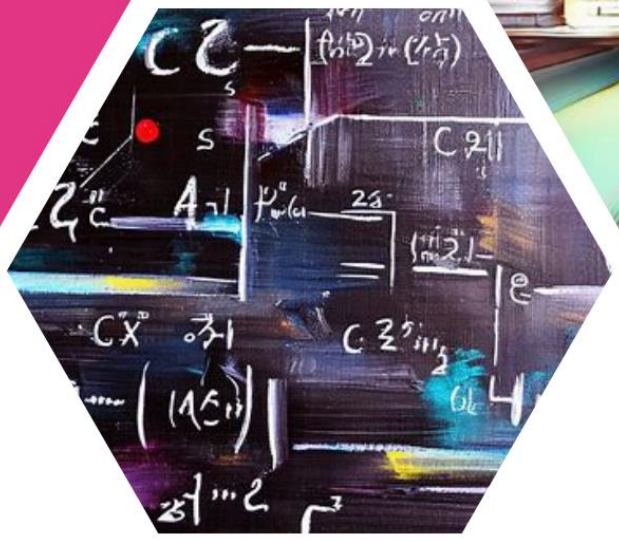
TUNED

A GUIDEBOOK FOR EDUCATORS

PEDAGOGICAL FRAMEWORK ON SELF-REGULATED LEARNING AND MOTIVATION FOR DISTANCE AND BLENDED LEARNING



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List of Abbreviations

Abbreviation	Definition
CBLE	Computer-based Learning Environment
CSCL	Computer Supported Collaborative Learning
GAT	Group Awareness Tool
HEI	Higher Educational Institution
ICT	Information and Communication Technology
LAD	Learning Analytics Dashboard
LMS	Learning Management System
MOOC	Massive Online Open Course
OER	Open Educational Resource
SG	Serious Game
SRL	Self-Regulated Learning
SSRL	Socially Shared Regulation of Learning
ZPD	Zone of Proximal Development

INTRODUCTION

Watercolor painting representing the link

between technology and creativity. Bing Image Creator

INTRODUCTION

With the shifts of the educational paradigm and the required skills for the twenty-first century, higher education students' learning environments have become more collaborative, diverse and technologically enhanced. Students are no longer passive receivers of knowledge in a classroom but active agents who can co-create knowledge and cultivate transversal competencies with diverse people. Students are also required to keep learning in a lifelong process to catch up with this rapidly changing world; this emphasises that educators need to teach their students about learning—how to learn and control its process—to become active lifelong learners (e.g., Finnish National Core Curriculum, 2016). In addition, the European Union strives to exploit the potential of the digital age in any area, and education is not an exception. The EU has identified digital competence as one of eight key competencies for lifelong learning, highlighting its importance for all stages of education, both formal and informal, and across all segments of the EU population (European Commission, 2020). Within this framework, digital competence is defined as follows:

> *The confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society (2006/962/EC).*

Educators **need to be equipped** with the necessary skills to take advantage of the potential of that digital technologies **to improve teaching and learning** and prepare their pupils for life in a digital society.

Besides these educational changes, the COVID-19 pandemic has accelerated the advancement of shifting learning environments into more online and blended modes all over the world. Since the pandemic, distance and hybrid teaching have permanently multiplied in higher education contexts. For example, consider the following:

> *Covid crisis demonstrated the importance of stepping up the readiness of digital solutions for teaching and learning in Europe and also pointed to where the weaknesses lie. However, teachers were not adequately prepared to use digital technologies in the classroom before the crisis (Education and Training Monitor, 2020).*

Meanwhile, the European Commission updated the Digital Competence Framework for Citizens (DigComp 2.2) with the aim of enhancing citizens' digital competencies to better navigate emerging technologies, including artificial intelligence (AI) and the Internet of Things (IoT), along with the new practices caused by the pandemic crisis. The revised version features various examples of relevant knowledge, skills and attitudes to the main competence areas, here with a focus on 'remote working' and 'digital accessibility'. The guidelines emphasise the need to update learning scenarios to equip individuals for their lives in the post-pandemic era, where emerging technologies and the 'new normal' are becoming increasingly prevalent.

This situation has led to academic educators, including professors, teachers and lecturers, to switch their teaching approaches to better support students in studying in a distant situation. Accordingly, students also need to adapt to new ways of learning—receiving teacher instructions remotely, studying using digital learning materials and submitting coursework in the relevant online platforms. Such technology-enhanced, distant learning has been widely adapted and is expected to continue even after the pandemic because people have become accustomed to digital tools and have benefited from remote working, shifting their work and lifestyles to be more hybrid than ever before. Despite people's increased competency in technology use compared with the past, pedagogical challenges remain in schools. Educators need to focus on students' attention and motivation, here by considering the socio-emotional aspects of teaching and learning while engaging them in distant learning. However, how can teachers support pupils' learning in digital environments that limit communication with pupils?

To answer this question, the TUNED project aims to improve the knowledge and skills of educators by applying pedagogical strategies from learning science, such as self-regulated learning and scaffolding. We intend to impact different levels of education: the first-level target is educators in higher educational institutions (HEIs), including professors, lecturers and teachers in initial teacher education (ITE). Training these educators will directly affect the second-level target: HE students and school teachers who take in-service training and lectures of ITE. Finally, the third-level target is students in the schools who will benefit from the new methods applied by teachers. In this way, we can trigger a domino effect that will improve training and teaching at every level of education. As our first step, this guidebook aims to help teachers, particularly in a higher education context, where online and blended learning methods are most commonly used, by providing theoretical and practical implications and frameworks to facilitate students' self-regulated learning in distant learning contexts. We hope this guidebook will provide readers with insights into effective scaffolding to enhance pupils' regulation skills and tips for exploiting the benefits of digital learning to create better online/blended learning experiences.

CHAPTER 1: SELF-REGULATED LEARNING

Azusa Nakata, Hanna Järvenoja

Ink portrait of a girl studying. Bing Image Creator

Executive Summary

Self-regulated learning (SRL) is a crucial skill for students in academic settings and in the modern working world. SRL involves learners actively monitoring, controlling and reflecting on their cognition, motivation, emotions and behaviour. It is an ongoing, iterative and dynamic cyclical process consisting of three phases: forethought, performance and self-reflection.

Self-regulated learners can take specific actions in each phase of SRL. For example, in the forethought phase, learners define the task, analyse its difficulty, set goals with strategic planning and stimulate their motivation. In the performance phase, they monitor their progress, control their cognition, motivation, emotions and behaviour, apply effective learning strategies and adapt them, if needed. In the reflection phase, they evaluate their learning experiences and outcomes, attribute success or failure and adapt their strategies for future goals.

Motivation plays a significant role in SRL because it influences goal setting, planning, task enactment and self-evaluation. Learners' beliefs about their abilities, the importance and value of the task and their emotional reactions to the task are essential motivational components. Different motivational variables play specific roles in each phase of the SRL cycle. For example, in the forethought phase, learners' beliefs about their abilities and the value they place on the task influence their goal setting and planning. In the performance phase, learners' motivation and emotions are crucial in coping with challenges and applying appropriate strategies. In the reflection phase, learners' self-perceptions and emotional reactions affect their evaluation and future goal setting. Learners can maintain their motivation by applying different motivation regulation strategies that are suitable for their personal preferences and the given contexts.

It is important to note that students need modelling and support to become self-regulated learners. Self-regulatory processes can be taught and practised with more capable persons, such as teachers, parents or even peers. Students can influence each other's regulatory processes (coregulation) and a group's collective processes (socially shared regulation) through social interactions. Enhancing students' self-regulated learning skills is particularly vital in online learning scenarios, in which learners may lack physical support from teachers and peers. By developing self-regulated learning skills, students can improve their learning outcomes, engagement, motivation and overall well-being.

Introduction of the chapter

You may have experiences of having students who stopped going to your course after a few months, even though they seemed to be very excited to learn new things in the beginning. Or doing their assignments for an exam desperately at the last minute, even if they have had plenty of time to prepare. You may have also seen students who seem to work hard but still do not learn that much. All these different scenarios can be related to SRL failure. In these scenarios, students may have difficulties in recognising and implementing proper learning strategies or may have challenges maintaining their motivation in the phase of challenges or competitive motives.

SRL skills have been found to be essential study skills for students in academic settings. Later on, SRL skills become the backbone of continuous learning, which is highly required in twenty-first-century working life (Zimmerman, 2002). It is a holistic, umbrella concept encompassing a considerable number of variables that influence learning (e.g., self-efficacy, cognitive strategies). The concept provides efficient strategies for learners to set goals, monitor and evaluate their performance and maintain their cognitive, motivational and emotional states while learning. Thus, SRL skills not only contribute to content learning, but they also participate in the learning and interaction processes, affording deeper-level learning through active, constructive and goal-directed participation. Teachers can facilitate not only students' self-regulation, but also their mutual peer-support (co-regulation) and group-level regulation (socially shared regulation of learning), even in distance education. By enhancing students' SRL skills, students can become more skilful in monitoring their learning process and controlling and maintaining their own cognition, motivation, emotions and behaviour, without a tutor's face-to-face support.

Although the importance of these skills is underlined, what exactly is SRL? In this chapter, we discuss the core idea of SRL, examining the different phases and targets of regulation. We also focus on the motivational elements that influence one's regulation of learning and strategies for maintaining them. Finally, we discuss the potential applications of SRL to facilitate groups of learners from collaborative learning perspectives.

What is Self-Regulated Learning and why is it important?

