales (9 items):						
	Rehearsal	MSLQ	3.59	0.80	3.87	0.74
	Elaboration	MSLQ	3.97	0.56	4.18	0.71
	Organization	MSLQ	3.30	0.95	3.43	0.70
Metacognitive scale (9 items):						
	Metacognitive self-regulation	MSR-R	3.47	0.57	3.69	0.49
Resource management strategies (14 items):						
	Time and study environment (TSE)	MSLQ	3.99	0.52	3.86	0.54
	Peer learning	MSLQ	3.19	0.83	3.20	1.03
	Help seeking	MSLQ	3.52	0.70	3.37	0.74
Motivation (16 items):						
	Autonomous	Academic SR	4.06	0.66	3.97	0.62
	Controlled	Academic SR	2.32	0.79	2.75	0.88
Self-efficacy (1 item):		Confidence	71.23	13.99	75.89	11.17

Table 5 Means and Standard Deviations for self-regulated learning skills, motivation, and self-efficacy) at Time 1 (pre-test) and Time 2 (post-test).

Significant changes

There was a significant increase in self-regulatory skills measured by the MSR-R subscale.

Metacognitive self-regulation assesses students' use of strategies helping them to control and regulate their cognition. This was assessed with nine items, measuring the degree of agreement on statements such as "When I study for this class, and I set goals for myself in order to direct my activities in each study period". Metacognitive self-regulation increased significantly from pre-test ($M = 3.47$, $SD = .57$) to post-test ($M = 3.69$, $SD = .49$), $t(35) = 2.54$, $p = .016$.

Regarding self-efficacy, there was a significant improvement in students' self-reported confidence from pre-test ($M = 71.23$, $SD = 13.99$) to post-test ($M = 75.89$, $SD = 11.17$), $t(35) = 2.21$, $p = .034$.

Self-efficacy was measured with the question *On a scale of 0-100, how confident are you that you are able to successfully study the learning materials for your future courses?*

An increase in controlled motivation from pre-test ($M = 2.32$, $SD = .79$) to post-survey ($M = 2.75$, $SD = .88$) was significant as well, $t(35) = 4.26$, $p < .001$. All significant changes are displayed in Table 6.

Subscales	t	df	p
Metacognitive self-regulation (MSR)	2.54	34 ¹	.016
Self-efficacy	2.21	34	.034
Controlled motivation	4.26	34	< .001

¹ Degrees of freedom: number of values that are free to vary in the data set, i.e., number of observations (N=35) minus 1.
 Table 6 Significant changes from pre-to post-test in metacognitive self-regulation, self-efficacy, and controlled motivation

Non-significant changes

There were non-significant changes in self-regulatory skills measured by the cognitive and resource management scales. In contrast to controlled motivation, a slight decline in self-reported autonomous motivation can be seen from pre-test to post-test. This change, however, was not significant, $t(34) = -1.07, p = .293$. All non-significant changes are displayed in Table xx.

Subscales	t	Df	p
Rehearsal	1.74	34	.091
Elaboration	1.83	34	.076
Organization	0.79	34	.436
Time and Study Environment (TSE)	-1.11	34	.274
Peer Learning	0.10	34	.920
Help Seeking	-1.42	34	.165
Autonomous motivation	-1.07	34	.293

Table 7 Non-significant changes in self-regulatory skills and autonomous motivation

Student perceptions

Students were asked whether, in their perception, they had developed additional self-regulated learning skills during the Introduction to Human Communication course in the post-test questionnaire. As depicted in Figure 10, a little over half of the 35 respondents (55,6%) indicated that they somewhat or strongly agreed with the statement, indicating that their self-regulated learning skills increased throughout the course. However, about a quarter (22,2%) neither agreed nor disagreed with this statement and 22,2% of the students somewhat or strongly disagreed with this statement.

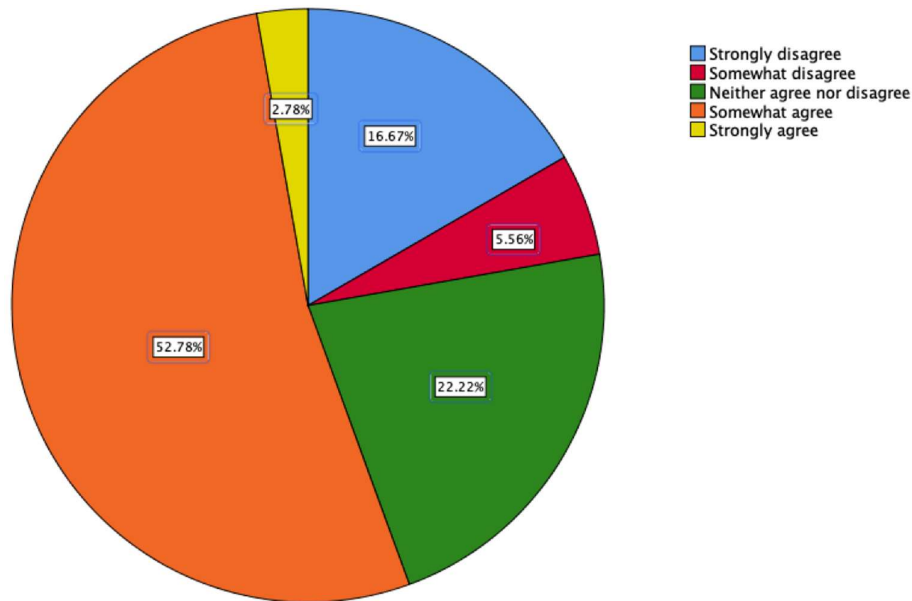


Figure 10: Participants' beliefs about developing additional self-regulated learning skills during the course.

Of the support offered within the course, students had the greatest appreciation for the instruction and explanation from their tutorial lecturer and the information about self-regulated learning that was available on the electronic learning environment Canvas. The instruction and explanation provided by the tutorial lecturers were found either moderately beneficial, very beneficial or extremely beneficial by 63% of the participants. In addition, 46% of the participants found the information provided on Canvas moderately beneficial, very beneficial or extremely beneficial. On the other hand, students found the available tools less beneficial in supporting their self-regulated learning skills. The learning diaries, for instance, were perceived as slightly beneficial by 31% of the participants. Table 8 displays an overview of students' responses when asked (measured on a five-point Likert scale) to what extent they experienced benefit from the various forms of self-regulated learning support embedded in the course.

Source of contextual regulation:	Not beneficial at all	Slightly	Moderately beneficial	Very beneficial	Extremely beneficial
Weekly online learning diaries	18	11	5	1	0
SRL-cycle for planning, monitoring and reflecting on your learning	16	10	4	4	1
Ace Your Self-Study App	22	6	2	4	1
Information about SRL available on Canvas	11	7	11	4	1
Instruction and explanation from the tutorial lecturers about SRL	7	6	15	6	1

Table 8 Experienced benefit from the various forms of self-regulated learning support embedded in the course

6.3.2 Quantitative patterns: types of regulators

The next step in analysing the data from the pre-test and post-test questionnaire was to determine which quantitative patterns of regulatory engagement emerged across the event of the course Introduction to Human Communication. Describing what happened across the event requires a more comprehensive description than comparing the pre-test and post-test data. In addition to an account of what was observed 'generally' across the sample of the 35 students established from the paired sample T-test, I also wanted to provide an impression of the variability in students' answers. This was done by calculating a difference score (*D*) based on students' scores on the Metacognitive self-regulation scale (MSR) of the MSLQ, used to measure metacognition, which comprises three general processes: planning, monitoring, and regulating. Metacognition is the instrument that controls the cognitive, behavioural, and motivational elements and forms the basis of self-regulated learning: it represents the ways learners monitor and purposefully direct their learning. Metacognitive processes clarify how self-regulation occurs. Metacognitive self-regulation was therefore used to establish categories of regulators based on observed changes across Time 1 and Time 2 data collection points.

The 35 students included in the analysis had complete data at both data points. For the Metacognitive self-regulation scale, means for Time 1 and Time 2 were established, and a difference score. The difference, or gain score, represents an index of change between observations from the same student across time, based on the student's score on the MSR-score at the beginning of the course and the end of the course, in which the intervention was implemented. The difference score was calculated by subtracting the Time 1 score from Time 2 score, thus incorporating a time component into the analysis. This difference score or gain score is used in educational research to address intra-individual change, illustrating that learning has occurred (e.g., McCardle and Hadwin, 2015; Williams and Zimmerman, 1996). This procedure resulted in two variables: the mean on the scale Metacognitive self-regulation at Time 1 ($M = 3.47$) and a difference score for this scale (.22). The positive difference score reflects a higher score at Time 2.

Consistent with the work of McCardle and Hadwin (2015), the participants were then grouped into quantitative categories. In my analysis, I arrived at the quantitative categories based on the observed difference score on the metacognitive self-regulation scale. This identified three categories of students: developing regulators, moderate regulators, and high regulators.

- *Developing regulators* were participants with relatively low scores at the beginning of the course (i.e., Time 1) with significant improvements at the end of the course (i.e., Time 2). There were nine students in this category (26% of the sample of 35 students).
- *Moderate regulators* were represented by 14 students (40%), and these students showed average scores at the start of the course (around the mean score of the entire group) and displayed very little change in the scores by the end of the course.
- The category of *High regulators* was made up of 12 students (34%), which had relatively high scores at the start of the course and demonstrated small increases when the course had finished.

The mean score for the entire group of 35 students was 3.47 at Time 1 and 3.69 at Time 2. Table 9 lists the means and difference scores by the three categories. Again, a positive difference reflects higher scores at Time 2.

	Developing regulators (N= 9)		Moderate regulators (N= 14)		High regulators (N= 12)	
	Time 1	Difference	Time 1	Difference	Time 1	Difference
Metacognitive self-regulation	2,90	.77	3,40	-.003	3.89	0,19

Table 9 Means and difference scores by the three categories

Figure 11 provides a graphical representation of the categories of Developing, Moderate and High regulators and depicts the means scores per category at Time 1 and at Time 2.

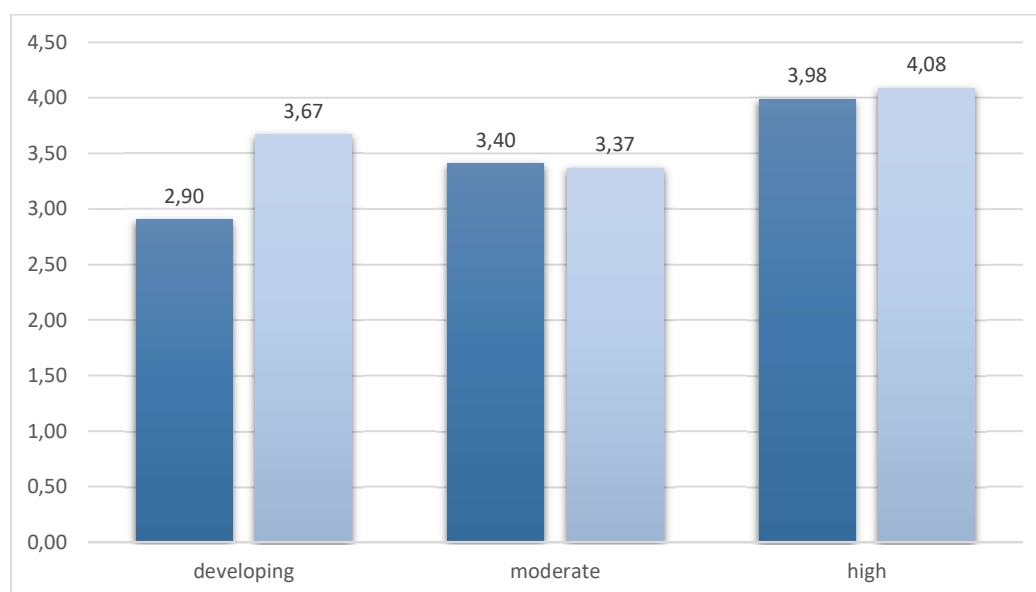


Figure 11: Mean scores (T1, T2) of Developing, Moderate and High regulators

6.4 Combining qualitative and quantitative patterns of regulatory engagement

6.4.1 Learning diaries

The pre-test and post-test questionnaires were complemented by two rounds of analysis of the learning diaries completed by the participants during the intervention. First, I conducted content analysis on a sample of 3 learning diaries per category, aiming to identify qualitative labels of categories of regulators. When this approach proved inadequate for this purpose, I conducted a second round of analysis of the learning diaries, this time using thematic analysis of what was recorded by all 35 students throughout the eight weeks of the intervention.

The weekly online learning diaries filled out at the end of each week were used to collect data about students' reflections upon their learning process and their engagement in the sources of contextual regulation. The questions in the learning diaries are designed to be sensitive to time, context, and

metacognitive processes. The learning diaries were anchored in the activities and assignments in students' coursework that varied from week to week. Diaries are sensitive to context and focused on real-time learning behaviours occurring during the enactment of teaching and learning throughout the course (Zimmerman, 2011).

Table 10 provides an overview of the total number of learning diaries filled out by all students in *Introduction to Human Communication*. Filling out the weekly online learning diaries was one of the course assignments, and, therefore, all students were required to complete the weekly learning diaries. Nevertheless, the learning diaries were not graded, nor did students receive a participation mark for filling out the learning diaries. Instead of making it mandatory for students to fill out the diaries, we preferred to motivate and stimulate their use as an instrument to foster self-regulatory behaviours. This was explained in the tutorial groups, the information on Canvas (the electronic learning environment in use), and students were sent regular reminders to complete the diaries. In the first week, 94% of all students filled out the learning diary, and this percentage declined each week, especially after the fifth week. For example, in week 8, 119 of the initial 314 students filled out the learning diary at the start of the course (38%).

Week	1	2	3	4	5	6	7	8
Number of learning diaries filled out (by all students in the course; N=314)	294	266	233	246	206	187	140	119

Table 10 Number of learning diaries filled out per week by all students in course IHC

The learning diaries from the 35 students who filled out both the pre-test and post-test questionnaires were included in the analysis. Including the students in the sample filled out both the pre-test and post-test questionnaire made it possible to combine the quantitative and qualitative data from the pre-test and post-test and the learning diaries. The 35 students that thus formed the sample for this study completed between 4 and 8 of the eight learning diaries in total. Little over half of the students (N=19) filled out seven or all 8 of the learning diaries. Table 11 displays the number of learning diaries filled in total per student.

Number of learning diaries filled out in total, per student	Number of students from the sample
4	5
5	6
6	4
7	8
8	11
<i>Total:</i>	35

Table 11 Number of learning diaries filled in total per student

Over an extended period, students' learning actions were researched by analysing learning diaries. The analysis of the diaries thus allowed the assessment of self-regulated learning as an event. The learning diaries consisted of open and closed questions (5-point Likert, yes/no, multiple answers, 1-10). In addition, they contain a selection of items from the pre-test and post-test questionnaire – allowing for triangulation of data and providing insight into how self-regulated learning constructs

such as the use of learning strategies and self-efficacy unfold over time. Therefore, the learning diaries used in this study lend themselves to a mixed-methods approach while also offering rich subjective data.

