Erasmus School of
History, Culture and
Communication

It takes two:

the role of co-regulation in building students' self-regulated learning skills

Educational innovation project

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Contents

1. Introduction

Self-regulated learning makes a positive contribution to learners' study success (e.g., Dent & Koenka, 2016; Donker et al., 2014). Nevertheless, students have little knowledge about study strategies in general (McCabe, 2011), they generally are unaware of which strategies are effective, and they lack information on how to use study strategies (Bjork et al., 2013). Therefore, it is essential to encourage, support, and facilitate the development of learners' self-regulation. Unfortunately, even when instruction and support are offered in their educational programmes, students do not necessarily adopt self-regulated learning skills and strategies because they mistakenly believe inadequate strategies like highlighting and rereading are effective (Soderstrom & Bjork, 2015; McCabe, 2011).

The aim of this CLI fellowship[1] project was to investigate how sources of contextual regulation embedded within a course could encourage students to engage in self-regulated learning. Therefore, to address the educational challenge, an intervention was developed, implemented, and evaluated based on the adapted model of co-regulated learning. The project aimed at producing two outputs: (1) an intervention providing sources of regulation in students' learning environment to solve the educational challenge observed in practice and (2) producing theoretical understanding about the role of co-regulated learning in stimulating students' engagement in self-regulated learning.

Using a variety of measures, my study indicates that the intervention programme had positive effects on students' propensity to engage in self-regulated learning. The current intervention increased students' self-regulatory skills, their self-efficacy, and their controlled motivation. Furthermore, I identified four qualitative profiles of regulators, which demonstrated how students engage differently with sources of contextual regulation when they are studying. Thus, the outcomes of my project resulted in an empirically underpinned innovative intervention as a solution to the defined educational challenge. Next to the practical relevance constituted by the intervention, a second output is an accompanying set of design principles.

2. Theoretical background of the study

Despite 30 years of research, contemporary researchers face several challenges when seeking to advance knowledge and understanding of self-regulated learning, and how to support it (e.g., 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 & 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 & Oshige, 2011). Another issue for researchers refers to self-regulated learning 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

[1] This CLI fellowship is connected to the research project for my Doctorate in Education (University of Sheffield). The completion is expected in early spring 2022. If by then you would like to receive my doctoral thesis, please contact me via LinkedIn.

to shape learning-in-action" (Butler & Cartier, 2018, p.352). Finally, in addition to these challenges, it remains demanding to mobilise the rich knowledge base on self-regulated learning to profoundly impact educational practice (Butler & Schnellert, 2012; Cartier, Butler, & Bouchard, 2010).

Two major theoretical frameworks guided this educational 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, providing sources of contextual regulation in the students' learning environment. Both theoretical perspectives reflect social constructivist epistemology.
My 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 is inseparable from the activity, context, and culture in which they learn (Hadwin & Oshige, 2011; 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, a fundamental assumption is that learning does not occur in a vacuum and is not located within the individual: learning, cognition, learning activities, and context 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 & 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. I introduced an adapted model of co-regulated learning, which enables researching co-regulation of learning within a university context 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.

3. 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 in' the intervention into a mandatory course provided students with opportunities to practice and develop self-regulatory learning behaviours within their own 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 regulations linked to: **(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 to 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 (Panadero, 2017; Zimmerman, 2000).
b. Improving self-regulated learning by using online **learning diaries**. Learning diaries encourage self-monitoring of the learning process and develop awareness of how current learning strategies affect goals by increasing planning, self-monitoring, and self-refection (Dignath-van Ewijk et al., 2015; Dörrenbächer and Perels, 2016; Fabriz et al., 2014). The diaries:
    I. function as an external cue and as a reminder to regulate learning. They stimulate metacognitive thought as students are reminded to apply a strategy and are asked whether and how the strategy worked.
    II. mediate between and support the transfer from the classroom-based sources of regulation (co-regulation) to the actual learning taking place at home or, during independent self-study (self-regulation).
    III. stimulate deliberate practice through repeated exercise of the strategies in the diaries.

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

4. Setting and process

Following a design-based research approach, the project was developed in close collaboration with faculty with extensive subject matter expertise and proficiency in teaching and educational design. As a CLI fellow, I initiated the project and served as the educational researcher with expertise in instructional design. In addition, during the project, we received valuable support from an educational technologist and skilled student research assistant. The setting for this CLI-fellowship project is the Erasmus School of History, Culture and Communication (ESHCC). The intervention was implemented in the course *Introduction to Human Communication* in the first year of the International Bachelor Communication and Media.

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 to analyse the educational challenge and achieve a shared and deepened understanding of the challenge, context, and the needs of stakeholders. Upon implementation, the other members of the teaching team were involved. A teach-the-teacher session was held before the start of the course. The weekly team meetings of the teaching team provided opportunities to discuss the implementation and students' and lecturers' experiences. These conversations made it possible to make minor adjustments to the intervention, as needed, during the implementation period. During the evaluation of the project, aspects like soundness and feasibility of the intervention and the project's research outputs were jointly investigated.