Definition of SRL

SRL is an ongoing process in which learners consciously monitor, guide and constrain according to their goals and the contextual features in the environment (Pintrich, 2000). As a result, SRL skills can help learners achieve better learning results (Pintrich, 2000; Zimmerman, 2002), be more engaged and motivated during challenging and complicated tasks (Boekaerts, 1996; Pintrich, 1999; Zimmerman, 2011) and have a greater extent of well-being because they experience less stress and fewer burnouts (Heikkilä et al., 2012). SRL is an ongoing, iterative and dynamic cyclical process. It includes different phases in which a learner sets goals with a strategic plan, monitors progress, adapts their strategies and reflects on their own learning process and outcomes (Pintrich, 2000; Zimmerman, 2000). A learner is an active, constructive agent in their learning process because they consciously monitor the context, attempt to change and make a decision and act on it (Pintrich, 2000; Pintrich & Zusho, 2002; Winne, 2015). In SRL processes, one's thoughts about one's own cognition—namely metacognition (Flavell, 1979)—play an important role because this supports optimising personal learning goals and standards, defining a discrepancy and challenge and regulating one's own behaviours (Efklides, 2011; Hadwin et al., 2017; Winne, 2015). Therefore, SRL skills differ across persons, depending on their metacognitive competencies, such as awareness and monitoring. Still, possessing these skills does not automatically lead to practising them. Instead, self-regulated learners must take an active role and responsibility for their own learning process every time they engage in learning and select the appropriate strategies to do so accurately. SRL is put into practice every time we engage in learning, and sometimes, we are more successful in it than others.

Several authors have studied SRL while also developing a model/theory of SRL (e.g., Boekaerts, 1997; Pintrich, 2000; Winne & Hadwin, 1998, 2008; Zimmerman, 1986, 1989, 2000). One of the most cited models of SRL is Zimmerman's cyclical model of SRL (see Zimmerman, 2000, 2008). The model is structured in three phases: **forethought**, **performance** and **self-reflection** (see Figure 1-1). The forethought phase consists of task analysis, goal setting, planning to reach these goals and a number of motivational beliefs that energise the process and influence the activation of learning strategies. In the performance phase, the students execute the task while monitoring their progress, using certain learning and motivation strategies. In the self-reflection phase, students reflect on how they have performed the task and attribute their success or failure. These attributions impact self-reactions, which, in turn,

impact how students approach future tasks. The self-regulatory processes in these different phases of the SRL cycle can be targeted not only at learners' cognitive processes, but also at the motivation and affective components of learning.

Figure 1-1. Cyclical process of SRL and different target areas. Referring to Hadwin et al. (2018), Pintritch (2000), Winne and Hadwin (1998) and Zimmerman (2002).

However, students do not become self-regulated by themselves: they need modelling and support to become self-regulated learners (Zimmerman, 2002). Furthermore, research shows that self-regulatory processes can be taught and practised and can lead to an increase in students' motivation and achievement (Schunk & Zimmerman, 1998). Bandura (1997) also acknowledged the social environment in which the development of SRL takes place and where meaningful interactions occur with more experienced partners. If the students have no support from a tutor and peers, they may easily get stuck or demotivated when encountering difficult situations both cognitively and emotionally. Especially in online learning situations where learners are not physically present, it is hard for teachers to support students in optimising the learning environment and maintaining their motivation. Enhancing students' self-regulated learning skills is vital in these learning scenarios.

Phases of regulation

As mentioned above, Zimmerman's cyclical model (see Zimmerman, 2000) includes three phases: **forethought, performance** and **self-reflection**. The forethought phase consists of task analysis, goal setting and strategic planning. In the performance phase, learners actively monitor their progress while doing a task. In the self-reflection phase, learners look back at their learning process and attribute their success or failure based on their experiences. In the SRL cycle, learners take their own effective strategies to regulate their cognition, motivation, emotion and behaviour. Let's look at the below example of two bachelor's students and compare how they experience their learning processes.

> Imagine that university students Matti and Anne have their final examination for a French course in two weeks. Their teacher advised them to review four units from the textbook, covering about 60 pages. Considering the two-week preparation time, the task was quite demanding and overwhelming.
>
> Matti found it difficult to determine where to start in the textbook because of its massive content. He wanted to do his best but did not envision specifically what score he wanted on the test. He did not come up with any good learning strategy, so he decided to start from page 1 and write down all the vocabulary five times in his notebook. He felt he was learning while writing vocabulary, but he did not think much. One week later, he realised that he had reviewed only the first unit out of four. He started getting stressed about the remaining units and eventually lost his motivation and confidence.
>
> On the other hand, Anne had a clear vision to aim for scores over 80 because she wanted to be selected as an exchange student in France. She clearly identified the areas she did not understand well, so she started reviewing those unclear elements first. Instead of writing vocabulary down in a notebook, she read them out loud and went through words repeatedly just before going to sleep. From her previous experience, she knew that this way worked best when memorising vocabulary. When studying, she also marked unclear things and asked teachers and peers for help because she believed that she could solve the problem the fastest doing so. She also kept in mind taking a break when she felt overwhelmed.

What differences did you see in their learning strategies? A good self-regulated learner like Anne can take, for example, the following actions in each phase of SRL:

Forethought phase

- Define the task and identify what should be done and what resources are needed (e.g., knowing which pages should be reviewed, what concepts remain unclear, etc.)
- Analyse the task difficulty and develop a feasible plan by consulting their prior knowledge, experiences and feelings (e.g. estimating how much time should be dedicated in completing a section, etc.)
- Understand the purpose of the task and stimulating their own motivation and interests towards it (e.g., connecting the learning task to their own surroundings, etc.)

Performance phase

- Monitor their learning process, assess whether they are on track as planned or struggling with some challenges (e.g., checking revision days until the examination day and identifying what sections are still not covered, etc.)
- Apply learning strategies that work best for them (e.g., marking vocabulary that they have not memorised, using different colour pens for different purposes, etc.)
- Control their cognition, motivation, emotion and behaviour by adapting their strategies (e.g., focusing only on essential elements within a limited time, changing their study place for better concentration, rewarding themselves after successfully completing a task, etc.)

Reflection phase

- Reflect on their learning experiences and outcomes after an examination (e.g., identifying what works and does not work, evaluating their learning satisfaction, etc.)
- Properly attribute the success or failure of the learning to their behaviour and context (e.g., not overreacting to the failure by blaming their lack of ability and effort but instead taking the situational difficulties into the results)
- Adapting the lessons learned to the next goal setting (e.g., remembering challenging times spent on memorising words, etc.)

It should be emphasised that these phases are not time ordered or in linear sequences in which learners go through each phase step by step. Instead, they are dynamically changing and ongoing (Pintrich, 2000). This means that learners are constantly monitoring, controlling and reflecting on their learning and changing their goals and strategies throughout the learning processes.

Targets for regulation: Cognition, motivation, emotions, and behaviour

As stated above, SRL is not a linear process from the forethought phase to final goal achievement. The learning process, instead, includes various opportunities for cognitive, motivational and socio-emotional challenges. There are various different theoretical models of SRL (cf. Panadero, 2017; Winne, 2015), yet they share fundamental concepts across the models – learners monitor, evaluate and change their cognitive and affective states (including motivation and emotion) and behaviour (e.g., Hadwin et al., 2017; Pintrich & Zusho, 2002;). Pintrich's model (2000) summarises the different targets of regulation from the viewpoints of cognition, motivation and affect, behaviours and context under each phase of the SRL cycle.

Learners' self-regulatory actions can aim to change or redirect their current cognitive actions; build, maintain or restore motivation in the situation or control; or reduce or strengthen their emotional state. In practice, it could be difficult to differentiate between the targets because they are intertwined and constantly changing. It is crucial, however, that learners can accurately direct their regulation to address the roots of the challenging situation (Winne & Hadwin, 2008).

For instance, in the **forethought phase,** when learners define the task, set leaning goals and plan ahead, they activate their prior knowledge and experience to understand the task and identify the distance between the current state and desired learning goals (cognition). They also influence their motivation towards the task by thinking about their interest in the subject and capabilities concerning the completion of the task, as well as their feelings about it (motivation and emotions). Depending on these standards, learners consider the time and effort needed and act on their plan to achieve their goals (behaviour and context). In the example, Anne knew what concepts were still unclear to her, so she started mapping them to make a feasible plan. Making a list of unclear concepts, dividing the section and allocating time or activating prior knowledge to understand the task are strategies to regulate the cognitive process to execute the task.

During the **performance phase** (monitoring and control phases in Pintrich's model), learners may seek help from friends when they feel overwhelmed by a task. Regulation is activated when learners find a gap between their current state and expected state through metacognitive monitoring of their learning process (Winne & Hadwin, 1998). Learners regulate their cognition, motivation and emotion to cope with the challenge and close a discrepancy. After receiving support, they may positively change their perceptions or feelings towards the task (motivation and emotion regulation) and apply another learning strategy based on the new knowledge given by their peers (cognition regulation). As a practical example, you may follow your to-do list and come across a delay and replan the study schedule according to the current status. Or if you feel bored while studying, you may change the learning environment or start different tasks to maintain your motivation. More examples of motivation regulation can be found in the next subchapter.

In the **reflection phase**, a learner evaluates and judges their learning performance, for example, how well they remembered new words based on their expectations (cognition) or how satisfied they are or how they feel about the task (motivation and emotion). They also evaluate their success or failure by taking into consideration the strategy they implemented, effort put or general ability to do the task (cognition). They sometimes attribute their failure to external factors such as a lack of time or teacher's ability (e.g., poor instructions) to protect their self-efficacy or motivation for future learning. Writing a learning diary is a good strategy to reflect on your own learning. For example, you can summarise what you have learned in the lesson or list up concepts that need more clarification. You can also note which strategy worked for a certain learning task.