6.4.2 Qualitative patterns of regulatory engagement

The quantitative comparison of the pre-test and post-test data provides insight into what might be generally true across the 35 students included in the analysis. In addition, the learning diaries allow for a qualitative and more comprehensive description of the changes in students' self-regulatory behaviour across cases or events. For a deeper understanding of how students' self-regulation of learning develops, the variability in students' responses needs to be taken into account, thus providing insight into both typical and discrepant findings (e.g., De Groot, 2001). By combining the pre-test and post-test questionnaire and the weekly learning diaries, I could examine the patterns that appeared when combining quantitative and qualitative self-report data. Therefore, an in-depth qualitative analysis of the learning diaries was combined with the quantitative results from comparing the pre-and post-test data. Combining the qualitative and quantitative data of my research project was, again, based on the work of McCardle and Hadwin (2015), who examined the dynamic adjustments learners make across study sessions. To understand regulation as it develops over time, they used a pre-test and post-test measure and combined this data with students' reflections on their learning strategies during a twelve-week academic course. This course was not contextualised and, thus, instruction was offered as a stand-alone intervention, not embedded within a subject-specific course.

Comparing the quantitative pre-test and post-test data led to identifying three categories of students. Based on the observed difference scores on the metacognitive self-regulation scale, three groups of regulators were recognised: developing regulators, moderate regulators, and high regulators. Next, an in-depth content analysis of the learning diaries was conducted to identify qualitative patterns of regulatory engagement in our group of 35 students. Content analysis is a method used to identify patterns in recorded communication: the learning diaries in the current research project (Neuendorf, 2017). The qualitative content analysis was focused on interpreting and understanding what students had recorded in their learning diaries throughout the course.

The following procedure was undertaken for the content analysis. For each participant, an individual qualitative profile was created in three steps. First, three participants were randomly selected from each category for an in-depth qualitative analysis, making nine in total. The qualitative analysis was conducted without showing the quantitative label for the participant, thus making sure the researcher was blinded to the quantitative category the participant was grouped into (i.e., developing, moderate or high regulator). As a second step, the changes in students' self-regulatory behaviour were assessed and coded for the three regulatory phases (forethought, performance, and reflection) and motivation and metacognitive awareness. The following labels were used to appraise students' self-regulation of learning: low, moderate, high, improving, or decreasing. As a third step, the nine individual qualitative profiles that resulted from the content analysis of the learning diaries were grouped based on membership into the quantitative profile (See Appendix 5). Subsequently, each group of individual qualitative labels was examined to identify common themes and discrepancies.

My initial idea was that this analysis would result in three qualitative group profiles or descriptions of cases. However, the sample of three participants per quantitative label turned out to be inadequate to paint a clear qualitative picture of the development of students' regulatory engagement throughout the intervention. There were too many disparities in the individual qualitative profiles, and it was not possible to identify the common themes and discrepancies I had anticipated. The codebook of the content analysis of the learning diaries can be found in Appendix 5. Therefore, the qualitative analysis was expanded to the entire set of 35 students. This time, as opposed to the first round of qualitative analysis, I took a thematic approach to analysing the learning diaries. Thematic analysis is an approach for analysing qualitative data focussing on identifying patterns of meaning, also referred to as themes. These themes emerge as being meaningful to the description of phenomena (Braun and Clarke, 2006).

The following procedure was undertaken for the thematic analysis of the learning diaries. First, I blinded myself again to students' quantitative labels (Developing, Moderate, or High regulators). Second, I read the collection of all learning diaries to become familiar with all data of the learning diaries, making notes of general impressions about each participant's self-regulatory processes during learning and their engagement with the sources of co-regulation. Third, again, I focused on students' self-regulatory behaviours regarding forethought, monitoring, and reflection. Nevertheless, I concentrated more specifically on the open questions in the learning diaries this time. In their answers to these open questions, students formulated their learning goals for the past week of studying. They also described what had worked well when studying during the previous week and what they thought they could improve next week when studying for the course. The fourth weekly open question in the learning diaries asked students to formulate their learning goals for the course's next week. Finally, I paid specific attention to the development of participants' metacognitive awareness, or the awareness or behaviour students demonstrated about their knowledge (about the course materials) and their regulation of the learning processes to complete the learning tasks in the course. The themes used for the analysis and description of these themes can be found in Appendix 5. The themes and their descriptions were based on the combined work of McCardle and Hadwin (2015) and the work of Cazan (2020), who measured the development of self-regulated learning in academic settings by using learning diaries as one of the measures in her study. The thematic analysis of the learning diaries of the 35 students resulted in the identification of four qualitative categories of regulators: Disengaged, Striving, Emerging, and Engaged regulators.

Disengaged regulators

Disengaged regulators were students who demonstrated an overall low regulatory engagement across the first-term course. Their learning objectives were general and unspecific:

“To keep up with the homework; To understand everything; Improve my time management; Understand all the material.”

For some students, a slight improvement of the learning goals was observed in terms of more specific standards and actions. Nevertheless, these were not consistent improvements. The monitoring phase of learning revealed students' perceived level of difficulty of the course content and the strategies they used:

“Taking notes on my laptop; Only focussing on important words; Planned studying; Rereading; Doing the readings on time, not last minute; I'm overwhelmed.”

The evaluation of the learning process by these students and their descriptions of what they could improve the following week were also basic and expressed in general terms:

“My time-management is not efficient; Spend more time studying; Using my time more wisely, spending more time on these tasks; Summarizing more detailed, Divide the tasks over the whole week.”

The learning diaries of the Disengaged regulators displayed an image of surface learning and generally low metacognitive awareness and engagement. Students in this category described some difficulties in learning for the course, but they displayed little intention to undertake action to improve their learning. There were six students in this category (17% of the sample of 35 students).

Striving regulators

Striving regulators were students who displayed awareness of academic issues and challenges when studying for the course, but the attempts to adapt their learning behaviours were not necessarily effective. The learning objectives of these students became more elaborate across the term. Learning objectives are important in learning as they function as specific standards upon which students can monitor and evaluate their progress. The learning objectives of striving regulators displayed shortcomings in the specificity of standards, which made it difficult to monitor and evaluate their learning progress:

“To finish my preparations on time and write a good paper; To learn the different types of verbal and nonverbal communication and see how they apply in real-life circumstances; Getting my work done without any distractions; To understand all new concepts.”

When monitoring what went well, these students displayed some awareness and use of learning strategies, although they were not necessarily able to distinguish between effective and less effective strategies:

“Preparing well; The note-taking and flashcards; When getting a task, doing it directly; Rereading over and over; Sitting alone and reading all material; Having a deadline for the group project.”

In evaluating the learning process and outcomes, striving regulators display intentions to use more efficient learning behaviours and strategies in the future. They reported similar challenges week to week and tried different ways to handle the same challenges without accomplishment:

“Try new strategies; Work faster; Revise more, maybe use the app; Study more ahead of time, Not procrastinating; Again, planning.”

The learning diaries of the Striving regulators demonstrated a regulatory focus on aspects of time and the learning environment. Generally, students fitting this profile paid less attention to their learning process or engagement with the course content. There were 11 students in this category (32% of the sample of 35 students).

Emerging regulators

Emerging regulators were learners that exhibited constant advancement of some aspects of self-regulated learning. They displayed some metacognitive awareness by describing their struggles and strengths in the learning diaries. The learning goals of emerging regulators become more specific and task-focused, and their goal-setting and strategic planning become better highlighted throughout the term:

“Get an insight on what this course would be and what to expect; To ask critical questions during a tutorial; Balance my social/study life and understand the material thoroughly. Be able to connect the concepts.”

Monitoring of these students revealed an increasing understanding of the learning process. Students' attempts to adapt their learning strategies and behaviour concentrate on organisation and motivation rather than learning and learning content: Concept maps for written assignments were a great way to organise thoughts and formulate further ideas.

“I got the reading and summarising done in time as I had planned; I've been able to apply concept mapping to take better notes; Summarizing each paragraph/chapter in general. Fully understanding the concepts through doing the assignment.”

The evaluation of students' learning and their ideas about what they could improve next week revealed more complexity and specificity of cognitive judgements:

“I have to take more time and start reproducing the knowledge by myself instead of just reading and understanding it; I want to keep up the summarising of the chapters because I think it will help me a lot when learning for the exam; Continuously asking myself questions to clarify my understanding, if I couldn't understand I will ask the teacher or my friends.”

The learning diaries of the Emerging regulators demonstrated that this group of learners is aware of academic challenges and is successfully adapting to some of the aspects of self-regulated learning. There were 13 students in this category (37% of the sample of 35 students).

Engaged regulators

Engaged regulators were a group of students that displayed deliberate attempts to make adaptations to their learning with conscious intent to improve their learning behaviours. The learning goals of engaged regulators were more complex and specific. They displayed a focus on learning and active engagement with the course content:

“To read all the chapters necessary to follow the lecture and the tutorials properly and to finish my assignment one day before the deadline; My learning goal for this week was to reflect on the work done so far and be able to identify the misunderstood material; To employ a different self-study strategy which in this case was writing flashcards.”

When monitoring, these students actively kept track of what went well, and they displayed active awareness and thoughtful use of learning strategies:

“The note-taking and rereading the notes for the assignments made me understand the concepts better because I had to apply them; The subdivision of the study worked well, alternating with small pauses and a repetition of key concepts; I was able to plan and successfully reach my goals of completing a self-study session whilst rewriting notes on a flashcard.”

In the reflection on their learning, engaged regulators clearly described the challenges they experienced and exhibited clear monitoring and evaluation of their learning process and outcomes:

“Focus more on studying and try to explain myself the different concepts in order to check my learning; Next week, I would like to start testing myself on the course material and be able to start memorising information by heart; Prepare more thorough [sic] by rereading material I am unsure of instead of having to panic and go on the internet immediately for even more unclear results. I've learnt from this week that all my answers to questions are in the textbook, and I should take more initiative to look and find them; Next week, I could spend

more time revisiting real-life examples and be able to apply the theories mentioned into other contexts for better understanding of the material.”

The learning diaries of the Engaged regulators demonstrated higher levels of metacognitive awareness. In addition, engaged regulators actively and intentionally attempted to adapt and improve their learning. There were five students in this category (14% of the sample of 35 students).

6.4.3 Combining the learning diaries and the pre-and post-test questionnaire

The thematic analysis of the learning diaries resulted in four qualitative profiles of regulators and demonstrated how students engage with self-regulatory processes in different manners when they are studying. Thus, two data sets were available with the quantitative categories derived from the pre-test and post-test comparison. By combining these two sets of self-reports, I wanted to determine whether the quantitative and qualitative profiles of students corresponded and to what extent and if there were differences. The quantitative profiles, based on students’ self-reports on metacognitive self-regulation in the pre-test and post-test questionnaire, represented the differences observed in those students at the start and end of the course. The qualitative profiles, on the other hand, which were based on students’ self-observations in the learning diaries, represented how their regulatory engagement unfolded during the course. Thus, a time- and context-based component are taken into account in the qualitative regulatory profiles of students. Table 12 summarises the quantitative and qualitative categories that had emerged from the analysis from the pre-test and post-test questionnaire and the learning diaries.

Quantitative categories (based on MSLQ-metacognitive self-regulation)	Qualitative categories (based on reflections in learning diaries)
<i>Developing regulators</i> Relatively low scores at Time 1 with significant improvements at Time 2	<i>Disengaged regulators</i> Exhibited overall low regulatory engagement across the course
	<i>Striving regulators</i> Demonstrated ineffective endeavours to adapt to academic challenges
<i>Moderate regulators</i> average scores at Time 1 with small increases at Time 2	<i>Emerging regulators</i> Displayed improvement in some of the aspects of self-regulated learning
	<i>Engaged regulators</i> Demonstrated active and intentional attempts to adapt and improve learning
<i>High regulators</i> High scores at Time 1 and 2	

Table 12 Summary of quantitative and qualitative categories

When comparing the quantitative and the qualitative categories, the following patterns emerged. First, students with different qualitative profiles were represented in each quantitative category, for example, in the quantitative category of High regulators (N=12), one disengaged regulator, three striving regulators, five emerging regulators, and three engaged regulators. Moreover, the students labelled as disengaged regulators were present in each quantitative category: developing, moderate and high regulators. This indicates that for some students, their self-reports on the pre-test and post-test painted a different picture of what occurred during the course than their self-reports from the

learning diaries evidenced. Thus, it is revealed that the two types of regulators did not always align. This may indicate differences in the ways students perceive their self-regulatory skills during learning. An overview is presented in Table 13.

Quantitative category \ Qualitative Category	Developing regulators N=9	Moderate regulators N=14	High regulators N=12
Disengaged regulators (N=6)	3 (33%)	2 (14%)	1 (8%)
Striving regulators (N=11)	4 (45%)	4 (29%)	3 (25%)
Emerging regulators (N=13)	2 (22%)	6 (43%)	5 (42%)
Engaged regulators (N=5)	-	2 (14%)	3 (25%)

Table 13 Overview of students per category

Nevertheless, there was an overlap between the quantitative and qualitative categories in general. This becomes apparent when combining the categories of disengaged and striving regulators (Table 14).

Quantitative category \ Qualitative category	Developing regulators N=9	Moderate regulators N=14	High regulators N=12
Disengaged and Striving regulators	7 (78%)	6 (43%)	4 (33%)
Emerging and Engaged regulators	2 (22%)	8 (55%)	8 (67%)

Table 14 Representation of combined qualitative categories per developing, moderate, and high regulators

The disengaged regulators were students that did not take active control over their learning, even though they did show an effort by filling out all self-report measures (i.e., the pre-test and post-test and a substantial amount of the learning diaries). The striving regulators were aware of their struggles and attempted to regulate their learning. Despite their investments, they were nevertheless unsuccessful. Therefore, the category of disengaged and striving regulators consisted of students who were ultimately inefficient in regulating their learning.

The two categories of emerging and engaged regulators can be combined as well. Students in both categories demonstrated metacognitive awareness and deliberate attempts to improve their learning process and outcomes. The difference between the two groups is the extent to which they were successful: engaged regulators consistently improve their learning, whereas emerging learners exhibit improvement but not in all aspects of self-regulated learning.

6.5 Focus group interview tutorial lecturers

6.5.1 Thematic analysis

The second subsidiary question I wanted to answer with this research project is how teachers experience the sources of regulation implemented in their course and how they perceive their students' reactions. I conducted a focus group interview with all six tutorial lecturers to address the second subsidiary research question. All lecturers gave their consent to participate in the interview. Unfortunately, due to the Covid-19 measures still in place (January 22, 2021), it was impossible to meet the tutorial lecturers on campus. Instead, the interview was held online and recorded. The interview guide, including all questions, can be found in Appendix 4. The qualitative data thus captured in the interview was transcribed verbatim. The interview with the tutorial lecturers complemented the self-report data and self-observations from students. Thematic analysis was used to interpret the respondents' views, opinions, and experiences with the intervention as expressed in the interview.

For the focus group interview in this study, I chose a hybrid approach of qualitative thematic analysis methods and thus incorporated a deductive and inductive approach (Fereday and Muir-Cochrane, 2006). Two rounds of thematic analysis were utilised as a data reduction strategy and by which data of the interview were segmented and categorized for thematic analysis. In the first round of analysis, I used the deductive approach and a list of a priori themes to analyse the data, as Crabtree and Miller (1999) outlined. The second round of analysis incorporated the data-driven inductive approach of Boyatzis (1998). Consistent with this approach, no predetermined framework or structure was used to analyse data. Instead, this subsequent inductive approach allowed themes to surface directly from the data using inductive coding.