5. The intervention

5.1 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 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 & Hadwin, 2015; Dresel et al., 2015; Peverly 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 International Bachelor Communication and Media courses at Erasmus University in the Netherlands. A total of 314 students were enrolled at the start of the course. After evaluation and minor re-design, the intervention was implemented for a second run in the academic year 2021-2022.

5.2 Overview 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 (Figure 1).
The learners' self-regulation processes are positioned at the core of the nested model of co-regulated learning. These cognitive, metacognitive, behavioural, and motivational processes of self-regulated learning take place when the learner engages with the teaching and learning environment. All cognitive and metacognitive strategies were implemented through implicit training, being included as course tasks, and practiced in the domain-specific context of the course. The sources of contextual regulation are affordances that offer 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.

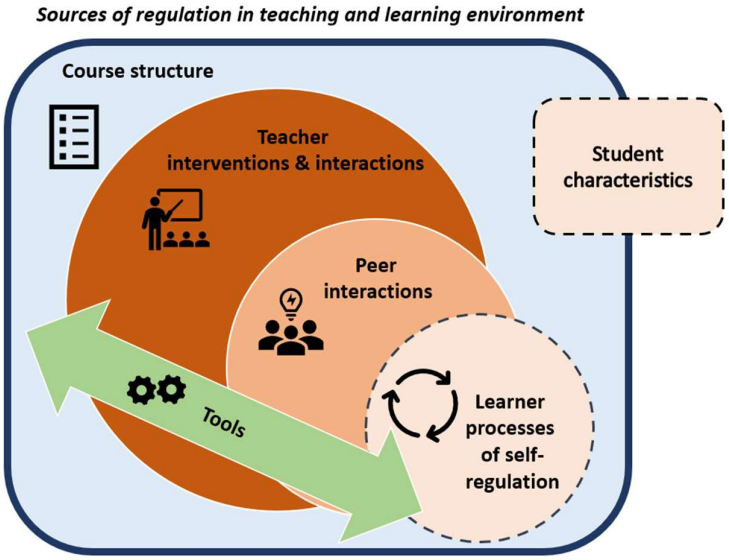

Figure 1: Model for co-regulation of learning in a university setting (adapted from Allal, 2007)

Students enter the context of the teaching and learning environment with learner characteristics: they 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 consist of students' study behaviours, their 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, which will be detailed in the next sections:

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

5.2.1 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: they overestimate their remembering of the learning materials and become overconfident about learning (Dunlosky & Rawson, 2012; Kornell & Bjork, 2009). Throughout the course, students were presented with several **quizzes**. The quiz questions helped them to 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 made 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 they often realise that a more profound comprehension is required for the exam, students still have time to adjust their studying, and there is enough time left for students to ask questions and lecturers to clarify specific topics and concepts from the teaching and learning materials.

5.2.2 Teacher interventions and interactions

In the model, the layer of teacher interventions and interactions represents the classroom setting as the situation 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 assist them in evaluating and adapting 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 (3m20) and the tools available in the course (2min.50). 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 explain 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 to make connections between the learning materials of the course 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 how to use 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.

5.2.3 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 during 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. Planning, monitoring, and evaluation are shared amongst them to elicit adaptations in learning and approach of 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 to conduct 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 own group did differently in their writing assignment and explain why. Hence, students were evaluating both others and their own work, thus encouraging students' 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.

5.2.4 Tools

Tools serve as linkages between the different levels of regulation; they amplify the effects of interactive co-regulation and allow recording of traces of student activity. They can include instructional materials, cultural artefacts, technological environments, and assessment procedures and 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 of traces). The teacher can use this for deferred regulation. The information can be used to identify 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**[2] 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

[2] The app is developed at Erasmus University's School of Social and Behavioural Sciences, and freely available in app-stores.

learning tasks such as studying texts, writing assignments and exam preparation. For each strategy, a short explanation and instruction video are included in the app.

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); during the first tutorial group, students were asked weekly 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 were asked to plan their learning activities for the week, define a learning goal for the course, monitor their learning during the week, and evaluate the attainment of their goals at the end of the 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 stimulate 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. It could be considered to make completing the diaries part of a participation mark.

6. Design principles

The knowledge claim of design-based educational research takes the form of design principles (Linn, Davis & Bell, 2004; van den Akker, 1999), also called intervention theory (e.g., Barab & Squire, 2004; Edelson, 2006), or lessons learned. Therefore, the description of the design of the intervention and its conditions is supplemented with design principles. 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. Design principles have both a substantive emphasis, providing insight into the purpose of the intervention and its key characteristics, and a procedural emphasis, providing guidelines for designing the intervention, its implementation conditions, and theoretical and empirical underpinnings of the intervention. The intervention description and the design principles inform future development and implementation decisions and help other educational practitioners select and apply the most appropriate substantive and procedural knowledge to design and develop interventions in their own settings (Van den Akker et al., 2006).

If you intend to design a contextualised intervention to foster first-year university students in self-regulated their learning, then you are best advised 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 as a form of assessment *for* learning that can affect self-regulated learning. Students should evaluate their own 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 affect learning goals by increasing planning, self-monitoring, and self-refection. Diaries thus stimulate students' metacognitive awareness. The diaries should depict 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, 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.

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Appendix: Infographic