Good self-regulated learners can control their cognitive, motivational and emotional states when they find a challenge during learning. They can accurately self-monitor in different target areas of regulation and can apply appropriate strategies based on knowledge about themselves, the task at hand and their past experiences (see metacognitive knowledge from Flavell, 1979).

Role of Motivation in SRL

Motivation as a fuel of learning

When learning stops, this most likely arises from learners' decreased motivation. When learners lose their will to learn, they can easily procrastinate and eventually stop learning. They can easily lose concentration and motivation to study when distracted by both internal and external disturbances, for example, notifications from social media or other temptations like YouTube videos, as well as unpleasant events that happened to themselves or their family and friends.

Therefore, although learning is regarded as a cognitive activity, motivation and emotion are critical factors in learning processes, having a significant impact on student engagement. When learner's (multiple) goals and situational demands clash and create conflicts, motivation and engagement are challenged, forcing individuals to exercise control over their emotions, their motivation and, sometimes, their social environment (Järvelä et al., 2021). If motivational (or emotional) challenges are not recognised and, hence, not addressed through regulation, they can handicap the cognitive processes in the current situation. Research has shown that higher education students often do not accurately solve motivational challenges, so there is a justified reason to pay particular attention to the motivational side of regulation (Koivuniemi et al., 2018).

In all, motivation plays a crucial role in the SRL cycle because learners' motivational factors influence their goal setting and planning, eventually affecting their task enactment and self-evaluation process (Efklides, 2011). One's perceptions and feelings towards the task differ by learner based on their motivational factors such as beliefs of their capabilities, curiosity towards the topic or values of the task. Pintrich and Zusho (2002, p. 87) summarised three general and essential components of learner motivation that influence one's regulatory process based on various models of motivation, as follows:

a) Beliefs about one's ability or skill to perform the task (**expectancy components**)
b) Beliefs about the importance and value of the task (**value components**)
c) Feelings about the self or emotional reactions to the task (**affective components**)

In the next section, we dive into these different motivational variables and how they influence a learner's regulatory phases.

Motivational variables playing different roles in each regulatory phase

Although motivation influences all of the phases of the SRL cycle, it could be helpful to understand what motivational variables may play a particularly important role in a certain phase of the cycle. Figure 1-2 illustrates the role of motivational elements in each phase of the SRL cycle.

Figure 1-2. Motivational variables influencing the SRL cycle.

In the **forethought phase**, when the students are still considering their commitment and setting their personal goals for the course or task, influential motivational constructs can be seen. One of the most important elements in this phase is one's belief in one's capabilities to execute a task, or 'self-efficacy', which was proposed by psychologist Albert Bandura (1977, 1982). He hypothesised that 'expectations of personal efficacy determine whether coping behaviour will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences' (Bandura, 1977, p. 191). In other words, learners may limit their effort and actions towards the task when they feel less confident to perform well, and accordingly, set lower learning goals and avoid challenging situations without trying to solve them. Another important motivational construct at the

beginning of learning is expectancy-value theory (e.g., Wigfield, 1994; Wigfield & Eccles, 2000); this theory addresses with a student's motivation towards a certain behaviour from two perspectives: how much a student expects success when doing the task and how personally valuable the task is when considering the potential effort (cost) that would be required. A student can see the task as having different types of values, but the main question is what the value–cost balance is. To sum up, motivational beliefs that consider one's own efficacy judgements and values and costs, as well as personal interest and motivational goal orientation, play a meaningful role in decision making at the forethought phase.

> In the example case, Matti perceived the task as difficult because of the massive amount of content. He was not clear about how he should have studied. He was taking a French course just because it was mandatory for graduation, so he did not have a specific purpose of getting higher scores from the exam. Therefore, he did not see the value of putting a lot of effort into this subject because he had other exams.
>
> On the other hand, Anne dreamed of doing a study exchange in France, so the final exam was very important for her. She valued the task for her personal life and was willing to put effort into learning. She also had a clear goal for the exam (to get scores over 80). She was also interested in the topic, so she enjoyed the study process, even though it was a little bit challenging for her.

In the **performance phase,** it becomes essential to maintain the established motivation. This is not, unfortunately, a straightforward process. We all know, for example, that it is not the same thing for a student to initially commit to a thesis project as it is to actually finish it. In between these two phases, the beginning and the end, the student is faced with a lot of situationally emerging competing motives, such as whether to write the thesis or go to the movies with friends. If (and when) motivational obstacles are faced, students can activate different motivation regulation strategies to restore and redirect their focus. Regulation of motivation and affect include attempts to regulate the various motivational beliefs that have been discussed in the achievement motivation literature (see Pintrich & Schunk, 1996; Wolters, 1998), such as *goal orientation* (purposes for doing task), *self-efficacy* (judgements of competence to perform a task), *task value beliefs* (beliefs about the importance, utility and relevance of the task) and *personal interest* in the task (liking the content area or domain). We introduce some practical strategies for maintaining motivation in the last section of this subchapter.

Let's look at the example case again. One week after they started preparing for the exam, Matti felt stressed about his progress, facing a challenge because he may not be able to review all the sections. He tried to release his stress and decided not to study over the weekend. He hung out with his friends and watched a movie series for a whole night. After refreshing himself, he felt upset with the remaining time and started regretting his decision. This negative emotion kept him away from the task. In this case, he attempted to regulate his motivation, but his strategy did not work as expected.

At the same time, Anne also felt a little bit tired halfway through. She reflected on her progress during the first week. She reviewed and clarified unclear things and roughly memorised the most important vocabulary items, but did not go through a workbook that had exercises corresponding to each section. She decided to dedicate Saturday to finishing the first two chapters in the morning and the last two in the evening. She also decided to have a day off on Sunday and go to her favourite cafe for pancakes as a reward for her intensive study on Saturday. She refreshed herself with the feeling of achievement and moved on to the final review phase the following week.

Finally, motivation is also present in the **self-reflection phase**. In this phase, the motivational appraisals that are made of, for example, one's own self-efficacy become frontline and often include affective reactions. It is natural to feel proud and happy when succeeding and, vice versa, to feel sad, frustrated or disappointed when facing failures. Attribution theory (e.g., Kelley, 1967; Weiner, 1986), which focuses on how people explain the causes of their (or others') behaviours, is an important motivational construct in the reflection phase. In academic situations, students often try to find causal explanations for their success or failure. For example, when students could not get satisfactory results from their performance, some students may think it was because of the teacher's poor instructions or too short a preparation period, while others think it was because of a lack of abilities or effort. Good self-regulators can attribute the consequences in a constructive way; for example, they may consider time allocation or strategy use was not appropriate, instead of feeling they have a lack of competencies.

When the exam ended, Matti and Anne had very different feelings towards the results and their experiences. Matti was not satisfied with the scores he received, but also understood his preparation was not enough. He thought he could get better results if he had more time, so he did not really connect the unsatisfied results to his personal ability. However, he has learned how important time management and strategic planning are. He also reflected on and noticed that taking a break for both weekends

did not work well for him because he lost his motivation after two days of skipping and felt more pressured because of the limited time. He determined that he would consider the lessons learned in the future.

Anne was very happy after achieving the scores she wanted. She was satisfied with her strategic study processes because she managed to control her behaviours and maintain her motivation until the end. One thing she was not happy about was vocabulary spelling. She could remember as many words as possible with her strategy (reading aloud and going through repeatedly), but she did not remember spellings well without writing them down. She determined next time she would test the spelling of the word and write it down if she still could not remember. However, she could say she did her best and that this experience made her more confident in studying.

Maintaining your motivation while learning

As the above section explained, a learner needs to particularly regulate their motivation in the performance phase to keep moving forward. Christopher Wolters (2003) has categorised different motivation regulation strategies that learners can activate when their motivation needs to be strengthened. These strategies are pretty simple, and each of us can modify them to fit our own situation, challenges and personal preferences. As we know from our own experiences, it is not always easy to regulate our own motivation. Online and blended learning settings can especially be challenging when the responsibility lies heavily on a student, and tutor and peer support can be very limited. Hence, we encourage teachers to gain knowledge of the different strategies to control and maintain motivations and support students' motivation regulation to keep learning. We introduce eight regulation strategies of motivation (Wolters, 2003): *self-consequating*, *goal-oriented self-talk*, *interest enhancement*, *environmental structuring*, *self-handicapping*, *attribution control*, *efficacy management* and *emotion regulation*.

Self-consequating, also called self-reinforcement, is a technique in which individuals self-control their motivation during learning by setting a consequence to their action. This can mean that students reinforce their behaviour by promising themselves 'rewards' that can be received after they achieve a particular learning goal. For example, after reading two pages of the textbook, you eat one piece of chocolate. By structuring small actionable steps and rewards, learners can drive their motivation to feel the happy moment after their effort and enjoy the process, much like a game. Conversely, learners can also set a punishment for their failure of planned learning actions, such as stopping net surfing for the next three hours.

Goal-oriented self-talk is a technique that students can use to make salient and emphasise the reasons they have for persisting or completing a task. These reasons can be related to the desire for deeper understanding, as well as performance, achievements or other meaningful goals that motivate students (see achievement goal theories). Accordingly, goal-oriented self-talk is rooted in learners' desires to achieve goals. For example, if you are learning English because you want to live in a foreign country, imagine yourself speaking fluent English and working in a foreign company, and then convince yourself why you should do the task; you can then learn by keeping the dream in mind. Athletes also use this strategy for continuous growth. They have a clear vision and goal for the near future and make concrete steps towards it by convincing themselves to keep up with their training.