6.5.2 Deductive thematic analysis

Following a deductive or confirmatory approach to the thematic analysis, the interview questions were based on a set of preconceived themes I expected to find reflected in the interview with the tutorial lecturers. These themes were explicitly included in the data collection and were therefore anticipated in the data set. The a priori themes were based on a review of the literature, the research question, and my professional experience in developing and implementing educational innovations. Nieveen's criteria (1999) for evaluating educational interventions were used to inform this set of themes. Nieveen (1999) proposed four criteria for high-quality interventions. The first two refer to the intervention's relevance (or, content validity) and consistency (or construct validity). The intervention is considered valid if it meets these requirements. The other criteria relate to its practicality (in the eyes of the end-users, i.e., teachers and learners) and the effectiveness of the intervention. In other words, whether or not it leads to the desired outcomes.

In the coding process in the first round, a template approach was applied (Crabtree and Miller, 1999). A template in the form of codes from a codebook was applied to organise the transcript for subsequent interpretation. The topics discussed in the interview included:

- (1) the aim and perceived outcomes of the intervention,
- (2) the support directed to the students, and
- (3) the support directed towards the teaching team.

To familiarise myself with the data, I read the interview transcript carefully. The next step was to assess the applicability of the predetermined codes to the raw information in the transcript. A code was confirmed when it was a topic discussed by participants. The next step I undertook was re-reading the transcript to find excerpts that matched the codes. This was done in Word, highlighting the excerpts with a different colour per code.

The interview guide provides a complete overview of the questions and topics discussed with the tutorial lecturers (see appendix 4). The first round of coding resulted in the codebook, as exemplified in Table 15.

Name of the code	Description	Text excerpts
Aims	Awareness of the goal of the intervention.	"I think it's so relevant that students can really benefit from it."
Outcomes	Change in students' self-regulated learning skills as a result of the intervention.	"I haven't heard much feedback from the students, so I genuinely don't know, if they thought it was helpful or not." "I remember some of them saying that it helped them to find out new techniques or new ways to study."
Support students	Ease of use of the intervention (sources of contextual regulation) for students.	"I think and also hearing back from them, that it was too much work, or that it was extra work..." "We can highlight that the material was amazing, in terms of access, and all the information that they could get on it was very clear and was available to them."
Support teaching team	Ease of use of the intervention (implementation) for teachers	"I also think that maybe, if we had those hours, we could actually spend time in class to actively practice with it." "the experience of the forms of support, I think they were great, everything that was needed was there..."

Table 15 Initial codebook for the analysis of the focus group interview

6.5.3 Inductive thematic analysis

The second round of analysis followed the deductive analysis of the data from the focus group interview. In the first coding round, I deductively started with a set of codes. The second round involved an inductive or exploratory approach to the thematic analysis (Boyatzis, 1998). Subsequently, I arrived at additional codes inductively and iterated on the codes as I sifted through the data from the interview with the tutorial lecturers.

When coding the transcript, I allocated inductive codes to sections that illustrated an additional theme found in the text. The added codes were either new or expanded from the predetermined codes in the initial codebook. Thus, the codebook was refined, and the second round of coding resulted in the finalised codebook, as exemplified in Table 16.

Code	Description	Example
Purpose	Awareness of the goal of the intervention, i.e., encouraging and supporting student self-regulated learning behaviours through sources of contextual regulation.	<p>"I personally think it's super relevant, I think it's great [...] I would think that the students think so too, without knowing"</p> <p>"I think you did a great job of introducing it - I of course understand the purpose and what to communicate to the students..."</p>
Need	Students' awareness of the need to further develop or remedy a lack of self-regulated learning skills.	<p>"...to get introduced into it and to get that feeling of 'oh, this is something that could actually benefit me...'"</p> <p>"...this is not something students receive, [...], this is not regular information for students right, so this is extra information."</p>
Motivating	Students' disposition or readiness to develop their self-regulated learning behaviours.	"definitely there were some students who clearly sort of were motivated by it possibly, but then again it was just difficult to gauge from my side."
Usability	Lecturers: Feasibility for lecturers to implement the intervention (instruction, tools, materials) in their teaching.	<p>"Yeah, for me too I think, in the beginning you explained it well and we were introduced to it well..."</p> <p>"...sometimes we were obviously focusing so much on concepts and talking, and then we would be like "oh, by the way, this is sort of the steps that you can use", but if we could just infuse that, then I just I thought maybe it would be easier for them to digest it."</p>
	Students: Support/instruction received by students and time available to them to make use of the intervention tools and materials.	"I think that really, I mean not everyone might have done something with it, but it's definitely you know they got the information and it just connect so well so, yeah."
Barriers	Lecturers: Factors that hinder the implementation of the intervention, as intended by the researcher.	<p>"...in our tutorials [...] there were always lots of other questions or things to address, and then there wasn't always enough time there to go over it in a lot of detail"</p> <p>"...with three hours we could've done more with it, definitely."</p>
	Students: Factors that inhibit students from making use of the intervention tools and materials, as intended by the researcher.	<p>"There was just so much they had to do."</p> <p>"I think what was missing was maybe have more time to practice with them; I think they still need some sort of guidance in the beginning..."</p>
Outcomes	The change in students' self-regulated skills as	"I definitely think that students benefit from this"

	observed by lecturers because of the intervention.	“I don’t know if that would then end up making them learn better or anything like that [...]. Cause all we have is the grades, right, the grades were normal.” “it’s very hard to compare also to our previous experience because of course this was a yeah time of Covid”
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Table 16 Finalised codebook

6.5.4 Focus group findings

The deductive and inductive coding of the data in the first and second rounds of the thematic analysis served to organise the data. The next step involved examining and connecting the codes and collated data to identify and develop themes from them (Crabtree and Miller, 1999). Themes are significant broader patterns of meaning. Four overarching themes were identified, which I felt adequately captured teachers’ experiences with the intervention as described in the raw data. Finally, the themes developed were reviewed to determine they provided a persuasive account of the data and answered the second subsidiary research question. The four themes identified are exemplified in Table 17.

Theme	Codes	Description
Relevance	Purpose	Awareness of the goal of the intervention, i.e., encouraging and supporting student self-regulated learning behaviours.
	Need	Students’ awareness of the need to further develop or remedy a lack of self-regulated learning skills.
	Motivating	Students’ disposition or readiness to develop their self-regulated learning behaviours.
Practicality	Usability (lecturers)	Clarity of the intervention and feasibility for lecturers to implement it (instruction, tools, materials) in their teaching.
	Usability (students)	Support/instruction received by students and time available to them to use the intervention tools and materials.
Impediments	Barriers (lecturers)	Factors that hinder the implementation of the intervention, as intended by the researcher.
	Barriers (students)	Factors that inhibit students from using the intervention tools and materials, as intended by the researcher.
Effectiveness	Outcomes	Benefits of the intervention and change in students’ self-regulated skills as observed by lecturers because of the sources of contextual regulation.

Table 17 Identified themes focus group interview

Relevance

The tutorial lecturers stated that the purpose of the intervention was clear to them, and they felt they were well introduced to the intervention and the subject of self-regulated learning by the researcher. Lecturers felt that the intervention and the information and support students received about self-regulated learning were relevant. They appreciated the support being integrated within the course.

When discussing students' awareness of the need to develop further or remedy a lack of self-regulated learning skills, the lecturers indicated that some students were appreciative of being introduced to additional or alternative study techniques:

"there were some that really found it useful and like really tried it out."

"...and those that just appreciated knowing a little bit of other ways..."

On the other hand, lecturers also observed a group of students who already came with a set of study skills that worked for them in their own experience. These students were somewhat sceptical of the intervention and felt they did not need it:

"a lot of them already came with their own kind of set ways of studying that works for them [...], those that [said] 'I already figured out the way that works for me...'"

At this point, lecturers indicated that it was difficult for them to gauge whether students were motivated by the support offered:

"...on the diaries, [...] there was a really small number of students that consistently dedicated their time to it..."

One of the lecturers thought that students were more inclined to try new strategies if they felt external pressure or wanted to 'do it right', especially at the beginning of the course and towards the exam.

Practicality

Lecturers indicated that students found the sources of contextual regulation in the course helped them find new techniques or new ways to study and appreciated the additional support. Lecturers were particularly enthusiastic about the additional materials developed for the students, such as the infographic and the two introductory video clips. They felt these were very accessible for students:

"...also, the way indeed in which you presented it with infographics, with these small videos; that makes it so much more bite-sized that actually, it's very easy to sort of try out."

In the learning diary of week six, I specifically asked students if there was a topic related to self-regulated learning that they would like to receive additional information about. About half of the students indicated they would like this extra information. The most common topics named were dealing with procrastination and exam preparation. The lecturers indicated that the information and tips that were provided to students on avoiding procrastination and preparing for the exam were well received:

"...I think those [practical tips] were helpful and also easy to discuss in class."

"I do remember in week seven or something there were these very practical tips on how to study and how to avoid procrastination..."

To prevent the intervention from leading to additional workload for the tutorial lecturers, they did not receive students' weekly learning diaries. As the researcher, I kept track of what was indicated by students every week, and I identified trends and topics that stood out. During the weekly team meetings, I reported these findings to the teaching staff, but lecturers could not read the diaries for themselves. Several tutorial lecturers expressed that it would have been easier for them to discuss the learning diaries if they had been more involved with them:

"For this to practically work for me I would have liked [...] to see the learning diaries and I would also like to see what they wrote."

The tutorial lecturers also suggested that students might have been more inclined to keep filling out the diaries throughout the course if they knew the tutorial lecturer would read the contents:

“...that would mean that students should know that teachers see the content of the learning diaries, I’m also wondering to what extent that will pressure them more into actually filling them out.”

Impediments

Lecturers reported that both on the side of students and of the lecturers themselves, it was felt that there was insufficient time available for the intervention. In the first week of the course, students were engaged with self-regulated learning. However, even though it was not supposed to be, students had indicated rather quickly that it seemed like additional work to them. One lecturer stated that students already had enough to do for their three courses in the first term. Lecturers observed that for students, as it was year one and term one, everything about studying in university was new to them and required more energy:

“...in practice they probably have enough time for it, but no it’s year one and you know term one, and it’s all new and exciting and everything costs more energy...”

“I think and also hearing back from them, that it was too much work, or that it was extra work...”

The 2020-2021 cohort of students had an additional challenge as they transitioned from secondary to higher education amid the Covid-19 pandemic. Students were not allowed on campus; they had only met their fellow students and their lecturers virtually and had to get used to online classes. Lecturers also lacked time, as the online tutorials were two hour-tutorials instead of three hours in a face-to-face situation, with a similar amount of learning materials. In addition, all teaching had to be delivered online at the time because of the Covid-19 measures in place. For most tutorial lecturers, this was a new way of teaching. It is especially demanding to teach tutorial groups in an online format since in the School’s educational model; tutorial groups involve high levels of active participation and interaction between students themselves and between students and tutorial lecturers. This meant that lecturers did not have much time in class to discuss self-regulated learning, provide instruction nor time to ask students how they were doing:

“...there just wasn’t time to talk about it within class. In that way, we were also never sure how students were really responding to the material because we couldn’t really go over it.”

“I also think that maybe, if we had those hours, we could actually spend time in class to actively practice with it.”

Furthermore, for most tutorial lecturers, the subject of self-regulated learning was unfamiliar as well, making it challenging for them to feel confident when addressing the subject in their tutorial groups:

“... as a teacher I definitely required some self-regulated learning from my side [...] you made amazing slides but sometimes it felt like “oh uh, what is this about again? I have to make sure I use this well”. And sometimes I struggled a little bit with that. Not because it was so much, but just because I was already on the verge of ‘how can I do this in a week.’”

Effectiveness

When asked if they thought that the intervention enhanced students’ self-regulated learning skills, lecturers found it difficult to say if this was the case. They had slightly differing perceptions. Some of the tutorial lecturers believed that students benefitted from the intervention. Other lecturers mentioned that they had not heard much feedback from the students.

They indicated that, other than the final grades, they lacked the information to assess if students became more self-regulated throughout the term:

"I don't know if that would then end up making them learn better or anything like that [...].

Cause all we have is the grades, right, the grades were normal."

"...it would also be helpful for us as lecturers to see...um...how did they perceive this material and if they are actually applying it in an effective way."

The lecturers who had been teaching the course in previous academic years felt that due to the Covid-19 measures and teaching entirely online, it was impossible to compare with previous cohorts without the intervention. A striking difference that some of the lecturers observed was the increased level of preparation for class by students:

"...in terms of the learning, I don't think that it was reflected on the grades, but my feeling is that the students were in general more prepared. I don't know to what extent that is related to self-regulated learning, but that's the impression I had in most of my tutorials in comparison to the ones that I had last year, that just the students were more prepared and more capable of engaging in the discussion, at least with my students I noticed that."

"I can also not sort of compare it to my previous experience in class and I think it would be very valuable to conduct something like this again when things are back to physical education..."

6.6 Summary

This chapter was dedicated to the findings of the research project. The first section of the chapter identified the quantitative patterns of regulatory engagement emerging across the course. Comparing the pre-test and post-test questionnaire data, significant increases in students' metacognitive self-regulation, self-efficacy, and controlled motivation were found. The pre-test and post-test data were analysed further to provide a sense of the variability in students' responses, and three quantitative categories of regulators were found: developing regulators, moderate regulators, and high regulators. The second section of this chapter combined the quantitative and qualitative data from the pre-test and post-test and the learning diaries. By performing a thematic analysis of the learning diaries, four patterns of regulatory behaviours in our categories of regulators surfaced. These four qualitative categories of regulators were: disengaged, striving, emerging, and engaged regulators. Some students' self-reports on the pre-test and post-test questionnaires presented a different picture of what occurred during the course than their self-reports from the diaries evidenced. After combining the qualitative categories into two groups, the overlap between the quantitative and qualitative categories emerged.

The third section of this chapter presented the results from the qualitative analysis of the focus group interview held with the teaching team, revealing teachers' experiences and perceptions of students' engagement in self-regulation and co-regulation during their course. How the results from all three sections address the research questions will be the focus of the Discussion chapter that follows.

Chapter 7: Discussion and Conclusions

7.1 Introduction

Self-regulated learning positively contributes to learners' study success (e.g., Dent and Koenka, 2016; Donker et al., 2014). Thus, it is essential to encourage, support, and facilitate the development of learners' self-regulation. Unfortunately, students do not necessarily develop self-regulated learning skills even with instruction and support. Furthermore, research on effectively translating insights from research into fostering self-regulated learning in a higher education setting is scarce (e.g., Bower et al., 2020). Therefore, this research project aimed to investigate how sources of contextual regulation embedded within a first-year university course could encourage students to engage in co-regulation of learning and how this influences students' self-regulated learning. In this research project, co-regulation is defined as "the joint influence of student self-regulation and sources of regulation in the learning environment" (Allal, 2018, p.30).

To answer this thesis's research question, I examined how an educational intervention, focussing on providing sources of regulation in students' learning environment, could affect first-year university students' participation in co-regulated and self-regulated learning. In doing this, I adopted a design-based research approach. Design-based research is aimed both at testing and refining theories and advancing practice. Furthermore, it is interventionist, aimed at designing an intervention in naturalistic settings. Therefore, this research project produced three forms of output, aiming to contribute to both educational research and educational practice: (1) the answering of the research question, (2) an empirically underpinned intervention, and (3) a set of design principles which can inform other educational practitioners about how to implement interventions in their own settings. The design of the intervention is based on a conceptual framework and upon theoretical propositions (as set out above in Chapter 4), whilst the systematic evaluation of the intervention intends to contribute to theory building.