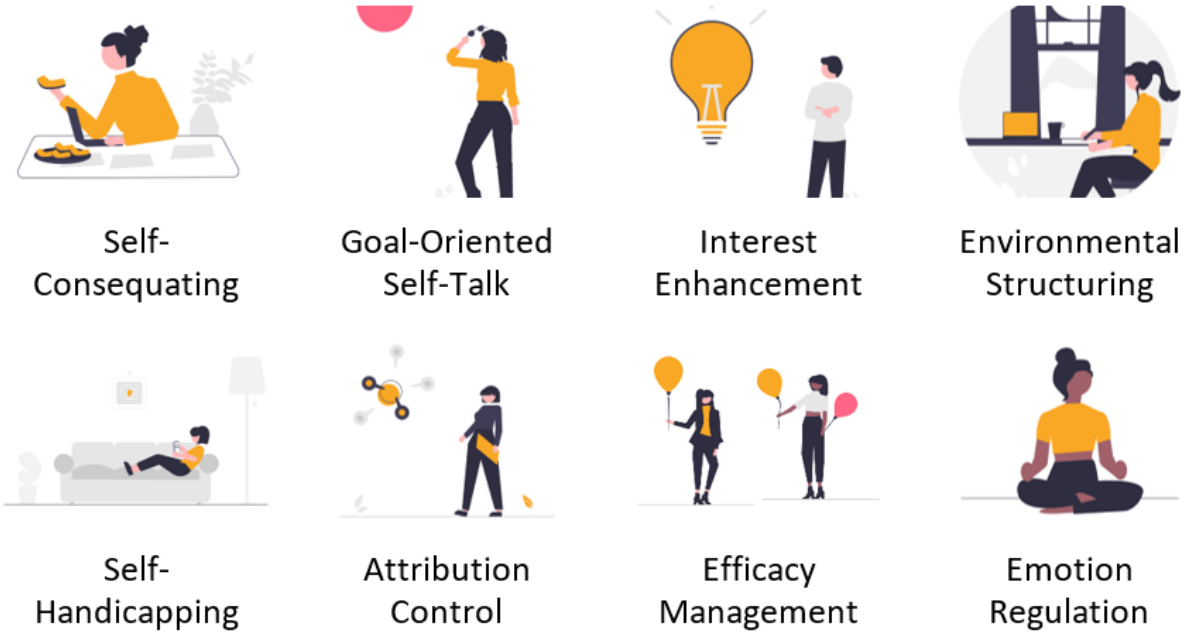


Figure 1-3. Images from: https://undraw.co/ Copyright 2022 Katerina Limpitsouni

Interest enhancement is an action in which students try to stimulate their curiosity about the topic and increase enjoyment to complete the task. By engaging in interest enhancement, students aim to either increase their intrinsic interest in the topic or their situational interest in the task. This strategy can be activated, for example, when the task feels boring, monotonous or too easy. For example, when students are required to write each English vocabulary five times, they can try to increase the task demands by making it more difficult, such as adding pronunciation symbols or other related family words.

Environmental structuring could be a prompt and powerful reinforcement of learning motivation. The main concept of this strategy is shutting down access to potential tempting or disturbing things. A simple example could be using a library to concentrate on studying or going to a cafe to force oneself to study by being surrounded by people. If you are studying at home, hiding a mobile phone in another room is also an effective environmental structuring.

Self-handicapping is a different type of motivation regulation technique because it does not actually serve the purpose of learning and achievement. Although the above-mentioned environmental structuring removes any obstacles to make the best study condition, self-handicapping is an attempt to make the situation more difficult, for example, by procrastinating the task and pressuring on them for the last minute work. By making obstacles themselves, students can attribute their poor performance to poor conditions (not their ability) and are able to protect their self-efficacy. On the other hand, it also works positively for some learners by increasing their concentration for the task by using urgency (e.g., a student gets motivated to study for the exam at a last minute under an urgent circumstance). However, it cannot be considered a constructive motivation regulation strategy from an SRL viewpoint.

Attribution control is purposefully selecting the reason for the student's own behaviours (causal attribution) to maintain their self-efficacy and motivation for future tasks. For example, students may intentionally attribute their poor learning performance to the surrounding environment (e.g., they could not concentrate because of noise from ongoing construction) or other external factors (e.g., teachers' instruction was not clear) to avoid blaming their own abilities.

Efficacy management allows students to keep their learning motivation and avoid getting overwhelmed because of a lack of ability to do the task. Wolters (2003) suggested three substrategies to protect self-efficacy. The first is lowering the aim or breaking the large task into small chanks or simpler segments to make it reachable and manageable (proximal goal setting). The second one is related to students' negative thinking towards the task, such as highlighting their unpreparedness (Defensive pessimism; Norem & Cantor, 1986). Wolters (2003) said such anxiety may work positively because students put more effort into studying when feeling pressured; however, this strategy may negatively impact students' learning outcomes in the long term (Cantor & Norem, 1989). The last strategy is verbalising or thinking positive phrases such as 'I can do it!' or 'I am doing well, just keep going' (efficacy self-talk). By believing in their own self, students can enhance their confidence in the task.

Emotion regulation helps students maintain their learning motivation and cognitive processes. When students feel anxious about the upcoming exam, they may try to relax themselves by having a long, deep breath or by sifting their attention to something else. One of the most famous emotion regulation strategies can be found in Gross's study (2002). There are five phases in which people attempt to cope with emotional events: situation selection, situation modification, attentional deployment, cognitive change and response modulation. By regulating their emotions, students can keep learning even in difficult situations.

Regulation of learning in collaborative learning

Collaborative learning

Nowadays, the classroom setting has become more active and collaborative. The term 'collaborative learning' has often been mentioned in educational fields and its positive (also negative) aspects have been more widely studied than ever. Collaborative learning is a situation in which multiple learners participate in a joint learning activity to expand their existing knowledge together and achieve a common learning goal (Dillenbourg, 1999; Janssen et al., 2012). Learners build a common understanding of the topic and create new knowledge by exchanging their own ideas and negotiating within a team (Beers et al., 2005). By sharing processes of reasoning and negotiation, learners become aware of the gap between their own and others' thinking and understanding, which supports new knowledge building and deeper understanding, leading to the learners' cognitive growth (Doise & Mugny, 1984; Teasley, 1997).

Not only cognitive aspects, but also social aspects, are highlighted in collaborative learning. Students are often required to work in a group to study a certain topic and create a learning artefact, such as a final presentation or essay together. Besides creating new knowledge together, students should learn how to collaborate with other peers to make a consensus and carry out the study project collectively through the learning processes. Thus, the collaborative learning method requires students to take initiative in their own learning to contribute to a group learning process, which contrasts with conventional teaching in which a massive amount of knowledge is transmitted from a teacher to students. Each student is responsible for engaging in learning activities, regulating their cognitive, motivational and emotional states to execute a collaborative task together with group members.

Co-regulation and Socially-shared regulation of learning

Although SRL is an individual, invisible, psychological process, one's regulation can be shared with others by influencing a peer's regulation processes (co-regulation) or a group's collective regulation (socially shared regulation; see Hadwin & Oshige, 2011). In the literature, co-regulation is referred to as 'a transitional process in a learner's acquisition of self-regulated learning, within which learners and others share a common problem-solving plane, and SRL is gradually appropriated by the individual learner through interactions' (Hadwin & Oshige, 2011, p. 247). Usually, it involves a more capable person such as a tutor, peer or family member who assists in one's regulation, for example, by explaining the task and checking the deadline of the assignment. Socially shared regulation (SSRL) is defined as 'the processes by which multiple others regulate their collective activity' (Hadwin & Oshige, 2011, p. 253).

In this mode, individual students participating in a collaborative task are responsible for engaging their learning and bringing their own regulation into a group learning situation. Therefore, learning goals and standards are cocreated by the members as a group's decision. The students strategically plan their group learning processes and collectively regulate their performance. Hadwin et al. (2017) stated, 'What distinguishes socially shared regulation from co-regulation is the extent to which joint regulation emerges through a series of transactive exchanges amongst group members' (p. 86); this emphasises that students' interactions are the key factor to enable collective regulation of learning among collaborating students.

In blended/online group learning, or what is called computer supported collaborative learning (CSCL), learners' interactions are limited because of a lack of social affordances in the digital environment (Kreijns et al., 2002). Learners' interactions include both teacher–student and peer interactions. Regardless of solo or group learning, the digital environment limits teachers from approaching their pupils to support them and students from seeking help and encouraging each other. Thus, there is a risk of feeling abandoned or isolated without getting any support, which quickly harms students' learning motivation.

References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. https://doi.org/10.1037/0033-295x.84.2.191

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American psychologist*, *37*(2), 122–147. https://doi.org/10.1037/0003-066X.37.2.122

Boekaerts, M. (1996). Self-regulated learning at the junction of cognition and motivation. *European psychologist*, *1*(2), 100–112. https://doi.org/10.1027/1016-9040.1.2.100

Boekaerts, M. (1997). Self-regulated learning: A new concept embraced by researchers, policy makers, educators, teachers, and students. *Learning and Instruction*, *7*(2), 11–186. http://dx.doi.org/10.1016/S0959-4752(96)00015-1

Cantor, N., & Norem, J. K. (1989). Defensive pessimism and stress and coping. *Social cognition*, *7*(2), 92–112. https://doi.org/10.1521/soco.1989.7.2.92

Dillenbourg, P. (1999). What do you mean by collaborative learning? In P. Dillenbourg (Ed.), *Collaborative-learning: Cognitive and computational approaches* (pp. 1–19). Oxford: Elsevier.

Doise, W., & Mugny, W. (1984). *The social development of the intellect.* Pergamon Press. https://doi.org/10.1016/C2009-0-11024-3

Efklides, A. (2011). Interactions of Metacognition With Motivation and Affect in Self-Regulated Learning: The MASRL Model. *Educational Psychologist*, *46*(1), 6–25. https://doi.org/10.1080/00461520.2011.538645

Finnish National Board of Education. (n.d.). National core curriculum for basic education. https://www.oph.fi/en/education-and-qualifications/national-core-curriculum-basic-education

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive developmental inquiry. *American Psychologist*, *34*(10), 906–911.