In the exploratory phase of this research project, several approaches were identified to address the educational challenge and improve students' self-regulated learning (see Chapter 2). Consistent with principles of design-based research, both the educational challenge and the outcomes of prior research were considered in the design and development of the intervention to encourage first-year university students to engage in self-regulated learning. Based on models of self-regulated learning, developed in a situated perspective, I proposed an adapted model for the intervention that was implemented as part of this research project (based on Allal, 2007). This enabled me to research co-regulation of learning within a first-year course for university students as the process whereby the social environment supports the emergence of regulation, recognising that support is distributed amongst people, tasks, tools, and environment (see Chapters 3 and 4). This model for co-regulation of learning in a university setting provided the conceptual rationale for this research project's design-based research approach and data collection techniques (Chapter 5).

This discussion chapter of the current thesis consists of two main sections. First, the significance of the study is discussed. Here, the research question is addressed using the data collected, analysed, and presented in the results section of this thesis (Chapter 6). I will also discuss the validity of my findings and share my reflections on the limitations of this design-based educational research project

and how these were addressed. Subsequently, in the second part of this chapter, the intervention and the accompanying design principles will be presented as the additional outputs of this research project. Towards the end of the chapter, I will make recommendations for future research into supporting self-regulated learning and finally, I will draw conclusions.

7.2 Addressing the research questions

As the intervention was designed to foster and encourage the development of self-regulated learning, I expected that offering sources of contextual regulation within the course would be beneficial, that students would make use of these sources of regulation and that they would engage in self-regulated learning throughout the 8-week course. In this research project, therefore, I examined the following primary research question, divided into two subsidiary questions:

How do sources of contextual regulation affect first-year university students' participation in co-regulation of learning and self-regulated learning?

The two subsidiary research questions are:

1. *In which ways do students make use of the sources of contextual regulation available in their course?*
2. *How do teachers experience the sources of regulation implemented in their course, and how do they perceive their students' reactions to these sources of regulation?*

To answer the primary research question, I combined the quantitative and qualitative data generated with the pre-test and post-test questionnaires, students' weekly learning diaries and the focus group interview with lecturers. For data collection, I used time- and context-specific measures focused on metacognitive processes (planning, monitoring, and reflection), cognitive, resource management-, and motivational strategies.

The conceptual framework shown in Figure 5 provides an overview of the key elements in the research question and the key relationships between those elements.

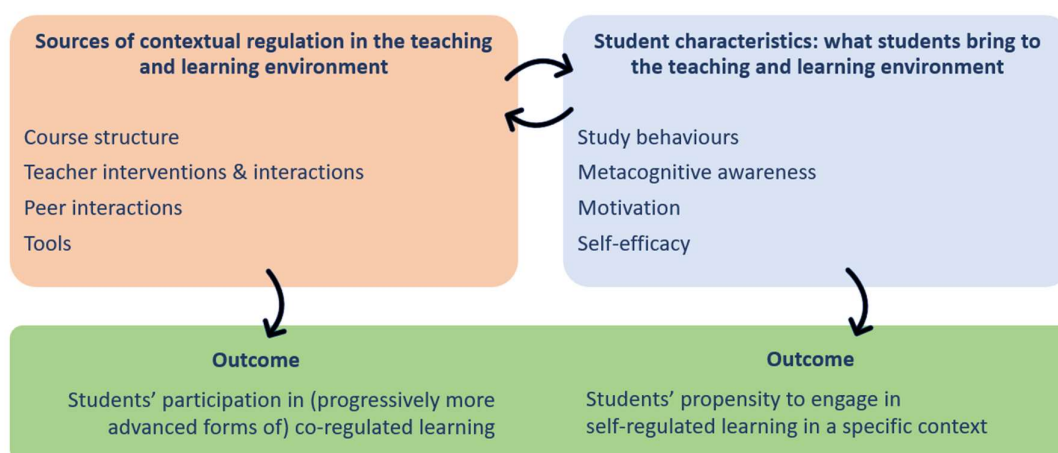


Figure 5, as first seen on page 52: Conceptual framework

7.2.1 Answering the first subsidiary research question

To help answer the primary research question, the first subsidiary research question concerned *how students used the sources of contextual regulation available in their course*. To address this question, I investigated how student engagement in both self-regulation and co-regulation unfolded over time and context. Self-regulated learning is considered an event (as opposed to an aptitude), which means that student self-regulation is documented as it takes place in a specific task, context, and study episode (Patrick and Middleton, 2002). An event instrument describes the regulation activities of students during the performance of a specific learning task. In addition, self-reports provide an account of learners' perceptions, which are vital in understanding students' adaptations while studying. Therefore, to understand co- and self-regulation, as it develops over time, this study used two measures to capture how students are affected and make use of the sources of contextual regulation available in their course. First, this study applied a self-report measure and learning diaries for students' self-observations, which served as part of the intervention and a measurement instrument. These instruments were used for capturing changes or adaptations of the learners' use of self-regulated learning strategies and processes over time, stressing the importance of self-regulated learning in context.

Comparing the quantitative data from the pre-test and post-test questionnaire, significant increases were found in students' metacognitive self-regulation ($t(35) = 2.54, p = .016$), self-efficacy ($t(35) = 2.21, p = .034$) and controlled motivation ($t(35) = 4.26, p < .001$). Based on the comparison of the pre-test and post-test questionnaire, the significant increases measured provided an account of what was observed 'generally' across the sample of the 35 students. In addition, I also wanted to obtain a sense of the variability in students' responses. Therefore, to establish which quantitative patterns of regulatory engagement emerged throughout the course, the participants were grouped into three quantitative profiles. These were based on their scores on the Metacognitive self-regulation scale of the MSLQ, which focuses on the control and self-regulation aspects of metacognition, consisting of three general processes: planning, monitoring, and regulating. This resulted in the identification of three profiles of students: *developing regulators*, *moderate regulators*, and *high regulators*.

While *developing regulators* were participants with relatively low scores at the beginning of the course with significant improvements at the end, *moderate regulators* were students who showed average scores at the start of the course and displayed very little change in the scores by the end of the course. Finally, in the category of *high regulators*, students had relatively high scores at the start of the course and demonstrated small increases by the time the course had finished.

While the quantitative patterns paint a picture of student self-regulated learning at the start and the end of the course, the learning diaries allow for a more comprehensive view of students' self-regulatory behaviours unfolding across the intervention. By combining the pre-test and post-test questionnaires and the weekly learning diaries, I examined the patterns that emerged when the quantitative and qualitative self-report data were combined.

The thematic analysis of the learning diaries resulted in the identification of four qualitative profiles of 'regulators': *disengaged*, *striving*, *emerging*, and *engaged* regulators.

The learning diaries of the *disengaged regulators* displayed an image of surface learning and generally low metacognitive awareness and engagement. Students described some difficulties in learning for the course but displayed little intention to improve learning. The learning diaries of the

striving regulators demonstrated a regulatory focus on aspects of time and the learning environment. Students displayed awareness of academic issues but their attempts to adapt their learning behaviours were ineffective. *Emerging regulators* were learners that exhibited constant advancement of some aspects of self-regulated learning. Their learning diaries displayed awareness of academic challenges and successful adaptation in some aspects of self-regulated learning. Finally, the learning diaries of the *engaged regulators* demonstrated higher levels of metacognitive awareness. Engaged regulators displayed deliberate attempts to make adaptations to their learning. The four qualitative profiles of regulators demonstrated that students engaged with self-regulatory processes in different manners when studying.

Table 12 summarises the quantitative and qualitative categories that emerged from the pre-test and post-test questionnaire analysis and the learning diaries.

Quantitative categories (based on MSLQ-metacognitive self-regulation)	Qualitative categories (based on reflections in learning diaries)
<i>Developing regulators</i> Relatively low scores at Time 1 with significant improvements at Time 2	<i>Disengaged regulators</i> Exhibited overall low regulatory engagement across the course
<i>Moderate regulators</i> average scores at Time 1 with small increases at Time 2	<i>Striving regulators</i> Demonstrated ineffective endeavours to adapt to academic challenges
	<i>Emerging regulators</i> Displayed improvement in some of the aspects of self-regulated learning
<i>High regulators</i> High scores at Time 1 and 2	<i>Engaged regulators</i> Demonstrated active and intentional attempts to adapt and improve learning

Table 12, as first seen on page 84: Summary of quantitative and qualitative categories

7.2.2 Answering the second subsidiary research question

The second subsidiary research question concerned *how teachers experienced the sources of regulation implemented in their course and how they perceived their students' reactions to these sources of regulation*. In addition to students' self-report data and self-observations, a focus group interview was conducted with the tutorial lecturers, allowing them to reveal their experiences from a teaching perspective. The interview investigated teachers' perceptions of the intervention and students' reactions, thus addressing the second subsidiary research question. Four overarching themes were identified which captured teachers' experiences with the intervention. The four themes identified after a deductive and inductive analysis of the focus group interview were *Relevance*, *Practicality*, *Impediments*, and *Effectiveness*, as exemplified in Table 17 below.

Theme	Codes	Description
Relevance	Purpose	Awareness of the goal of the intervention, i.e., encouraging and supporting student self-regulated learning behaviours.
	Need	Students' awareness of the need to further develop or remedy a lack of self-regulated learning skills.
	Motivating	Students' disposition or readiness to develop their self-regulated learning behaviours.
Practicality	Usability (lecturers)	Clarity of the intervention and feasibility for lecturers to implement it (instruction, tools, materials) in their teaching.
	Usability (students)	Support/instruction received by students and time available to them to use the intervention tools and materials.
Impediments	Barriers (lecturers)	Factors that hinder the implementation of the intervention, as intended by the researcher.
	Barriers (students)	Factors that inhibit students from using the intervention tools and materials, as intended by the researcher.
Effectiveness	Outcomes	Benefits of the intervention and change in students' self-regulated skills as observed by lecturers because of the sources of contextual regulation.

Table 17, as first seen on page 89: Identified themes from the focus group interview

Relevance involved the awareness of the intervention's purpose, the need to develop self-regulated learning skills, and whether the intervention was motivating students. While the tutorial lecturers stated that the purpose of the intervention was clear and relevant for students, they indicated that not all students felt the need or readiness to develop self-regulated learning skills further. One of the factors preventing students from adopting self-regulated learning skills described by Zimmerman (1989) is the assumption that an evidence-informed self-regulation process or strategy will not work from them, that they do not need it, or that it is preferable in a particular way learning context. These observations are consistent with findings from previous research. Zimmerman (1989) refers to students not recognising the need for using evidence-based strategies. Furthermore, students only self-regulate their learning when they deem it necessary (Winne, 2011). Indeed, learning challenges, such as an exam, activate regulatory processes and enact strategy use (e.g., Hadwin, Järvelä, and Miller, 2011).

Practicality referred to the intervention's usability: whether it was feasible for lecturers to implement and if students received sufficient support to use the intervention tools and materials. Lecturers believed that the intervention and the supporting materials were accessible for students, thus encouraging them to try new learning strategies. For lecturers, practical tips about applying cognitive, metacognitive, and resource management strategies were easy to discuss during tutorial groups. On the other hand, several tutorial lecturers expressed that they would have liked to have more insight into students' learning diaries. Lecturers expected that this would have made it easier to discuss the learning diaries in the tutorial groups. In addition, they thought that students would have been more inclined to keep filling out the diaries throughout the course if they knew the tutorial lecturer would read the contents. Again, this fits with the findings of previous research: as students' endeavours to self-regulate their learning usually demand additional preparation time,

attention and effort, the learning goal or outcome needs to be sufficiently interesting for them to be motivated to self-regulate (Zimmerman, 1989).

Impediments related to factors that hindered the implementation and barriers that inhibited students from using the intervention. Both lecturers and a considerable number of students perceived the self-regulated learning intervention as additional work. The Covid-19 measures in place at the time of the intervention implementation posed challenges for both students and lecturers. It was more demanding for students to transition to higher education, as they were not allowed on campus and had to do all their learning online. Lecturers lacked time as they had one hour less to deliver the online tutorials but with the same content and learning materials. During the course, in the fall of 2020, Covid-19 measures were in place, resulting in online-only teaching: both the weekly lecture and the tutorial groups were facilitated online. Although lecturers felt that students were generally well prepared and engaged during the tutorial groups, teaching online was demanding for lecturers. The Covid-19 measures made it challenging for lecturers to deliver the intervention as intended. Teaching in an online format is demanding since the tutorial groups involve high levels of active participation and interaction between students themselves and between students and tutorial lecturers. The focus on the successful delivery of online education for first-year students who did not know each other, their lecturers, or the university was at odds with the amount of time available in class to discuss self-regulated learning or ask students how they were faring.

In addition, the subject of self-regulated learning was unfamiliar to lecturers, and, as a result, they sometimes lacked the confidence to address the subject in their tutorial groups. Even when the intervention and the course in which it is implemented are carefully designed, developed, and implemented, sufficient time and attention are needed by lecturers to deliver the intervention. Otherwise, attention will remain focussed on 'what is learned' with little room for 'how it is learned'. The Covid-19 measures were unavoidable, but they demonstrate the importance of freeing up time in contact hours to address the topic of self-regulated learning adequately.

Another consideration for implementation concerns the role of teachers as well. In our course, the lecturers were generally supportive of the topic of self-regulated learning. They were aware of the relevance and endorsed the intervention. However, their expertise lies in the content and the course's domain-specific knowledge. They do not have expertise in learning sciences in general or self-regulated learning, and they lack time to thoroughly familiarise themselves with the topic. To a certain extent, this was calculated for in the way the intervention was designed, developed, and implemented: the lecturers received teacher-training before the start of the course, all course materials and information about self-regulated learning were developed for them and ready to use, and in my role as the learning designer and researcher, I attended the weekly meetings of the teaching teams to provide additional information and to answer questions. Nevertheless, when one wants to implement an intervention designed to encourage self-regulated learning, it is recommended to raise awareness and provide adequate teacher training to the lecturers who will deliver the intervention in their course.

Effectiveness pertained to the benefits of the intervention and changes in observed students' self-regulated learning behaviours. Some of the tutorial lecturers believed that students benefitted from the intervention. Other lecturers mentioned that they had not heard much feedback from the

students. Due to the Covid-19 measures and online teaching, it was difficult for lecturers to compare the academic year 2020-2021 with previous cohorts who had not experienced the intervention. A striking difference they did observe referred to students' increased level of preparation for the tutorial groups. However, it is not clear if this resulted from the intervention or other factors such as students' online learning.

7.2.3 Answering the primary research question

Notwithstanding the benefits of self-regulated learning for academic accomplishment, students tend to have little knowledge about study strategies in general (McCabe, 2011); they are unaware of which strategies are effective, and they lack information on how to use study strategies (Bjork, Dunlosky, and Kornell, 2013). Unfortunately, even when instruction and support are offered in their educational programmes, students do not necessarily adopt self-regulated learning skills and strategies, for example, because they mistakenly believe inadequate strategies like highlighting and rereading are effective (Soderstrom and Bjork, 2015; McCabe, 2011). Still, research about the effective translation of insights from research into fostering self-regulated learning in a higher education setting is scarce (e.g., Biber et al., 2020). Therefore, it is essential to encourage and facilitate the development of learners' self-regulation and empirically evaluate its results.

With this research project, I wanted to gain insight into how sources of contextual regulation affect first-year university students' participation in co-regulation of learning and self-regulated learning. This primary research question can be answered by combining the results from the self-report data (pre-test and post-test), students' self-observations (learning diaries), and a focus group interview with the tutorial lecturers. Using this variety of measures to answer the research question, my study indicates that the intervention programme positively affected students' propensity to engage in self-regulated learning actively. The current intervention increased students' self-regulatory skills, self-efficacy, and controlled motivation. Furthermore, I identified both quantitative and qualitative profiles of regulators, which demonstrated how students engage differently with sources of contextual regulation when they are studying. The quantitative profiles represent the differences observed in those students at the start and end of the course. On the other hand, the qualitative profiles represented how their regulatory engagement unfolded during the course.

In addition to the pre-test and post-test questionnaire data, students' learning actions over a period were researched by analysing the learning diaries. Simultaneously, students' future learning actions are affected by reflection on their learning actions through completing the diaries. Specifically, diaries can foster formal self-monitoring, which involves systematically observing and recording self-regulated learning processes (Schmitz and Perels, 2011). When the different regulator profiles were compared, both similarities and differences emerged. Consistent with the research on learning diaries by Schmitz (2006), this research study has confirmed that using diaries leads to reactive effects: i.e., the effect derived from monitoring when observed behaviour changes as an effect of self-observation.

After combining the qualitative categories, a more distinct overlap of the quantitative and qualitative categories emerged (Table 14). In general, there was an overlap between the quantitative and qualitative categories of regulators. Nevertheless, differences were found as well.

For example, I expected that the quantitative category of *high regulators*, who scored high on metacognitive self-regulation at both the start and end of the course, would largely be engaged regulators: students who displayed active and intentional attempts to improve learning throughout the course. Still, the category of high regulators consisted of one disengaged regulator, and there were also striving regulators, emerging regulators, and some engaged regulators represented. Moreover, the other way around: students that exhibited overall low regulatory engagement across the course, the qualitative label of *disengaged regulators*, were found in each quantitative category: developing, moderate, but also high regulators. Thus, for some students, their self-reports on the pre-test and post-test painted a different picture of what occurred during the course than their self-observations from the learning diaries evidenced.

Quantitative category \ Qualitative category	Developing regulators N=9	Moderate regulators N=14	High regulators N=12
Disengaged and Striving regulators	7 (78%)	6 (43%)	4 (33%)
Emerging and Engaged regulators	2 (22%)	8 (55%)	8 (67%)

Table 14, as first seen on page 85: Representation of combined qualitative categories in terms of developing, moderate, and high regulators

In the category of *developing regulators* - the students with relatively low scores on metacognitive self-regulation at Time 1 with significant improvements at Time 2 - the disengaged and striving regulators are overrepresented. Students reported improvements in metacognitive self-regulation at the end of the course, but their diaries did not show improvement over the term. The disengaged regulators could have overestimated their ability and the need to regulate their learning, as they showed little engagement in their diaries. An explanation for the striving regulators might be that these students developed metacognitive knowledge but could not apply it to their learning.

In the category of *moderate regulators* - the students with average scores at Time 1 with small increases at Time 2 - all qualitative categories are evenly represented. On average, it might seem that the quantitative and qualitative categories were consistent. Still, even though these students reported little change in quantitative terms throughout the term, the category of moderate regulators consisted of students that evidenced a wide variation in their regulatory engagement, behaviours, and degree of success in making adaptations in their learning.

Finally, in the category of *high regulators* - the students with high scores on metacognitive self-regulation at both Time 1 and Time 2 - the emerging and engaged regulators are overrepresented. In this category, there is most consistency between the two types of self-report: both in the questionnaires and the learning diaries, these students displayed metacognitive awareness and were actively attempting to regulate their learning and were, in general, successful in doing so. Especially the engaged regulators were committed and conscious regulators from the start of the course and remained metacognitively aware of their learning throughout the course. This was reflected in the moderate increase in their quantitative scores on metacognitive self-regulation.

The primary research question can thus be answered as follows. This research study confirms that the intervention in the form of offering sources of contextual regulation embedded within students' learning environment increases students' propensity to engage in self-regulated learning in the specific context of their own subject. In addition, it demonstrates that students participated in co-regulated learning in distinct ways. The different profiles of regulators (both quantitative and qualitative) established by analysing the data from the pre-test and post-test questionnaire and the learning diaries indicate that, although all students in the sample are engaging with the sources of contextual regulation, they do so in different ways. Disparities were observed within students' regulatory engagement, the awareness of their academic challenges, and the degree to which they demonstrate active, intentional attempts to adapt and improve their learning. Combining the disengaged and striving regulators and the emerging and engaged regulators provided insight into the success of the students' adaptations. The difference between the two groups is the extent to which their attempts were fruitful. In the first group, disengaged and striving regulators consisted of students who were ultimately inefficient in regulating their learning. The second group of emerging and engaged regulators demonstrated metacognitive awareness and deliberate attempts to improve their learning process and outcomes.

7.3 Significance of the study

7.3.1 Theoretical grounding of the study

Although we can now build on three decades of self-regulated learning scholarship, researchers face several challenges when seeking to advance knowledge about self-regulated learning and how to support it (e.g., Schunk, 2008). These challenges are both theoretical and methodological. For instance, considering how self-regulated processes are situated and context-dependent (e.g., Järvenoja, Järvelä and Malmberg, 2015) requires methodological strategies that investigate how individual, social, and contextual factors interact to encourage learners' involvement in self-regulated learning behaviour (e.g., Hadwin and Oshige, 2011). Furthermore, perceiving self-regulated learning as a multifaceted, multi-component and integrative theory (Butler, 2015; Zimmerman, 2008) requires approaches for researching how these various elements "co-relate dynamically to shape learning-in-action" (Butler and Cartier, 2018, p.352). Finally, in addition to these theoretical and methodological challenges, it remains demanding to mobilise the rich knowledge base on self-regulated learning to profoundly impact educational practice (Butler and Schnellert, 2012; Cartier, Butler, and Bouchard, 2010).

Two major theoretical frameworks guided this educational research project. First, *situated cognition* (Brown et al., 1989; Lave and Wenger, 1991) provided the basis for integrating the intervention within a discipline-specific course. Second, *co-regulated learning* (Allal, 2007) was adopted as the framework for designing the intervention, providing sources of contextual regulation in the students' learning environment. Both theoretical perspectives reflect social constructivist epistemology. My research project investigated cognition in context, and the intervention positions the regulation of learning within a social constructivist theory of learning, suggesting learning is situation-specific and context-dependent. How students arrive at understanding theory, content, learning strategies, and themselves as learners are inseparable from the activity, context, and culture in which they learn (Hadwin and Oshige, 2011; Lave and Wenger, 1991; Brown et al., 1989). Within the often-adopted socio-cognitive perspective on self-regulation of learning, on the other hand, the emphasis remains

on the learner's cognitive processing and skills acquisition and development within the individual. However, when researching cognition in context, the fundamental assumption is that learning does not occur in a vacuum and is not located within the individual: learning, cognition, and learning activities cannot be considered isolated processes. Instead, they are co-constituted, and learning develops and constantly changes within dynamic contexts and conditions (Järvenoja et al., 2015; Barab and Squire, 2004). Thus, learning and teaching form interdependent elements of educational activity and student self-regulation, and sources of regulation in the learning environment are reciprocal (Allal, 2018). The intervention design is based on Allal's model of co-regulated learning (2007), which aims to integrate the social, contextual, and individual levels of regulation and defines co-regulation as the "joint influence of student self-regulation and sources of regulation in the learning environment" (Allal, 2018, p.30). I introduced an adapted model of co-regulated learning, which enables the researching of co-regulation of learning within a university context defined as the process whereby social environment supports the emergence of regulation recognising support is distributed across the learner, teachers, peers, tasks, and instructional materials. Subsequently, together with the well-known cyclical phases model of self-regulated learning (Zimmerman, 2000), these sources of contextual regulation were implemented in the naturalistic setting of a first-year university course. An intervention was designed, developed, implemented, and evaluated based on the adapted model of co-regulated learning to answer the research question and address the educational challenge.

7.3.2 Contributions of this research project

Design-based research intends to bridge educational research and practice, producing theoretical understanding and interventions that solve educational challenges. Hence, the outputs of the current research project are directed at internal and external audiences of professionals. These audiences include educational researchers, practitioners (lecturers), instructional designers, innovation specialists, and policymakers. From their own perspectives, these different audiences may be interested in learning about educational design research, intervention development, and the theoretical goal of creating a new understanding. Therefore, the results of this educational design research project are reported to two audiences: a professional audience and a research audience. The main goal of reporting the outcomes of my research to fellow researchers is to share emerging theoretical understanding about co-regulated learning. In the first instance, this is done by writing this doctoral thesis, answering the primary research question, and discussing the findings with the panel of examiners. The scientific report in the form of this thesis details the designed intervention, its theoretical underpinnings, and the results and implications of empirical testing. Consistent with the intention to bridge research and practice, educational professionals should be regularly informed of the progress and results of educational design research projects. The main goal of reporting to the audience of educational practitioners is to inform and inspire others to develop and implement self- and co-regulated learning interventions or combine educational innovation with design-based research. For the current research project, this is done by presenting my research, the intervention, and the study results to multiple audiences within the university. Furthermore, detailed information about the intervention and its elements and the accompanying design principles are shared with the Community for Learning and Innovation, thus reaching staff members of all Schools involved in educational innovation and educational research.

The current research contributes to educational research and educational practice in three ways. First, it contributes to the knowledge base about co- and self-regulated learning by addressing the research question. Second, it produced an empirically underpinned innovative intervention to solve the defined educational challenge. Thirdly, the intervention is accompanied by a set of design principles or intervention theory. The intervention and the design principles are detailed in section 7.4 below.

1. The knowledge base about co- and self-regulated learning

This research adds to the knowledge base about the subject of co-regulation of learning in that it explores in some detail how the intervention enables students to apply self-regulated learning processes (like planning, monitoring and reflection) and self-regulated strategies (such as self-explaining or interleaved practice) in the context of their subject. Using a variety of measures to answer the research question, my study indicated that the intervention programme had positive effects on students' propensity to engage in co- and self-regulated learning. The current intervention increased students' self-regulatory skills, self-efficacy, and controlled motivation. In addition, the analysis of the self-observations by students and the evaluation of the intervention by the tutorial lecturers demonstrated that students do indeed make use of the sources of contextual regulation offered through the intervention. Moreover, I identified both quantitative and qualitative profiles of 'regulators', establishing how students engage differently with sources of contextual regulation when they are studying.

Furthermore, learning diaries form an external strategy for monitoring and enhancing reflection. In this manner, learning diaries are not merely a measurement instrument but an intervention tool simultaneously (Panadero et al., 2016). Methodologically, this research study contributed by demonstrating that learning diaries can serve as a combined method of data collection and an intervention tool.

2. An empirically underpinned intervention

Secondly, this research contributes to educational practice by presenting an empirically underpinned intervention that provides sources of regulation in students' learning environment to solve the defined educational challenge observed in practice. The intervention was systematically evaluated based on students' self-reports and self-observations about their learning and engagement with contextual regulation sources. In the focus group interview, the lecturers evaluated the intervention and its elements. The intervention was evaluated according to the four criteria to assess the quality of educational interventions, as described by Nieveen (2010): its *relevance*, *consistency*, *practicality*, and *effectiveness*. Thus, the evaluation of the intervention served two purposes. First, it is the means by which the study's research questions are addressed, and second, it forms an output in its own right.

The research study confirmed that an intervention programme that involves collaboration between the educational researcher and lecturers enables students to apply self-regulated learning processes and strategies in context. Collaboration with lecturers as subject-matter experts synchronises the sources of contextual regulation with the course content, ensuring that students practise self-regulated learning skills with the learning materials of their subject.

3. *A set of design principles*

Next to the practical relevance constituted by the intervention, the third form of output is an accompanying set of design principles, which can be applied by others who would like to design, develop, implement, and evaluate a similar intervention in their own educational settings. The design principles serve as heuristic principles for lecturers, instructional designers, and educational researchers aiming to support and encourage students' self-regulated learning with a contextualised innovation. On the one hand, the intervention and accompanying design principles provide insight into the objective of the intervention and its principal characteristics. On the other hand, they offer procedures for designing the intervention, its implementation conditions, and theoretical and empirical underpinnings of the intervention.

7.3.3 Validation of the contributions of this research project

The intervention at the heart of this research project aimed to impact educational practice while advancing knowledge of co-regulated learning that will be of use to others. As with any research approach, an essential question to be answered as a design-based researcher is what counts as trustworthy evidence. In their seminal article about design-based research, Barab and Squire (2004) argue that "It is one thing to demonstrate learning gains or show that statistical differences have been achieved; it is quite another thing to demonstrate the usefulness or consequentiality of the work" (p.7). The following guidelines were considered to generate credible, trustworthy, and plausible research outputs in my research project. The study design aimed to preserve academic rigour while conducting relevant and collaborative inquiry at the same time.

Research transparency was achieved by the detailed account provided of the theoretical background and conceptual framework underpinning the research project, a complete description of the intervention and accompanying design principles, and the research project results. This detailed form of reporting allows readers to assess the findings' trustworthiness and understand, question, and perhaps "even build on the theoretical understanding produced" (McKenney and Reeves, 2012, p.205).

Furthermore, a congruent study design was used for the research project. As self-regulated learning in this study is considered time- and context-specific, I used measurement instruments consistent with a situated and contextualised perspective on learning. Regulation unfolds over time and is sensitive to changes in context; thus, measurement of self-regulated learning "should span multiple, in-context learning sessions" (McCardle and Hadwin, 2015, pp. 60). Therefore, data were collected at the beginning and end of the course with the pre-test and post-test questionnaire throughout the course with the weekly learning diaries, thus measuring self-regulated learning at multiple time points.

The joint role of designer and researcher that I took on in this study meant that I was not merely observing interactions within the teaching and learning environment of the course *Introduction to Human Communication*. Instead, as a design-based researcher, accepting that context is important in educational research, I had an inherently 'transformative agenda' (Barab and Squire, 2004), thus influencing and shaping the phenomenon I studied and indeed implementing the very same intervention I have been evaluating and making claims about. Therefore, it was important to prevent (as far as possible) my involvement in this dual role of designer and researcher of the intervention

from biasing the research project's findings. Confirmability denotes the degree to which the respondents shape the study's findings and the degree to which the research study's results can be confirmed by other researchers instead of researcher bias (Korstjens and Moser, 2018). This concern was addressed through the triangulation of data collection methods. I combined the quantitative and qualitative data collected to answer the primary research question. The study used multiple data types: self-reports, self-observations, and observations by the course's teaching team. In addition, both inductive and deductive analysis was used to analyse the data collected. From a more personal point of view, it helped me walk the narrow line between bias and objectivity by not being directly in touch with the course students. I had conversations with the teaching team every week, but I did not discuss with students what I had read in their learning diaries. By not speaking directly with students or conducting focus group interviews with students, I could maintain a certain form of neutrality and observe the effects of the intervention with some distance. Instead, a validated pre-test and post-test questionnaire were used to evaluate the intervention, the contents of the learning diaries, and the focus group interview with the tutorial lecturers.