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, *39*(3), 281–291. https://doi.org/10.1017/S0048577201393198

Hadwin, A., & Oshige, M. (2011). Self-Regulation, Coregulation, and Socially Shared Regulation: Exploring Perspectives of Social in Self-Regulated Learning Theory. *Teachers College Record*, *113*(2), 240–265. https://doi.org/10.1177/016146811111300204

Hadwin, A., Järvelä, S., & Miller, M. (2017). Self-regulation, co-regulation, and shared regulation in collaborative learning environments. In *Handbook of self-regulation of learning and performance* (pp. 83-106). Routledge.

Hadwin, A., Järvelä, S., & Miller, M. (2018). Self-regulation, co-regulation, and shared regulation in collaborative learning environments. In D. H. Schunk & J. A. Greene (Eds.), *Handbook of self-regulation of learning and performance* (pp. 83–106). Routledge/Taylor & Francis Group. https://doi.org/10.4324/9781315697048-6

Heikkilä, A., Lonka, K., Nieminen, J., & Niemivirta, M. (2012). Relations between teacher students' approaches to learning, cognitive and attributional strategies, well-being, and study success. *Higher Education, 64*, 455–471. https://doi.org/10.1007/s10734-012-9504-9

Janssen, J., Erkens, G., Kirschner, P. A., & Kanselaar, G. (2012). Task-related and social regulation during online collaborative learning. *Metacognition and Learning, 7*(1), 25–43. https://doi.org/10.1007/s11409-010-9061-5

Järvelä, S., Järvenoja, H., & Muukkonen, H. (2021). Motivation in collaborative inquiry environments. In *International handbook of inquiry and learning* (pp. 157–173). Routledge.

Kelley, H. H. (1967). Attribution theory in social psychology. *Nebraska Symposium on Motivation, 15*, 192–238.

Koivuniemi, M., Järvenoja, H., & Järvelä, S. (2018). Teacher education students' strategic activities in challenging collaborative learning situations. *Learning, culture and social interaction, 19*, 109–123. https://doi.org/10.1016/j.lcsi.2018.05.002

Kreijins, K., Kirschner, P. A., & Jochems, W. (2002). The Sociability of Computer-Supported Collaborative Learning Environments. *Journal of Educational Technology & Society, 5*(1), 8–22. https://www.jstor.org/stable/jeductechsoci.5.1.8

Norem, J., & Cantor, N. (1986). Defensive pessimism: Harnessing anxiety as motivation. *Journal of Personality and Social Psychology, 51*, 1208–1217.

Panadero, E. (2017). A Review of Self-regulated Learning: Six Models and Four Directions for Research. *Frontiers in Psychology, 8*, 422. https://doi.org/10.3389/fpsyg.2017.00422

Pintrich, P. R., & Schunk, D. H. (1996). *Motivation in education: Theory, research, and applications*. Ohio: Merrill.

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International journal of educational research, 31*(6), 459–470. https://doi.org/10.1016/S0883-0355(99)00015-4

Pintrich, P. R., & Zusho, A. (2002). Student motivation and self-regulated learning in the college classroom. In J. C. Smart & W. G. Tierney (Eds.), *Higher Education: Handbook of Theory and Research:* (Vol. 17). New York: Agathon Press.

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 452–502). Academic: Elsevier https://doi.org/10.1016/B978-012109890-2/50043-3

Schunk, D. H., & Zimmerman, B. J. (Eds.). (1998). *Self-regulated learning: From teaching to self-reflective practice.* Guilford Press.

Teasley, S. D. (1997). Talking about reasoning: How important is the peer in peer collaboration? In L. B. Resnick, R. Säljö, C. Pontecorvo, & B. Burge (Eds.), *Discourse, tools and reasoning* (pp. 361–384). https://doi.org/10.1007/978-3-662-03362-3_16

Weiner, B. (1986). *An attributional theory of motivation and emotion.* New York: SpringerVerlag.

Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A development perspective. *Educational Psychologist, 6*(1), 49–78.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-Value Theory of Achievement Motivation. *Contemporary Educational Psychology, 25*(1), 68–81. https://doi.org/10.1006/ceps.1999.1015

Winne, P. H. (2015). Self-regulated learning. In. J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences, Vol. 21* (2nd ed., pp. 535– 540). Amsterdam: Elsevier. https://doi.org/10.1016/B978-0-08-097086-8.25091-5

Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Metacognition in educational theory and practice* (pp. 277–304). Mahwah: Erlbaum.

Winne, P. H., & Hadwin, A. (2008). The weave of motivation and self-regulated learning. In D. H. Schunk, & B. J.Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research and applications* (pp. 297–314). Erlbaum.

Wolters, C. A. (1998). Self-regulated learning and college students' regulation of motivation. *Journal of educational psychology, 90*(2), 224–235. https://doi.org/10.1037/0022-0663.90.2.224

Wolters, C. A. (2003). Regulation of Motivation: Evaluating an Underemphasized Aspect of Self-Regulated Learning. *Educational Psychologist, 38*(4), 189–205. https://doi.org/10.1207/S15326985EP3804_1

Zimmerman, B. J. (1986). Development of self-regulated learning: Which are the key subprocesses? *Contemporary Educational Psychology, 16*, 307–313. http://dx.doi.org/10.1016/0361-476X(86)90027-5

Zimmerman, B. J. (1989). Models of self-regulated learning and academic achievement. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theory, research, and practice* (pp. 1–25). New York: Springer.

Zimmerman, B. J. (2000). Attaining Self-Regulation. In Handbook of Self-Regulation (pp. 13–39). Elsevier. https://doi.org/10.1016/B978-012109890-2/50031-7

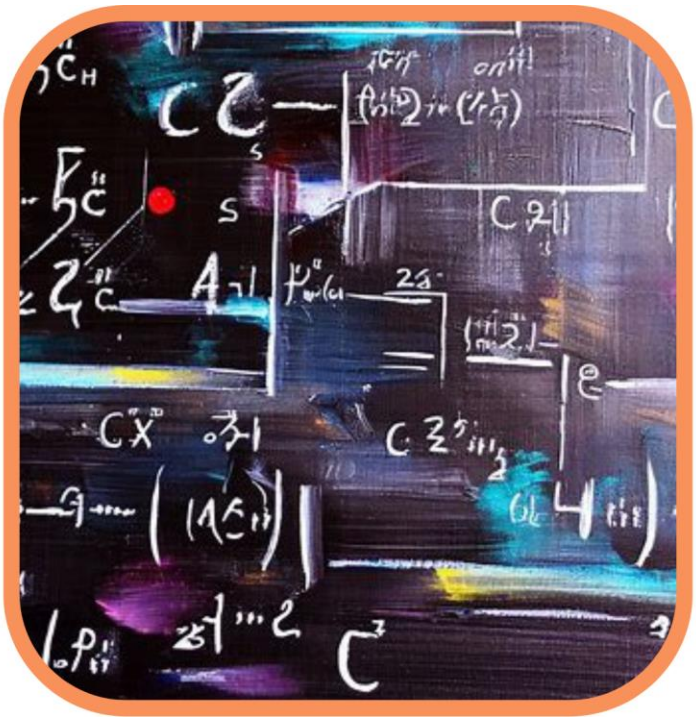
Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into practice, 41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2

Zimmerman, B. J. (2008). Investigating Self-Regulation and Motivation: Historical Background, Methodological Developments, and Future Prospects. *American Educational Research Journal, 45*(1), 166–183. https://doi.org/10.3102/0002831207312909

Zimmerman, B. J. (2011). Motivational sources and outcomes of self-regulated learning and performance: Graduate center of city university of New York. In *Handbook of self-regulation of learning and performance* (pp. 63–78). Routledge.

CHAPTER 2: SCAFFOLDING SELF-REGULATED LEARNING

Marina Constantinou, Eleni Kyza, Raffaele Di Fuccio



Painting of a blackboard full of formulas and scribbles. Bing Image Creator

Executive Summary

This chapter discusses the concept of scaffolding SRL and its theoretical foundations. SRL refers to learners actively monitoring and managing their own cognitive, motivational and emotional processes to achieve their learning goals. Scaffolding, on the other hand, involves providing support or guidance to learners as they work towards their goals, hence gradually increasing their autonomy. The research suggests that scaffolding SRL can be effective in improving students' motivation and achievement.

Working in this context, this chapter explores the theoretical foundations of scaffolding SRL, including Vygotsky's sociocultural theory, which emphasises the role of social interactions and the Zone of Proximal Development (ZPD) in learning. Scaffolding SRL encourages learners to engage in dialogue, collaborate with others and seek guidance and feedback. It also incorporates elements from Social Cognitive Theory, highlighting the importance of self-efficacy and gradually increasing self-regulation.

Metacognitive thinking is closely related to scaffolding SRL because it involves reflecting on one's own thinking and regulating learning strategies. Learners can set goals, break down complex tasks and evaluate their progress to enhance their metacognitive skills. Additionally, the chapter discusses the concept of self-scaffolding, in which learners actively evaluate their own learning process and draw on their prior experiences and knowledge to move forward.

The role of motivation and affect in scaffolding SRL is also addressed. Scaffolding strategies can influence student motivation, regulate emotions and promote persistence in the face of challenges. Several research studies have highlighted the positive effects of scaffolding on student motivation and engagement.

Different types of scaffolding SRL are described, including cognitive apprenticeship, metacognitive prompts, goal setting, self-reflection and collaborative work. These approaches provide learners with support and guidance, gradually reducing scaffolding to promote autonomy and independent learning.

Finally, the chapter emphasises the role of assessment in scaffolding SRL. Assessment can provide feedback on learners' progress and help them identify areas for improvement. Engaging and reflective prompts, combined with additional scaffolding, can enhance learners' awareness of their own thinking and learning strategies.

Introduction of the chapter

As discussed in Chapter 1, SRL is a critical component for learners' academic achievements as they progressively take ownership of their learning (Russell et al., 2020). Although SRL is a process through which a learner purposefully monitors their motivational, emotional and cognitive processes to achieve their learning goals, its effectiveness depends on the development of relevant skills and methods that may fail to develop alone (Duffy & Azevedo, 2015; Moos, 2009; Zimmerman & Schunk, 2011). Scaffolding SRL can be particularly useful in these cases (Azevedo & Hadwin, 2005). Students do not become self-regulated by themselves; instead, they need modelling and support to become self-regulated learners (Zimmerman, 2002). Furthermore, research shows that self-regulatory processes can be taught and practised, are teachable and can lead to increases in students' motivation and achievement (Schunk & Zimmerman, 1998).

Scaffolding refers to providing support or guidance to learners by an instructor, an agent or a tool as they work towards achieving a goal, such as that of regulating cognitive processes, or merely remaining motivated in doing so (Azevedo & Hadwin, 2005; Duffy & Azevedo, 2015). Scaffolding can be provided in several forms in the context of SRL, such as offering feedback, prompting and modelling, with the goal to progressively help the learner increase their autonomy (Quigley et al., 2018), as part of the goal to assist learners in developing the necessary skills and attitudes required to engage in effective SRL. Scaffolding SRL is significant because it holds the potential to improve performance and promote lifelong learning (Perisco & Steffens, 2017). This scaffolding can support students to become more adaptable to changes, better manage their time and set attainable objectives, all of which are variables that can also foster affective-related behaviours, such as engagement and motivation (Williamson, 2015).

This chapter provides a brief literature review on scaffolding SRL (and SSRL; see also Chapter 1), including its theoretical foundations and empirical evidence on effectiveness and challenges in both online and offline learning environments for teachers and students. Additionally, the role of scaffolding one's self-assessment to support SRL will be discussed. The integration of these two instructional-support ideas (scaffolding and SRL) can contribute to creating of powerful learning environments (Azevedo & Hadwin, 2005) that bear promise for nurturing students' successful and independent learning.

Theoretical foundations of scaffolded self-regulated learning

In this section, the learning theories that underpin scaffolding SRL will be explored. The concept of scaffolding is central to Vygotsky's sociocultural theory of cognitive development (1978). Here, scaffolding is the assistance provided by a more knowledgeable person to assist a student in completing a task or solving a problem that would be too difficult for them to achieve alone. Vygotsky (1978) argued that social interactions assist learning and growth and that scaffolding is an efficient technique to facilitate this process. As the learner gains proficiency, the scaffolding provided by a teacher, parent or more skilled peer gradually fades until the learner can complete the task alone. Thus, scaffolding is a crucial technique for encouraging cognitive development and independent learning.

Vygotsky (1978) emphasised the relevance of social interactions as a means for actively participating in developing knowledge through constructing knowledge with others. According to social constructivism, learning is a dynamic and collaborative process in which learners engage in discussions and negotiate meanings with others (Bretz et al., 2013). Vygotsky introduced the idea of the ZPD to refer to the gap between what a learner can achieve independently and what they can achieve with support. The ZPD highlights the significance of providing learners with support and guidance to enable them to progress beyond their current level of independence. Similarly, scaffolding SRL efforts have learners actively participating in their own learning to facilitate their development as self-regulated learners. Scaffolding SRL encourages learners to engage in dialogue to collaborate and seek out opportunities for learning within that social micro-environment (Schunk, 2012). This is consistent with the social constructivist perspective of learning because collaborating with others allows learners to receive guidance and feedback, as well as learn from the experiences of others. The ZPD is also pertinent to scaffolding SRL because it emphasises the need to give appropriate scaffolding so that learners can work within their ZPD and enhance their SRL skills with the objective of progressively decreasing the level of external scaffolding required.

Scaffolding self-regulated learning provides structured support to learners as they progressively develop their self-regulation skills, something that will, in turn, allow them to build their independence, autonomy and motivation towards directing their own learning (Russell et al., 2020). When learners are provided with scaffolding, they can focus on the cognitive processing required for learning and problem-solving. For instance, when learners are given structured guidance, clear learning objectives and feedback, they can concentrate on processing relevant information, optimising their cognitive effort and work on better understanding how to regulate their own learning without being distracted by extraneous

and intrinsic cognitive load as a result of their attempt to navigate their learning alone (Agustian & Seery, 2017).

The construct of scaffolding also employs elements from Social Cognitive Theory (Bandura, 1977; Leonard, 2002) that emphasise the relevance of the social environment and its interplay with cognitive and behavioural factors. Humans learn through observation, imitation and modelling of behaviours they encounter in their social surroundings, and they employ attention, motivation and self-efficacy to manage their own behaviour (Bandura, 1986). This theory is closely aligned with the notion of scaffolding SRL because the importance of active participation in learning is highlighted, as well as with the use of scaffolded support to help learners become self-regulated through cognitive and social interactions (Zimmerman, 2000).

Another way in which Social Cognitive Theory relates to scaffolding SRL is through the concept of self-efficacy and one's belief in one's competence to successfully execute a task, which is an important aspect in self-regulation (Bandura, 1986; Quigley et al., 2018). Instructors can scaffold learners to develop self-efficacy by allowing them to practice and seek feedback on their self-regulated learning practices. In Social Cognitive Theory learners use cognitive processes such as attention and self-regulation to manage their own behaviours (Bandura, 1986). In scaffolding SRL, learners can be supported to attend to aspects of their work to stay focused, motivated to remain engaged in the learning process and eventually monitor their own learning process and outcomes. Instructors can support the development of self-regulated learners by examining the factors that influence the learner to act within a social setting (Leonard, 2002).

Metacognitive thinking

Metacognition is the outcome of reflecting on one's own thinking (Flavell, 1979) and is regarded as a key component of effective learning (Efklides, 2006). Metacognition is closely related to scaffolding SRL because evaluating one's progress, identifying areas of development and adjusting strategies to accomplish set objectives are key components of SRL. In one of the initial steps of scaffolding SRL, the instructor can assist learners in setting their own goals, which is a metacognitive method that involves the creation of SMART goals (specific, measurable, attainable, relevant and time bound; Day & Tosey, 2011). By tracking their progress, learners can identify areas in which they may need additional support. Another way in which metacognitive thinking can support SRL is by helping learners understand how to plan their learning by breaking down complex tasks into manageable and smaller sections, something that helps in time organisation and management (Quintana et al.,

2004; Wolters & Brady, 2020). Finally, evaluation is an important metacognitive tool that supports SRL because self-reflection allows the learner to identify in which way and how they need further support so that they can eventually adjust their approach accordingly (Quigley et al., 2018).

Self-scaffolding

Even though the term 'scaffolding' was originally associated with Vygotsky's sociocultural theory, which emphasises the role of social interaction in learning, it has been claimed that scaffolding can also be applied to individual learners who can engage in self-scaffolding via metacognitive processes in the form of internalised scaffolding. Even though the learner is mainly involved in the process, the learner still relies on their social background because they draw on prior experiences and knowledge and may seek feedback from others to support that learning. As part of a metacognitive process, the notion of self-scaffolding emphasises the importance of learners actively participating in their learning and supporting the process of their own cognitive development by actively constructing knowledge (Bickhard, 2005; Dawson, 2008). Learners who have been supported to adopt metacognitive skills through scaffolding can become better future learners (Dawson, 2008) and, as a result, self-scaffold learning in new contexts (Bickhard, 2005). As independent learners, there is minimal need for external support, but seeking advice can be regarded as a form of self-scaffolding as the learner is aware of cognitive gaps that need to be addressed (Bosanquet et al., 2015).

The role of motivation and affect in scaffolding SRL

Self-regulated learning not only addresses cognitive strategies, but it also involves emotional and motivational factors. Regarding the affective value of scaffolding in self-regulated learning, techniques have been utilised to influence student motivation, which can help learners better regulate their emotions, set realistic goals and persist in the face of challenges (Devolder et al., 2011). As a result, the affective value of learning can be seen as an important element in scaffolding SRL.

Alexiou and Paraskeva (2019) explored motivation on the usage of an e-portfolio system in higher education and how it may help students manage their academic learning paths and develop SRL processes. According to the study, implementing the e-portfolio system, as a dynamic social networking tool, enhanced learning. It assisted students in developing their SRL processes, which resulted in a much higher level of motivation and learning techniques

in the experimental group. The findings indicate that a structured learning environment with clear goals and balanced workload influences motivation, SRL and, in turn, academic success. Similarly, Lawrie et al. (2016) indicated that offering students online modules comprising elements such as scaffolding, visual representations and feedback was shown to motivate students to engage in self-controlled inquiry.

Duffy and Azevedo (2015) further discussed that an agent's prompts and comments encouraged learning behaviours, including greater usage of SRL strategies and time examining relevant content throughout a learning session. Their findings indicate that the effectiveness of instructional cues and feedback is significantly influenced by motivation, particularly the drive towards achieving goals. For example, scaffolding effectively worked for performance-oriented learners whose learning was driven by motivation to outperform others or gain favourable judgement. In contrast, mastery-oriented learners whose learning was driven by motivation for their personal growth did not benefit much from scaffolding.[1] The study's results suggested that the learners' dominant accomplishment objective influenced how they interacted with the scaffolds they received. Unlike performance-oriented learners, who may respond positively to cues that help them adapt their learning efforts and outperform their peers, mastery-oriented learners may perceive scaffolding as invasive and controlling. According to Ion et al. (2017), the usefulness of feedback in fostering self-evaluation and self-regulation of learning, though respected by both students and educators, emphasises the importance of understanding its function in learning. Most feedback focuses on feedforward, offering recommendations for the future, suggesting tasks and enhancing capabilities. Nonetheless, students respond the best to praise that highlights their talents. Peer feedback is seen as another useful method for promoting motivation and for ensuring that students feel supported. Their study emphasises the need to give students more control over providing feedback, encouraging a more dialogic approach and greater participation in the process.