Matters of validity and reliability in design-based research represent the context-specific nature of this research approach. However, when conducting design-based educational research, the objective is not to replicate educational innovations in the same manner but in different settings or classrooms. Therefore, the challenge is not to remove 'confounding variables' to reach validity and reliability but rather to develop the knowledge base about the subject of co-regulation of learning, retaining its utility even when applied to new local educational settings. As mentioned in chapter 6, teaching requires educators' professional judgement tailored to the specifics of each educational situation. In this perspective, the role of educational research and its outcomes are to assist professional judgement and action rather than prescribe what should be done. Complete replicability then is neither desirable nor attainable. Instead, design-based research is conducted in situ with the participants and aims for ecological validity: the results should be considered a foundation for adaptations to other teaching and learning situations. Therefore, design-based research should produce guiding principles that can be generalized across similar contexts. This study grounded the design on theories and used theory to explain the findings. The literature review and the theoretical framework provided this grounding in this research project. Furthermore, a full description of the context of this study and the elements of the intervention are included. Finally, the intervention is supplemented with a set of design principles.

7.3.4 Addressing limitations

The research presented in this thesis has some potential limitations. These limitations should be considered when interpreting the results. First, the sample was limited to 35 students. Second, the self-reports and self-observations analysis were based on students who chose to participate in the research project. Third, the intervention was implemented in a mandatory course, thus providing the intervention to all first-year students of the programme. Nevertheless, only the data provided by students who consent to participate in the research could be collected and analysed. This might have created a selection bias in our sample, as only students who were already interested in improving their self-regulated learning skills may have signed up for the current study.

Another possible limitation of this study is that learning strategy use and application of self-regulated learning processes was measured by self-reports and self-observations. Previous research did

demonstrate that students' self-reports do not always correspond with what they actually carried out when studying (e.g., Hadwin et al., 2007). Therefore, this study explored a combination of qualitative and quantitative self-reports, revealing that the two types of regulators did not always align. This may indicate dissimilarities in the ways students perceive their self-regulatory skills during learning. Nevertheless, by triangulating different instruments for data collection, I intended to gain a holistic account of how students engaged with the sources of contextual regulation in their course. In addition, the weekly learning diaries provided a nuanced view of how students' self-regulated learning unfolded over the course duration.

7.4 The intervention and the design-principles

7.4.1 Introduction to the intervention

As design-based research aims to produce two forms of output, conceptual and practical, this section of the discussion chapter evaluates the practical output, the empirically underpinned intervention in which sources of regulation are integrated within a first term, first-year university course. In this section, this intervention is detailed. The results of this evaluation inform the design principles to be generated from this research project. Alongside the empirically underpinned intervention, design-based research produces an accompanying collection of clearly articulated design principles, outlined in the next section.

The target group of the intervention

The intervention is aimed at first-year university students and is implemented in one of the first term courses. Within the university, the ability to self-regulate one's learning becomes increasingly important because students must handle more complex learning situations, and there is typically less opportunity to receive external guidance or feedback. Furthermore, there are fewer contact hours and a stronger emphasis on self-study. Therefore, notably in transitioning from secondary school to a tertiary education context, greater reliance upon self-regulated learning emerges (Webster and Hadwin, 2015; Dresel et al., 2015; Peeverly et al., 2003). As a result, this intervention is especially relevant for first-year students in a university context. In this project, the intervention was implemented in 2020-2021 in one of the courses of the international programme in Communication Sciences at the university in the Netherlands. A total of 314 students were enrolled at the start of the course. After evaluation and a minor re-design, the intervention was implemented for a second run in 2021-2022, with 340 students. There were still Covid-restrictions in place: at the time of this course, a maximum of 75 students could physically attend the lectures. However, the tutorial lectures took place on campus, thus allowing students to attend this course element face-to-face.

Approaches to improve self-regulated learning

Consistent with the assertion that context matters, the intervention fosters students' self-regulatory learning skills within a real educational, naturalistic setting (Brown, 1992). Welding the intervention into a mandatory course provided students with opportunities to practice and develop self-regulatory learning behaviours within their programme, with their discipline-specific learning materials. For the intervention, several approaches were identified to encourage, support, and facilitate the development of learners' self-regulation.

Allal's model (2007) provided the key components for the intervention, based on a situated model of regulation of learning. The sources of contextual regulation present in the teaching and learning

environment aimed at supporting self-regulatory learning behaviours are: (1) the course structure, (2) teacher interventions and interactions, (3) peer interactions, and (4) tools. In addition, two approaches were adopted to guide the development of these sources of contextual regulation. These are:

- a. Promoting self-regulated learning by teaching students how to use specific cognitive and metacognitive strategies through instruction (Broadbent et al., 2014; Dignath and Büttner, 2008). To develop metacognitive awareness and evaluate and adapt their learning strategies, students need to be presented with a holistic framework (Cleary et al., 2008). The framework used in our intervention to conceptualise the process of self-regulated learning is Zimmerman's Cyclical Phases Model (Zimmerman, 2000).
- b. Improving self-regulated learning by using online learning diaries. Learning diaries foster self-monitoring of learning and develop an awareness of how strategy use affects goals by planning, monitoring, and self-reflection (Dignath-van Ewijk et al., 2015; Dörrenbächer and Perels, 2016; Fabriz et al., 2014). The diaries:
 - I. function as an external prompt and as a reminder to regulate learning. They stimulate metacognitive thought as students are reminded to apply a strategy and ask whether and how it worked.
 - II. mediate between and support the transfer from the classroom-based sources of regulation (co-regulation) to the actual learning at home or during independent self-study (self-regulation).
 - III. stimulate deliberate practice through the repeated exercise of the strategies in the diaries.

Consistent with previous studies (Dignath-van Ewijk et al., 2015; Schmitz and Perels, 2011), my results implied that the use of diaries was related to an increase in self-efficacy, self-regulation, and metacognitive awareness.

7.4.2 Elements of the intervention

Sources of contextual regulation were implemented at the various levels of the teaching and learning environment, as depicted in the co-regulated learning model below (Figure xx, see also chapter 4). The learners' self-regulation processes are positioned at the core of the nested model of co-regulated learning. These cognitive, metacognitive, behavioural, and motivational self-regulated learning processes occur when learners actively engage with the teaching and learning environment. All cognitive and metacognitive strategies were included as course tasks and practised in the domain-specific context of the course. The sources of contextual regulation are affordances that provide opportunities for action by the learner. Whether, how and when these sources of contextual regulation become operant depends on students' appraisal of the learning situation (e.g., Boekaerts, 2011) and is influenced by learner agency (Allal, 2019; Hadwin et al., 2018), as is depicted by a dashed line around the learner processes in Figure 4.

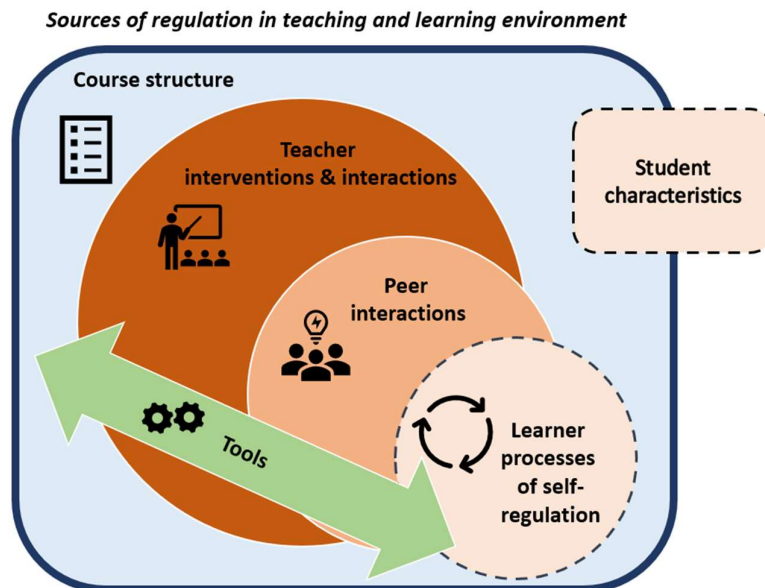


Figure 4, as first seen on page 44: Model for co-regulation of learning in a university-setting (adapted from Allal, 2007)

Students enter the context of the teaching and learning environment with learner characteristics related to their acquired previous learning experiences, study habits, and conceptions about learning and their abilities (e.g., Butler and Cartier, 2018; Järvenoja et al., 2015). These characteristics include students' study behaviours, metacognitive awareness, motivation, and self-efficacy beliefs. Thus, student characteristics bi-directionally influence the context of the teaching and learning environment, on the one hand, and students' propensity to engage in self-regulated learning in the context of the specific course, on the other. Specifically, the intervention included the following sources of contextual regulation present in the teaching and learning environment:

- 1) the course structure,
- 2) teacher interventions and interactions,
- 3) peer interactions, and
- 4) tools.

1) Course structure

The term 'course structure' refers to the course instructional design, which is defined prior to enacting the teaching and learning situation. It forms a framework and structure for the actions and interactions of the participants within the course: the teacher(s), the students, and the individual learner. The course structure includes the specification of learning goals, the sequencing of lectures, tutorials and individual work, the type and sequencing of assignments and activities, the organisation of time and space in the instructional setting. For the intervention implemented in the first-year course, we evaluated the existing assignments and assessment and made the following adjustments to the course structure to facilitate the development of learners' self-regulation:

- a. Giving students experience with formative tests assessing deep comprehension and de-emphasising superficial understanding, merely extracting facts when reading. These formative tests provide students with feedback about the efficacy of their study strategies. Passive and ineffective but often-used strategies such as highlighting and rereading create an illusion of fluency (e.g., Kornell et al., 2009). Because of their ease-of-processing, these strategies mislead

students' metacognitive judgements: students overestimate their remembering of the learning materials and become overconfident about learning (Dunlosky and Rawson, 2012; Kornell and Bjork, 2009). Throughout the course, students were presented with several quizzes. The quiz questions helped guide their reflections, and the results were discussed during the tutorial groups. Formative tests are thus meant to enhance students' metacognitive awareness and promote effective strategies that foster deep comprehension and long-term retention.

- b. Mid-term, students took part in a mock exam that resembled the final exam for the course to assess their progress and judge their understanding of the course materials. The exam has a formative character, and the results are not part of students' course grades. The mock exam covered all study materials from Week 1 to Week 5 (the chapters from the textbook, the additional sources, and the lectures). The mock exam aimed to give students feedback on the quality of their preparations thus far. Test expectancy refers to how building expectations for a test influences how students monitor their learning (Thiede et al., 2003). The aim of the mock exam was also to provide insight into the kind of multiple-choice questions asked on the final exam. As students often realise that a more profound comprehension is required for the exam, they still have time to adjust their studying, and there is enough time left for them to ask questions and lecturers to clarify specific topics and concepts from the teaching and learning materials.

2) *Teacher interventions and interactions*

The model's layer of teacher interventions and interactions represents the classroom setting where the teacher enacts the instructional situation. A teacher's interventions and interactions include whole-class discussions to prepare or follow tasks and the interaction with small groups and individual students (Allal, 2018, 2007). The classroom-setting refers to the joint enactment of all teaching within a particular course, whether online, in a hybrid format, or face-to-face, on campus. The teacher interventions and interactions were primarily implemented in the tutorial groups of the course. These tutorials are typically characterised by smaller group sizes (of 21 to 24 students per group), more interactions between students and lecturers, and between students, and active engagement in the tutorial group is required. Self-regulated learning was promoted through explicit and implicit instruction in the tutorial groups. Students were taught how to use specific cognitive and metacognitive strategies (e.g., Broadbent et al., 2014; Dignath and Büttner, 2008). Within our course, this was implemented as follows:

- a. Zimmerman's Cyclical Phases Model (2000) was presented as a holistic framework to develop students' metacognitive awareness and evaluate and adapt their learning strategies. Students received information about self-regulated learning: what is it, why is it important and how to develop it. This was done by instruction within the tutorial groups by the lecturer. In addition, students received additional materials via their electronic learning environment, Canvas. This consisted of a video clip about academic self-regulation (3 mins 20 secs) and the tools available in the course (2 mins 50 secs). In addition, an infographic was developed called 'How to self-regulate your learning in a nutshell' to keep at hand when studying (see also Appendix 1).
- b. In the tutorial groups, instruction about cognitive and metacognitive strategies was provided in relation to the course materials. For example, students received specific information and tips on effective strategies for studying academic texts or writing assignments. Lecturers introduced these strategies and discussed them with students. For each week, the PowerPoint slides of the tutorial groups contained this information. These slides were available on Canvas as well.

Examples of cognitive strategies included self-explanation, spacing and self-testing. When reading a text, self-explanation requires students to clarify to themselves the meaning and relevance of topics and concepts in the text. Furthermore, students were encouraged to spread repetitions of learning over time (spacing) and avoid cramming or ‘massing’. For example, by using flashcards, self-testing was promoted as a strategy to check understanding of the materials students were studying. These strategies support metacognitive monitoring and help students connect the course’s learning materials and prior knowledge (e.g., Biwer et al., 2020).

- c. In week 6, students were asked (in the learning diary of that week) if there were additional topics regarding self-regulated learning on which they would like to receive support. Many students named topics like time management and tackling procrastination. Therefore, students received information and practical tips on using effective resource management strategies and the cognitive and metacognitive strategies included in the course. These are regulatory strategies for controlling non-cognitive resources, and they are used to create optimal learning conditions. Examples of these practical tips were planning by making weekly schedules, reinforcement techniques, using timers, or using social support for task completion.

3) Peer interactions

Peer interactions as a source of contextual regulation refer to the interactions between students. This can include group discussions during collaborative tasks in class or self-study, peer review or joint reflection on learning materials. It also refers to informal exchanges between students (Allal, 2018; 2007). In group work, regulatory engagement and expertise are distributed and shared across students: when students work together on a task, a group of students is taking metacognitive control of a task together. In addition, planning, monitoring, and evaluation are shared to elicit learning adaptations and the approach taken towards the task (Hadwin et al., 2018). Previously, group work was already included as part of activities during the tutorial groups and as part of the summative assessment of the course *Introduction to Human Communication*. For example, students wrote a group paper, and in a small group of 3 or 4 students, they prepared and gave a group lecture. Peer interactions as a source of contextual regulation were implemented more explicitly in the following way:

- a. Peer assessment was included in the course assignment of the group paper as a form of assessment for learning that can affect self-regulated learning (Panadero et al., 2016). Each group provided feedback on the paper written by another group, scaffolded by a short rubric. Scaffolding was particularly important for the peer-assessment activity as students’ domain-specific knowledge and skills were limited. In addition to the feedback students provided to another group, they also had to reflect on what their group did differently in their writing assignment and explain why. Hence, students evaluated both others and their own work, thus encouraging their metacognitive awareness. Each group could adjust their paper after the round of peer assessment, thus using the feedback they received and the insights provided by giving feedback to another group.

4) Tools

Tools serve as links between the various levels of regulation in the model; they amplify the effects of interactive co-regulation and allow recording traces of student activity. They can include instructional materials, educational technology, and assessment instruments (Allal, 2019). For example, an assessment rubric containing performance criteria forms part of the course’s instructional design.