[1] For further information about mastery-oriented and performance-oriented learners, please see the work of Dweck (1990, 2006).

Types of scaffolding SRL

Scaffolding SRL can be seen as consisting of several key steps (Quigley et al., 2018), starting with the more knowledgeable other, usually an instructor, establishing explicit learning objectives and directions on reaching them with the learner. Scaffolding may take the form of modelling, feedback or even direct instruction to help the learner develop the required conceptual knowledge and relevant skills to reach their objectives. Once the necessary knowledge and skills are mastered by the learner, the scaffolding is gradually reduced, allowing for greater autonomy and control over the individual's learning (fading). Because the strategy of scaffolding SRL is adaptable and may be implemented in a variety of ways to fit different learning contexts and learners, scaffolding can take many forms. Some common approaches for scaffolding SRL are the following:

- **Cognitive apprenticeship:** This model comprises an expert or more experienced instructor leading a less experienced learner through a task, breaking it down into smaller, more manageable steps and providing feedback throughout each step (Collins et al., 1988; Persico & Steffens, 2017; Järvelä, 1995).

- **Metacognitive prompts:** Prompts that encourage learners to reflect on their learning process, such as asking for clarifications, elaborating on their thinking or identifying thinking processes into problem solving are all examples of metacognitive prompts that can be used by the instructor to provide further support and guidance (Guo, 2022).

- **Goal setting:** Instructors can assist learners in defining attainable objectives and tracking their progress towards those goals while providing feedback and support along the way (Quigley et al., 2018).

- **Self-reflection:** This helps learners reflect on their learning progress and identify areas for improvement that can help them become more self-aware and better at regulating their own learning (Quigley et al., 2018).

- **Collaborative work:** Group work and peer-to-peer teaching are examples of collaborative learning in which learners work together to attain a common learning goal (Johnson & Davies, 2014). Here, scaffolding SRL can come from the instructor, peers or materials.

Prompts are often used for scaffolding SRL and cognitive control. In fact, based on Devolder et al.'s (2011) prompts, subtle cues to remind learners to use specific strategies to regulate

learning only work well when combined with additional scaffolding like metacognitive feedback or reflective prompts that stimulate self-reflection and help learners become aware of their own thinking and learning strategies.

Assessment and SRL

Assessment is a critical component of the learning process and plays an important role in scaffolding SRL (Marin & Perez Garcias, 2016). Assessments can provide feedback on progress and support students in identifying their strengths and weaknesses. Educators can assist students in enhancing their metacognitive abilities, being more conscious of their learning process and taking ownership of their learning by utilising assessment as part of the scaffolding process for SRL. Marin and Perez Garcias (2016) discussed the idea of formative assessment in higher education and its different implementations, including peer assessment, collaborative assessment and self-evaluation. Their study emphasised the connection between formative assessments and those for learning. The results provided considerable research that shows how formative assessment techniques, such as peer feedback and co-assessment, involve students actively engaging in the assessment process by providing feedback to their peers or by working collaboratively to evaluate their own work. Indeed, when students engage in these types of formative assessment activities, they may develop positive interdependence, self-regulation and management skills. The study contended that combining summative and formative assessments might allow students to review and prepare challenging material. Self-evaluation, peer assessment and collaborative assessment are only a few of the formative assessment techniques included. With self-assessment, students can evaluate their own abilities and merits, which can help them become more aware of their learning processes. Students evaluate and comment on each other's work as part of peer assessment, also known as peer review. This may help students improve their communication and evaluation skills, along with their ability to work collaboratively and independently. The article by Marin and Perez Garcias (2016) outlined the advantages of peer evaluation, including how it may increase student input, make feedback more thorough and understandable and boost students' self-efficacy and self-esteem. The article also listed the steps that must be taken to build up a self- or peer assessment strategy, including planning, carrying it out, monitoring its progress and self-evaluation.

As part of a self-assessment strategy, Jones (2017) suggested that classroom activities can aid in developing SRL. These activities can help students become more aware of their own learning processes and take responsibility for their learning. Asking students to create quizzes or test questions is one way to promote SRL. Higher-order thinking is scaffolded through the process of formulating questions. Instead of memorising or applying the subject, students should consider how to assess their understanding of it. The study aimed to investigate how students felt about developing quizzes or test questions. In a university classroom, three quiz-building activities were carried out, and a subsequent poll revealed that students found the activity beneficial for learning but were worried about the quality of the questions produced. Student preference also favoured group activities over individual ones. According to the survey, one-third of students said that taking part in the quiz-building exercise changed their approach to studying. The findings suggested that creating quizzes can be a helpful strategy for promoting SRL. Teachers can use low-risk activities like these to help students understand their own learning and gain a sense of control. It is also important to provide opportunities for reflection to solidify newly acquired viewpoints.

Modelling SRL

Modelling is essential for scaffolding SRL. Through the exemplification of SRL strategies and provision of opportunities for learners to practice and apply those strategies, educators can aid and direct learners in becoming self-regulated learners. Learners can observe and imitate people's behaviour; in this context, those who can successfully self-regulate their learning can be seen as modelling practices for others. For example, learners can observe how an effective self-regulated learner sets goals, plans their learning approach, monitors their progress and then applies these ideas to improve their learning.

Teachers can promote SRL directly by teaching learning strategies and helping students develop knowledge and skills on how to self-regulate (Brown et al., 1981). An educator can implicitly help their students to adopt certain behaviours, for example, by modelling the use of a strategy, without giving more information on the use of the learning strategy and its significance (Collins et al., 1991). On the other hand, an educator can explicitly instruct their students to perform a certain activity, for example, by explaining a learning strategy and the reason why it is useful. Next, educators can also promote SRL indirectly by arranging the learning environment in a constructivist way so that students can and have to self-regulate

their learning (e.g., by offering choices to students and providing them with situations in which they can take over responsibility for their learning; Pressley et al., 1992).

Need for SRL-specific instructional competencies for teachers

There is significant evidence in the literature showing that SRL is beneficial for several outcomes, such as student well-being (Kaplan & Maehr, 1999; Noble & Wyatt, 2008; Tavakolizadeh et al., 2012), academic performance (Cleary & Zimmerman, 2004; Perry & Vandekamp, 2000; Zimmerman, 1990; 2002; Zimmerman & Schunk, 2001) and so forth. Additionally, Boekaerts (1999) stated the importance of SRL support as an educational model that should play a central role in teaching practice. However, research has found that SRL instruction occurs only to a limited extent (e.g., Dignath-van Ewijk, 2016; Lombaerts et al., 2009b). Correspondingly, similar to what Dignath-van Ewijk (2016) indicated, the question remains regarding why educators do not invest more in fostering students' SRL. Perhaps, there is not much faith in SRL, or there is a lack of understanding on how to support it. Hence, there is a need for clear and usable SRL-specific instructional competences for teachers.

Taking this into consideration, Russel et al. (2020) discussed the elements that help instructors encourage students' SRL. Goal setting, planning, applying task methods, time management, reflection on previous learning strategies and adaptation of future learning are all part of actively participating in the students' learning journey, as well as encouraging and supporting them in becoming self-regulated learners (Russel et al., 2020). In addition to contextual elements like teaching, assessment methods and activity design, personal factors like experiences, knowledge and beliefs also impact students' SRL.

For university students, SRL abilities are crucial, yet many still lack them. Educators may facilitate SRL through guiding or peer interaction (co-regulation) and by providing learners with the opportunities to practice and hone their skills. However, instructional strategies should take into consideration learners' characteristics and capacity for self-regulating. According to the findings presented in Russel et al. (2020), educators identified four common instructional strategies to support students' self-regulated learning: task design approaches, instructional strategies, assessment and feedback strategies.

Scaffolding in Computer-Based Learning Environments (CBLEs)

According to Azevedo and Hadwin (2005), scaffolding has grown in significance in the design of computer-based learning environments (CBLEs), as well as in-person tutoring sessions. Research has demonstrated that the lack of scaffolding in CBLEs might result in poor learning experiences, such as a failure to control one's own learning processes and the inability to develop conceptual knowledge of the subject. Therefore, the significance of embedded conceptual, metacognitive, procedural and strategic scaffolds in CBLEs has been highlighted by scholars. Azevedo and Hadwin (2005) addressed challenges regarding the creation of metacognitive tools and construction of adaptive individualised scaffolds. The aspects of scaffolding explored vary, including adaptive scaffolding based on diagnosis and individualisation, self-diagnostic strategies without tailored help and fading. Scaffolding was found to assist in the acquisition of different types of information, including, but not limited to, operational, conceptual or thinking skills. The authors took different approaches when designing pedagogical agents for scaffolding SRL and metacognition, ranging from static prompts and computer-based tools to more dynamic and adaptive scaffolding through a human agent. The literature has concentrated on various types of scaffolding, including the enhancement of question-and-answer interactions, supporting navigation behaviour and creating self-regulatory techniques and behaviour.