During the enactment of the teaching and learning situation, the rubric can be discussed and specified during a class discussion to prepare for a learning task (linkage). This discussion of the rubric can make learning goals or objectives for a specific task more explicit (amplification). Students can subsequently use the rubric during self-study to monitor and evaluate their performance of this task. Alternatively, the rubric can be used as a student checklist for peer assessment of other students' work (recording traces). The teacher can use this for deferred regulation. The information can identify the difficulties students experienced in performing a task and prepare a new classroom activity to help students overcome these challenges. The following tools were implemented in our course as sources of contextual regulation:

- a. The [Ace Your Self-study App](#)¹ was provided to students to help them select adequate learning strategies. This mobile application aims to help learners self-regulate their learning during self-study. It provides flexible support during learning and contains 22 evidence-based strategies for learning tasks such as studying texts, writing assignments and exam preparation. In addition, a short explanation and instruction video are included in the app for each strategy.
- b. The self-regulated learning cycle is based on Zimmerman's (2000) Cyclical Phases Model. Students were asked to use the cycle to go through the forethought, performance, and self-reflection phase stepwise to plan, monitor and reflect on their learning. The self-regulated learning cycle was explained in the infographic (see appendix 1); during the first tutorial group, students were asked every week if they planned, monitored, and reflected on their learning in the learning diaries.
- c. Students used the online [learning diaries](#) to reflect upon their learning process. In the learning diaries, students defined a learning goal for the course, monitored their learning during the week, and evaluated the attainment of their goals at the end of each week. Students also reflected on their strategy use, linked explicitly to the course assignments of the week. The learning diaries were composed with several requirements in mind: (1) the diaries depicted the whole self-regulation cycle, (2) they provided the opportunity to foster the students' use of metacognitive strategies and (3) the use of the learning diaries should be feasible for the students during their studies. Students filled out the online diaries once a week after studying for the course. The diaries were distributed via Canvas, with a link to the EUR Qualtrics environment. The learning diaries were not graded, but they were a course assignment for all students. Therefore, a case could be made for completing the diaries part of a participation mark. A full overview of questions in the learning diaries can be found in Appendix 3.

Lessons learned 2020-2021

In the academic year 2020-2021, the intervention was implemented for the first time. The results of the current research project were shared with the teaching team. Based on these results, the course coordinator and the teaching team decided to implement the intervention for the second time in 2021-2022. This time, the course ran from 6 September to 29 October 2021. Two adjustments were made based on the lecturers' experiences of last year with the intervention. These experiences were discussed in detail in the focus group interview with the tutorial lecturers. The learning diaries were available to students from week 1 to week 7. During week 8 of the course, students finished their assignments and preparation for the exam. In 2020-2021, this was reflected in the low number of diaries filled in for week 8.

¹ [This app](#) is developed at university's School of Social and Behavioural Sciences, and freely available in app-stores.

Furthermore, the information about self-regulated learning in the tutorial groups was more practical for students. Therefore, in 2020-2021, the focus was more on effective and ineffective strategies. Instead, in 2021-2022, students received more information about why certain strategies are effective and how to determine if they are effective (i.e., a strategy is effective when it is active and provides feedback about what students already do not yet know). In addition, based on the evaluation of the intervention with the tutorial lecturers, each strategy was supplemented with very practical tips on how to apply the strategy.

Consequential validity of the current study can be provided in the future after the research results are validated through the effects of the use of the intervention and the application of the design principles in other educational settings. The notion of consequential validity is based on Messick's (1992) argument that the validity of an assertion can be obtained by investigating the social consequences of its use (Barab and Squire, 2004; Messick, 1992). This can partly be realised after evaluating the second implementation of the intervention in the academic year 2021-2022. The intervention is slightly adapted based on its evaluation during the previous academic year and lessons learned from 2020-2021. Other changes concern the teaching team, in which a few members were replaced. Furthermore, teaching in 2021-2022 took place in a hybrid format, allowing the tutorial groups to take place on campus, while the weekly lecture could be attended by a maximum of 75 students (out of 340 students registered for the course). The consequential validity of the current research project possibly increases after the intervention has been implemented in a different context, for example, a first-year course in a programme of a different School at the university.

7.4.3 Design principles

The claim to knowledge of design-based educational research takes shape through design principles (Linn, Davis and Bell, 2004; van den Akker, 1999), also called intervention theory (e.g., Barab and Squire, 2004; Edelson, 2006). Therefore, the description of the design of the intervention and its conditions is supplemented with design principles. Design principles have both a substantive component, providing insight into the purpose of the intervention and its essential characteristics, and a procedural component, providing guidelines for designing and implementing the intervention and underpinnings. The intervention description and the design principles help other educational practitioners select appropriate substantive and procedural knowledge to design and develop interventions in their educational contexts (Van den Akker et al., 2006).

If you intend to design a contextualised intervention to foster first-year university students in self-regulated learning, then you are recommended to give that intervention the following *characteristics*:

- To encourage student self-regulated learning, incorporate the following sources of contextual regulation in (a) the course structure, (b) in the teacher interventions and interactions, (c) in peer interactions, and (d) in the form of tools, which serve as linkages between the different levels of regulation, amplifying the effects of interactive co-regulation.

You are advised to provide this intervention via the following *procedures*:

- In the design of the course structure, forms of formative assessment and practice testing should be included, providing students with feedback about the efficacy of their study strategies.

- The teacher interventions and interactions should promote self-regulated learning through explicit and implicit instruction. Students should be provided with guidance on self-regulated learning, how to use specific cognitive and metacognitive strategies in a practical manner, and they should be presented with a holistic framework to evaluate and adapt their learning strategies.
- It is advised to include peer interactions as a source of contextual regulation in the form of peer assessment for learning that can affect self-regulated learning. Students should evaluate their work and the work of others, thus stimulating their metacognitive awareness. As first-year students have limited domain-specific knowledge and skills, it is recommended to provide them with a short grading rubric to conduct the peer-assessment activity.
- The Ace Your Self-study App is suggested as a tool to help learners self-regulate by providing flexible support during self-study, containing 22 evidence-based strategies for learning tasks such as studying texts, writing assignments and exam preparation.
- Weekly online learning diaries are suggested as a tool that improves self-regulated learning by increasing awareness of how current learning strategies influence the attainment of learning goals by increased planning, monitoring, and self-reflection. Diaries thus stimulate students' metacognitive awareness. The diaries should portray the whole self-regulation cycle; they should allow students to use metacognitive strategies, and the use of the learning diaries should be feasible for the students during their studies.

In general, the intervention is most advantageous when it is offered early in the curriculum and when it is based on a robust theoretical framework, incorporates all aspects of self-regulated learning, concentrates on teaching various self-regulated learning strategies, and is spread throughout the course, connected with course assignments, activities, and assessment.

In addition, when implementing a co-regulated learning intervention, it is recommended to raise awareness about self-regulated learning and provide adequate teacher training to the lecturers who will deliver the intervention in their course. Teacher training should introduce the intervention and its theoretical underpinnings and provide hands-on and practical support for lecturers. The evaluation with the course lecturers in the academic year 2020-2021 showed that the intervention is acceptably consistent and practical. Nevertheless, even though the intervention is carefully designed and developed, and lecturers received support from the educational designer/researcher during implementation, lecturers need sufficient time and attention to deliver the intervention and adequately address the topic of self-regulated learning.

7.5 Recommendations for future research

The current research project confirmed that the intervention in the form of offering sources of contextual regulation embedded within students' learning environment increases students' propensity to engage in self-regulated learning. A strength of this study was the use of combined methods, resulting in the establishment of different types of regulators. Thus, valuable insight is provided into the distinct ways students participated in co-regulated learning. The first group consisted of students that were ultimately inefficient in regulating their learning, while students in the second group demonstrated metacognitive awareness and deliberate attempts to improve their learning process and outcomes. An interesting line of future research would be to use the insights

about the different types of regulators *during* the course. In the current study, the types of regulators and their differences in metacognitive awareness and the degree to which they successfully adapted their study behaviours all became apparent *after* the course had finished. On the other hand, neither students nor lecturers received information about students' engagement with the sources of contextual regulation during the course. Alternatively, as self-regulated learning is an ongoing process, it would be interesting to research the effects of providing this information during the course. On the one hand, students could be provided with tailored advice on how to become self-regulated learners. Direct feedback about the results of the pre-test questionnaire could be supplied to students, for example, about their strategy use and metacognitive awareness. On the other hand, students could be provided insight into their development from the learning diaries during the course. Their answers and regulatory profile could be supplied with tailored advice to develop further or amend a lack of self-regulated learning skills.

On the other hand, lecturers would have more timely access to information about the self-regulated learning strategies or -processes students struggled with. This information could then be used for deferred regulation by the lecturers by preparing classrooms activities designed to assist students in overcoming the struggles they reported in their learning diaries. Such a line of research would require learning analytics to improve learning and support teaching. A scoping review by Viberg et al. (2020) indicated that current learning analytics research is conducted to measure self-regulated learning rather than to support the development of students' self-regulatory learning skills. Therefore, exploring further how learning analytics can foster self-regulated learning is a promising line of future research.

7.6 Conclusion

Given its importance during education and throughout life, I consider the ability to regulate one's learning to be an essential skill. Taking this into account, in the current thesis, I proposed a contextualised intervention that considers the development of self-regulated learning in a university setting a shared responsibility. Students, teachers, and the educational institution play a role in students' engagement in developing adaptive self-regulated learning skills that are foundational to lifelong learning.

This research study demonstrates that the intervention in the form of offering sources of contextual regulation embedded within students' learning environment increases students' propensity to engage in self-regulated learning in the specific context of their own subject. In addition, it demonstrates that students participated in co-regulated learning in distinct ways. The different profiles of regulators indicate that, although all students in the sample were engaging with the sources of contextual regulation, they do so in different ways. By applying and triangulating different instruments for data collection, a holistic account was provided of how students engaged with the sources of contextual regulation and in their course. In addition, the weekly learning diaries provided a nuanced view of how students' self-regulated learning unfolded over the term of the course. Thus, this research study demonstrated the value of learning diaries as a combined data collection and intervention tool.

The research study emphasises that an intervention programme that involves collaboration between the educational researcher and lecturers enables students to apply self-regulated learning processes and strategies in context. Collaboration with lecturers as subject-matter experts synchronises contextual regulation sources with the course content, ensuring that students practise self-regulated learning skills with the learning materials of their subject.

This thesis thus impacted educational research and educational practice in the following ways. The study contributes to the knowledge base about co- and self-regulated learning by addressing the research question. In addition, the research study resulted in an empirically underpinned innovative intervention that is accompanied by a set of design principles or intervention theory. The design principles can be applied by lecturers, instructional designers, and educational researchers who wish to support and encourage students' self-regulated learning with a contextualised innovation.

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Appendices

Appendix 1 – Example from the intervention’s instructional materials

The infographic “How to self-regulate your learning, in a nutshell” that students received during the course:

Erasmus School of
History, Culture and
Communication

How to self-regulate your learning *in a nutshell*

What is self-regulated learning?
Self-regulated learning is a process you can use as a learner to manage your thoughts, your behaviours and your motivation. Self-regulated learning helps you achieve your learning goals. It involves the proactive processes that students use to achieve academic success.

How do you become a self-regulated learner?
Self-regulated learners control the factors that influence their learning. They use effective learning strategies, they motivate themselves, and they monitor and adapt their study behaviours if needed. So, how do you plan, monitor and regulate your own learning process?

Supporting tools in this course
To help you to become a self-regulated learner there are 3 tools available to you that you can use when studying for this course:

1. The self-regulated learning cycle
2. A learning diary
3. The Ace Your Self-study app

Self-regulated learning cycle
Use the self-regulated learning cycle to plan, monitor and reflect on your learning for this course. Each week, take the following steps:



Forethought:

- Identify your tasks and formulate your learning goal for this week
- Select the learning strategies you are going to use for this week's tasks
- Make a planning

Performance:

- Apply the learning strategies you selected for your tasks
- Monitor your performance

Self-reflection:

- Reflect on and evaluate your performance and results
- Was the strategy you chose effective?
- Use your reflection as input to plan for next week's tasks

The learning diary
As part of the course you will be keeping a weekly online learning diary to support your learning. The diary:

- Helps you to apply what you have learned in the online tutorial
- Reminds you to formulate goals and to use learning strategies
- Asks you if the strategy worked

Available on Canvas

Keep it up
Don't worry if applying a new learning strategy may feel inefficient at first. Learning the method can be as important as learning the material. Don't give up.

Ace Your Self-study app
To help you select adequate learning strategies and to assist you to master these learning strategies, the Ace your self-study app is a great support. The app:

- Provides flexible and personal support to you during learning
- Contains 22 effective strategies for learning: tasks like studying texts, writing assignments and preparing for exams
- Each of the strategies available in the app includes a 2-sentence explanation and a short instruction-video.

Available in all App stores

Four recommended strategies

- ✓ **Self-testing:** Improves learning and retention. Give yourself a practice test to check your understanding of the materials you are studying. Use flashcards, answer questions from a practice exam, or ask someone to question you.
- ✓ **Spacing:** spreading learning over time is effective. Spread repetitions of the learning content over time; avoid cramming.
- ✓ **Organize and elaborate:** contextualize the material you need to study by making an outline, flowchart or graphical organizer of the major topics and ideas.
- ✓ **Self-explanation:** as you read a text, explain the meaning and relevance of the main ideas to yourself. Ask yourself what new information the text provides you and how this relates to what you already know.

What doesn't work well
Try to avoid underlining and re-reading.

X Although these are frequently used by students, research shows these methods are ineffective and time-consuming.
If you do highlight, make it useful by turning the marked information into flashcards or self-testing. Replace re-reading of study materials by more active strategies such as self-explanation, practice testing and elaboration.

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2020

Appendix 2 – Pre-test and post-test questionnaire

The following scales and items were included in both the questionnaire at the beginning of the study and at the end of the study:

1. Learning strategies: Motivated Strategies for Learning Questionnaire, MSLQ (Pintrich, Smith, García, and McKeachie, 1991, 1993).
2. Motivation: academic self-regulation scale (Vansteenkiste, Simons, Lens, Sheldon, and Deci, 2004)
3. Self-efficacy: indication of degree of confidence (Bandura, 2006).

The following items were added to the questionnaire at the end of the study:

4. Satisfaction related to the learning process.
5. Satisfaction related to the support on effective study behaviours offered in the course.

1. Learning strategies scales from the MSLQ used in the pre-test questionnaire

Cognitive and metacognitive scales:	Items:
- Rehearsal	2
- Elaboration	5
- Organization	2
- Metacognitive self-regulation (MSR-R)	9
Resource management strategies:	Items:
- Time and study environment (TSE)	8
- Peer learning	2
- Help seeking	4

Cognitive and Metacognitive Strategies: Rehearsal

46. When studying for this class, I read my class notes and the course readings over and over again.
59. I memorize key words to remind me of important concepts in this class.

Cognitive and Metacognitive Strategies: Elaboration

53. When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.
64. When reading for this class, I try to relate the material to what I already know.
67. When I study for this course, I write brief summaries of the main ideas from the readings and the concepts from the lectures.
69. I try to understand the material in this class by making connections between the readings and the concepts from the lectures.
81. I try to apply ideas from course readings in other class activities such as lecture and discussion.

Cognitive and Metacognitive Strategies: Organization

42. When I study for this course, I go through the readings and my class notes and try to find the most important ideas.
49. I make simple charts, diagrams, or tables to help me organize course material.

Cognitive and Metacognitive Strategies: Metacognitive Self-Regulation (i.e., MSR-R)

- 41. When I become confused about something I'm reading for this class, I go back and try to figure it out.
- 44. If course materials are difficult to understand, I change the way I read the material.
- 54. Before I study new course material thoroughly, I often skim it to see how it is organized.
- 55. I ask myself questions to make sure I understand the material I have been studying in this class.
- 56. I try to change the way I study in order to fit the course requirements and instructor's teaching style.
- 61. I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.
- 76. When studying for this course I try to determine which concepts I don't understand well.
- 78. When I study for this class, I set goals for myself in order to direct my activities in each study period.
- 79. If I get confused taking notes in class, I make sure I sort it out afterwards.

Resource Management Strategies: Time and Study Environment

- 35. I usually study in a place where I can concentrate on my course work.
- 43. I make good use of my study time for this course.
- 52. I find it hard to stick to a study schedule. (REVERSED)
- 65. I have a regular place set aside for studying.
- 70. I make sure I keep up with the weekly readings and assignments for this course.
- 73. I attend class regularly.
- 77. I often find that I don't spend very much time on this course because of other activities. (REVERSED)
- 80. I rarely find time to review my notes or readings before an exam. (REVERSED)

Resource Management: Peer Learning

- 34. When studying for this course, I often try to explain the material to a classmate or a friend.
- 45. I try to work with other students from this class to complete the course assignments.

Resource Management: Help Seeking

- 40. Even if I have trouble learning the material in this class, I try to do the work on my own, without help from anyone. (REVERSED)
- 58. I ask the instructor to clarify concepts I don't understand well.
- 68. When I can't understand the material in this course, I ask another student in this class for help.
- 75. I try to identify students in this class whom I can ask for help if necessary.

2. Motivation:

Motivation is measured using a 16-item task-specific version of the academic self-regulation scale (Vansteenkiste, Simons, Lens, Sheldon, and Deci, 2004), for which students have to indicate why they engaged in studying in general. The scale consists of four subscales: external (e.g., "... because I am supposed to do so"), introjected (e.g., "... because I would feel guilty if I did not do it"), identified (e.g., "... because I could learn something from it"), and intrinsic motivation (e.g., "... because I found it interesting"). Items will be measured on a 5-point Likert-type scale ranging from 1 (not at all true) to 5 (totally true). Students were asked the following questions: *I'm studying...*

- 1) Because I want others to think I'm a good student.

- 2) Because I enjoy doing it.
- 3) Because I would get in trouble if I did not.
- 4) Because I want to learn new things.
- 5) Because I would feel ashamed if I didn't study.
- 6) Because others (parents, friends, etc.) oblige me to do so.
- 7) Because it's an exciting thing to do.
- 8) Because this represents a meaningful choice to me.
- 9) Because that's what others (parents, friends, etc.) force me to do.
- 10) Because that's what others (e.g., parents, friends) expect me to do.
- 11) Because I am highly interested in doing this.
- 12) Because I would feel guilty if I didn't study.
- 13) Because it is personally important to me.
- 14) Because I want others to think I'm smart.
- 15) Because it's fun.
- 16) Because this is an important life goal to me.

3. Self-efficacy:

To measure self-efficacy, students will be asked to indicate their degree of confidence in their ability to be successful in self-studying the learning materials offered in this course by recording a number from 0 to 100 (Bandura, 2006). In the pre-test questionnaire, students were asked:

- On a scale of 0-100, how confident are you that you are able to successfully study the learning materials for the Introduction to Human Communication course? (the further you drag the slider to the right, the higher the level of confidence) (slider 0-100)

In the post-test questionnaire, students were asked:

- On a scale of 0-100, how confident are you that you are able to successfully study the learning materials for your future courses? (the further you drag the slider to the right, the higher the level of confidence) (slider 0-100)

4. Satisfaction related to the learning process (added to questionnaire at the end of the study):

To measure satisfaction related to the learning process two items were included in which students were prompted to rate their satisfaction with their learning process during the course. Students were asked (measured on a five-point Likert scale):

- When studying for the IHC course I developed additional self-regulated learning skills during the IHC course.
- How much do you think the self-regulated learning support in the IHC course contributed to this?

5. Satisfaction related to the support offered in the course (added to questionnaire at the end of the study):

To measure satisfaction related to the support offered on effective study behaviours, five items were added on the experienced effectiveness and benefit of the sources of regulation. Students were asked (measured on a five-point Likert scale) to what extent they experienced benefit from the following forms of self-regulated learning support embedded in the course:

- The weekly online learning diaries
- The SRL-cycle for planning, monitoring and reflecting on your learning
- The Ace Your Self-Study App

- The information about SRL available on Canvas (i.e. infographic, video's, tips and further explanation)
- The instruction and explanation from the tutorial lecturers about self-regulated learning

Appendix 3 – Scales, topics, and questions in the learning diaries

Scales/ Topics:	Questions:	Answer category:	Learning diaries, week:								
			1	2	3	4	5	6	7	8	
MSLQ, Cognitive and Metacognitive Strategies: Rehearsal	46. When studying for this course, this week...I read my class notes and the course readings over and over again.	5-point Likert	X	X	X	X	X	X	X	X	X
MSLQ, Cognitive and Metacognitive Strategies: Elaboration	64. When studying for this course, this week... I tried to relate the material to what I already know.	5-point Likert	X	X	X	X	X	X	X	X	X
	67. When studying for this course, this week...I wrote brief summaries of the main ideas from the readings and the concepts from the (web)lectures.	5-point Likert	X	X	X	X	X	X	X	X	X
MSLQ, Cognitive and Metacognitive Strategies: Metacognitive Self-Regulation (MSR-R)	41. when I became confused about something was reading for this class, I went back and tried to figure it out.	5-point Likert	X	X	X	X	X	X	X	X	X
	55. I asked myself questions to make sure I understood the material	5-point Likert	X	X	X	X	X	X	X	X	
MSLQ, Resource Management: Peer Learning	34. I tried to explain the material to a classmate or a friend.	5-point Likert	X	X	X	X	X	X	X	X	X
MSLQ, Resource Management: Help Seeking	40. even if I had trouble learning the material, I tried to do the work on my own, without help from anyone. (REVERSED)	5-point Likert	X	X	X	X	X	X	X	X	X
	58. I asked the instructor to clarify concepts I didn't understand well.	5-point Likert	X	X	X	X	X	X	X	X	X
	68. when I couldn't understand the material, I asked another student in this class for help.	5-point Likert	X	X	X	X	X	X	X	X	X
Motivation	I could motivate myself well for this week's tasks	5-point Likert	X	X	X	X	X	X	X	X	X
	I was studying this week because I think the topic of the course is interesting	5-point Likert	X	X	X	X	X	X	X	X	X
	I was studying this week because I want to receive a good grade for this course	5-point Likert	X	X	X	X	X	X	X	X	X
Metacognitive Self-Regulation	Is there a topic concerning self-regulated learning you would like to learn more about?	Open						X			
Forethought: SRL-cycle	When studying this week, did you use the self-regulated learning cycle to plan, monitor and reflect on your learning?	Yes/No	X						X	X	X
	When studying this week, I consciously went through the steps of the.... forethought phase	5-point Likert		X	X	X	X				
	... performance phase	5-point Likert		X	X	X	X				
	... self-reflection phase	5-point Likert		X	X	X	X				
Forethought: Goal-setting	This week I had a concrete learning goal for this course.	Yes/no	X						X	X	X
	My learning goal for this week was...	Open	X	X	X	X	X				
Forethought: Planning	When studying this week... I planned my tasks before I began working on it.	5-point Likert	X	X	X	X	X	X	X	X	X
	...I distributed my study sessions over the entire week.	5-point Likert	X	X	X	X	X	X	X	X	X

 I thought about how I would approach my study tasks	5-point Likert	X	X	X	X	X	X	X	X
Performance: Time spent (absolute)	How much time have you spent this week studying for Introduction to Human Communication (including web-lectures, tutorial, readings, assignments)?	No. of hours	X	X	X	X	X	X	X	X
Performance: Ace Your Self-Study App	Did you use the Ace your self-study app for this week's studying for Introduction to Human Communication?	Yes/no	X	X	X	X	X	X	X	X
Performance: Strategies-readings	Which strategy did you use to study this week's readings for Introduction to Human Communication? (multiple answers possible: min. 1 / max. 3)	Multiple answer 1-3	X						X	
Performance: Strategies: writing assignment (group paper)	Which strategy did you use to for this week's writing assignment (group paper) for Introduction to Human Communication? (multiple answers possible: min. 1 / max. 3)	Multiple answer 1-3	X						X	
Performance: Helpfulness of strategies	Please group the following learning strategies to the box that is most applicable to you: Studying last week, this was an effective strategy for me	Group 11 strategies		X	X		X			X
	I tried out this strategy last week but it was not very helpful for me	Group 11 strategies		X	X		X			X
	I did not use these strategies	Group 11 strategies		X	X		X			X
Performance: Strategy used	Which strategy did you use this week when studying for Introduction to Human Communication?	Multiple choice (1)		X	X					
Performance: Strategies: other	Did you use any other strategies than the ones you mentioned in the previous two questions?	Yes (namely) no	X							
Reflection: process	When studying this week: I asked myself if I was understanding what I needed to know.	5-point Likert	X	X	X	X	X	X	X	X
	...I kept my learning goal for IHC in mind.	5-point Likert	X	X	X	X	X	X	X	X
	...I remained calm when facing learning difficulties because I can rely on my abilities	5-point Likert	X	X	X	X	X	X	X	X
	... I made an effort to evaluate my work for IHC	5-point Likert	X	X	X	X	X	X	X	X
	... I am satisfied with my learning results of this week.	5-point Likert	X	X	X	X	X	X	X	X
Reflection: strategies	On a scale from 1 to 10, how effective were the strategies you used...to study this week's readings	1-10	X	X	X	X	X	X	X	X
	... for this week's writing assignment	1-10	X	X	X	X	X	X	X	X
Reflection: Learning outcomes	How successful were you in achieving your learning goal this week?	1-10	X	X	X	X	X	X	X	X
	How well did you understand this week's materials for IHC?	1-10	X	X	X	X	X	X	X	X
	How well prepared do you feel for the final exam right now?	1-10								X
	What has worked well this week, when studying for IHC?	Open	X	X	X	X	X	X	X	
Reflection: Evaluation/ Input next cycle	What can you improve next week, when studying for IHC?	Open	X	X	X	X	X	X	X	
	My learning goal for next week for this course is....	Open	X	X	X	X	X	X	X	

Appendix 4 - Interview guide for focus-group with tutorial lecturers

The following interview guide was used for the focus-group interview with the tutorial lecturers of the course *Introduction to Human Communication*. The interview took place on 22 January 2021 and lasted one hour.

1. Procedure – 5 min.

- Welcome and thank you for participating in this focus group interview.
- Did you all receive the participant information sheet and the consent form I sent you? Do you all confirm your participation in this study?
- The interview will take approximately 1 hour and is recorded. These recordings will be treated confidentially.
- During this interview, I will start with a short recap of the research project and the intervention. Then we'll talk about **your experiences** as a tutorial lecturer, offering sources of contextual regulation in teaching course CM1001 and **your view** on students' reactions on the topic of self-regulated learning.
- Please feel free to add and mention more that comes to mind. All your answers are valid and interesting to us. There is no judgment involved in this group interview. I am curious about your experiences and opinions.

2. Recap of the research project – 10 min.

- Here you see some slides with a summary of the educational innovation and the research project ((slide 3-4)
- Here you see a slide with an overview of the four sources of contextual regulation (slide 5)
- The intervention consists of 4 sources of contextual regulation that will be implemented in *Introduction to Human Communication*:
 - Re-design of the structure of the teaching and learning situation (resources, activities, assessment) to allow for cue-utilization.
 - Teacher-student interactions: explicit instruction of evidence-based self-regulated learning strategies focused on reading academic texts.
 - Peer interactions in the form of reciprocal and joint reflection on course/reading materials.
 - Tools: SRL-cycle, Ace your self-study app and Structured online diaries, kept by students to keep account of their self-regulation and strategy use, and to foster formal self-monitoring. These tools serve as linkages between the different levels of regulation, amplify effects of co-regulation and allow recording of traces of student activity'.

I'll start with a few general questions about the educational innovation:

Question 1: Was the purpose of the innovation clear to you?

Question 2: In your opinion, are students' SRL-skills enhanced as a result of the educational innovation?

3. Support directed towards students - 15 min.

- Here you see a slide with an overview of the support directed towards students (slides 7-11)

Question 3: Is the intervention motivating for students?

Question 4: Is the intervention relevant for students?

Question 5: Is the time effort/ time spent on the intervention realistic for students?

Question 6: Did students receive enough instruction, and did they have enough time to practice?

Question 7: For students, was there something missing in the educational innovation?

4. Support directed towards the teaching team - 15 min.

Here you see a slide with an overview of the support directed towards the teaching team of *Introduction to Human Communication* (slide 13-14)

Question 8: what was your experience with the forms of support offered?

Question 9: Is it feasible for the lecturer to implement this intervention?

Question 10: Is there something that would enhance the practical feasibility of this intervention?

Question 11: For you, as a lecturer, was there something missing in the support offered i.r.t. the educational innovation?

Question 12: Did the quality of the teaching and learning in this course improve as a result of the intervention?

5. Wrap-up / debriefing – 5 min.

Question 13: Is there something that you would like to mention about the educational innovation that has not been discussed?

- Closing: thank you; opportunity to email me with questions about this research
- Sharing of the outcomes

Appendix 5 - Individual qualitative profiles

Codes and themes used for the content and thematic analysis of students' learning diaries, based on McCardle and Hadwin (2015) and Cazan (2020).

Codebook of the content analysis of the learning diaries (first round of qualitative analysis):									
Profile:	Developing regulators			Moderate regulators			High regulators		
Participant:	P13	P25	P32	P17	P19	P21	P23	P29	P34
<i>Forethought phase</i>	Improving	Moderate	Low	Low	Low	Moderate	Low	Low	Low
<i>Monitoring phase</i>	Improving	Improving	Low	Low	Moderate	High	Low	High	Low
<i>Reflection phase</i>	Low	Improving	Low	Low	Moderate	Moderate	Moderate	Moderate	Moderate
<i>Motivation</i>	High	High	High	Decreasing	High	Moderate	Moderate	High	High
<i>Metacognitive awareness</i>	Moderate	Moderate	Low	Low	Moderate	High	Moderate	High	Low

Themes and description used for the thematic analysis of the learning diaries (second round of qualitative analysis):	
Disengaged regulators	Low engagement of regulatory processes
	Learning objectives vague and unstructured, lacking specific standards
	Unstructured and surface learning
	Described some difficulties but did not evidence intent to address these
	Generally unable to identify unproductive behaviours and ways to eliminate them
Striving regulators	Struggling to adapt to challenges – making adaptations but these were not necessarily successful
	Some awareness of academic issues or problems
	Reflecting on difficulties addressing those problems
	Improving in goals (more specific standards and action) though not consistent from week to week
	Focus of regulation around surface characteristics such as time, grades and environment
Emergent regulators	Consistent improvement in some aspects of SRL
	Demonstrated improvement in setting task-focused academic goals
	Evidenced attempts to monitor/evaluate and adapt though these tended to focus on organisation, time, and motivation rather than on learning and learning content
	Awareness of struggles and strengths

	Evaluation of learning progress and outcomes more specific and highlight a general preoccupation to use more efficient learning strategies in the future
Engaged regulators	Intentional self-improvement
	Focus on learning and active engagement with course content
	Metacognitive awareness evidenced by description of their struggles
	Demonstrated monitoring and evaluating
	Deliberate attempts to make changes to their learning
	Active and deliberate in experimenting and improving their learning

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