Recent technological developments have enabled the creation of computer-based scaffolds that can offer students timely and focused help to improve their self-regulated learning processes. For instance, a computer or virtual agent can serve equally well as a scaffold, just like a real person. The help offered by these computer-based scaffolds can take many different forms and be customised to the requirements and objectives of the students, including prompts, feedback, tips and activities. Research has demonstrated that computer-based scaffolding can successfully cultivate self-regulated learning and enhance students' learning outcomes in different educational contexts, including online learning environments, game-based learning and intelligent tutoring systems. However, computer-based scaffolds should be designed in a way that is compatible with the students' learning needs and preferences and should be used in conjunction with other forms of support, such as peer feedback, to ensure the effectiveness of the scaffolding process.

Scaffolding SRL Through the 5E Instructional Model

As discussed, scaffolding SRL can take different forms. A well-known pedagogical framework, namely, 5E (Hirum, 2013), is one way to support students' SRL. Here, each 'E' in the 5E model represents a specific step that could help the teacher in designing a lesson, taking into consideration all the elements that have been discussed thus far. Before discussing the practical applications of scaffolding SRL through the use of the 5E instructional model, it is important to establish a link between the theoretical foundations of the 5E model and scaffolding SRL. The theoretical basis of the 5E model falls under the field of constructivism (Wyatt et al., 2014) and complies with the theoretical foundations supporting the scaffolding of students' mutual influence on their SRL, that is, co-regulation and socially shared regulation of learning (SSRL), which were introduced in the first chapter. As the previous section of this chapter discussed, metacognition, self-scaffolding, social cognitive theory, the ZPD, cognitive load theory and social constructivism all relate to constructivism in various ways.

As supported in Schunk (2012), constructivism advocates for a learner-centred approach emphasising the significance of learners' active participation in their learning process. The value of social interaction as part of the learning process has been acknowledged, and scaffolding has been highlighted because learners are supported while constructing their own understanding (Schunk, 2012; Vygotsky, 1962). This viewpoint is supported by self-scaffolding (Bickhard, 2005) and the ZPD (Vygotsky, 1978), which describe the learners' ability to regulate their own learning and importance of providing them with support tailored to their existing abilities. Additionally, the learner's cognitive processes are taken into consideration through cognitive load theory and metacognition (Schunk, 2012) by emphasising the importance of reducing internal and extraneous cognitive load to improve learning, while also giving cognitive space for the learner to monitor and regulate their own thinking.

The main idea is that, through constructivist learning theory, learners are actively participating and constructing their own understanding of new knowledge, rather than adopting a passive role in the classroom. The learner represents a 'Copernican Revolution', shifting from an instructor-centred teaching model to one highlighting the teacher–learner relation, in which both parts must collaborate and cooperate (Boddy et al., 2003). Additionally, social constructivism (Vygotsky, 1962) highlights the social element of the 5E teaching model, aligning with the TUNED project's proposition for scaffolded SRL, which focuses on the importance of the social context and interactions. Empirical studies on SRL in collaborative

learning environments (Hadwin et al., 2011) have claimed that students can extend their regulation of learning processes to peer learners by shifting regulation from the individual to group level. Järvenoja et al. (2015) explained the impact of the social context on SRL as follows:

> *The situated perspective of regulated learning considers the actual regulation intentions and actions in which a learner engages in order to control, direct, or adjust their activities and thoughts. Regulatory behaviours that aim to control metacognitive, cognitive, motivational, and emotional processes to ensure goal-directed learning are context bound and become activated in learning situations. Each situation requires unique responses to learning instead of drawing upon a repertoire of preformulated strategies the learner might possess. In doing this, a learner may focus on emotional or motivational processes, or, alternatively, metacognitive and cognitive processes, both of which are equally important in a learning situation.* (p. 205)

The 5E instructional model/5E learning cycle model

The BSCS 5E instructional model (5E model) was developed to enhance science curriculum development, aiming at creating instructional materials for professional training (Bybee et al., 2006; Hirumi, 2013). There are five phases of the model: engagement, exploration, explanation, elaboration and evaluation.

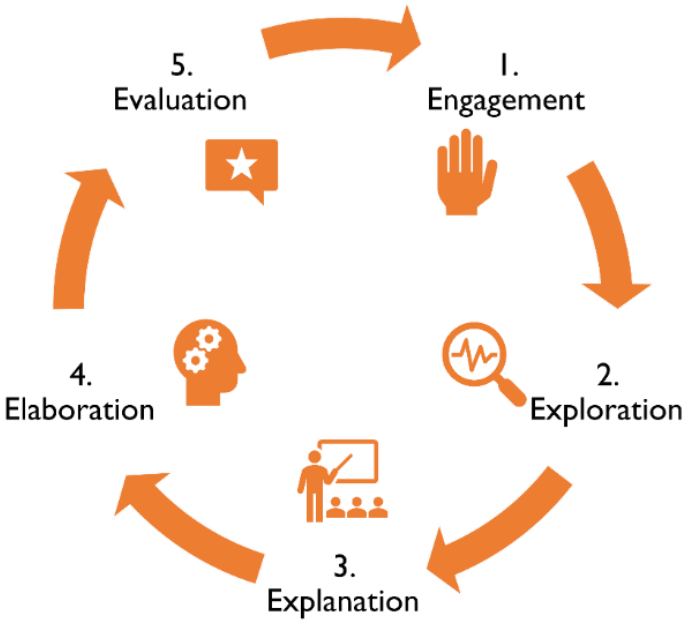


Figure 2-1. The 5E instructional model cycle

Bybee et al. stated the following:

> *Each phase has a specific function and contributes to the teacher's coherent instruction and to the learners' formulation of a better understanding of scientific and technological knowledge, attitudes and skills. The model frames a sequence and organization of programs, units, and lessons. Once internalized, it also can inform the many instantaneous decision that science teachers must make in classroom situations*. (2006, p. 1)

Based on the 5E model (Bybee et al., 2006, p. 2), the details of each phase are as follows:

- **Engagement:** Learners engage with a new concept by participating in short activities that elicit prior knowledge and intrigue their interests. Activities make connections between previous and new learning experiences, consider present conceptions related to a new learning objective and focus the learners' minds on the 'learning outcomes of current activities'.

- **Exploration:** Learners participate in 'exploration experiences' that identify and challenge current knowledge (including 'misconceptions'), skills and processes to facilitate 'conceptual change'. The activities within this phase may consist of lab activities or other hands-on activities that encourage the use of current understanding to generate new ideas, 'explore questions and possibilities' and 'design and conduct a preliminary investigation'.

- **Explanation:** Learners focus more deeply on a particular aspect of their exploration experiences. In this phase, demonstrations of skills, knowledge and understandings of concepts are emphasised. Activities ask learners to work individually or in groups to explain what they have learned from their exploration experiences.

- **Elaboration:** Teachers provide opportunities for learners to elaborate on, correct mistakes or misconceptions and otherwise extend their understandings of concepts. Activities include applying concepts to real-world problems.

- **Evaluation:** Learners assess their mastery of the skills and their understanding associated with the learning objectives. Instructors evaluate students' progress and outcomes.

Application of the 5E model

The model was originally designed for the science education field, but it is applicable in different disciplines, such as mathematics, Information and Communication Technology (ICT), social sciences and humanities. The reason for its broad applicability is related to the opportunities provided for students to comprehend new concepts. Even though each 'E' component from the instructional mode is useful for supporting the teaching and learning process, collectively, every part contributes to building a powerful instructional approach. Kukula and Harbour (2009) applied the 5E model to a lesson of biometric technology regarding fingerprinting in a middle school. They customised each phase to fit their lesson scope as follows:

- Engage: by stimulating interest and curiosity about biometrics.
- Explore: by encouraging students to work together without direct instruction from fellows and teachers.
- Explain: by enabling students to explain difficult concepts and definitions in their own words.
- Elaborate: by having students apply what they have learned in biometrics to a new situation.
- Evaluate: by measuring the effectiveness and evaluating the results.

In Annexes, you can find a practical lesson plan that applies the 5E model in online teaching.

Relevance to scaffolding SRL

Although all stages of the 5E model are of value, scaffolding SLR is particularly relevant in the elaboration stage, where learners are encouraged to reflect on their own learning processes, employing metacognitive strategies to evaluate the effort involved in the task and decide what they need to do next. The teacher can scaffold learning by identifying the level of challenge that is appropriate for each learner and by providing scaffolding tools and resources that will help students become independent learners and, eventually, self-scaffold. This model also allows for the training of soft skills and focuses on higher-order thinking skills. It refers to organisational skills related to self-management, self-development and self-regulation, which are essential aspects that the TUNED project focuses on.

References

Agustian, H. Y., & Seery, M. K. (2017). Reasserting the role of pre-laboratory activities in chemistry education: a proposed framework for their design. *Chemistry Education Research and Practice*, *18*(4), 518–532.

Alexiou, A., & Paraskeva, F. (2019). Examining self-regulated learning through a social networking ePortfolio in higher education. *International Journal of Learning Technology*, *14*(2), 162–192. https://doi.org/10.1504/ijlt.2019.101849

Azevedo, R., & Hadwin, A. F. (2005). Scaffolding Self-Regulated Learning and metacognition – implications for the design of computer-based scaffolds. *Instructional Science*, *33*(5–6), 367–379. https://doi.org/10.1007/s11251-005-1272-9

Bandura, A. (1986*). Social Foundations of Thought and Action: A Social Cognitive Theory.* Englewood Cliffs, NJ: Prentice-Hall. ISBN 0-13-815614-X

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Bickhard, M. H. (2005). Functional scaffolding and self-scaffolding. *New Ideas in Psychology*, *23*(3), 166–173. https://doi.org/10.1016/j.newideapsych.2006.04.001

Bosanquet, P., Radford, J., & Webster, R. (2015). *The teaching assistant's guide to effective interaction: How to maximise your practice*. Routledge.

Bretz, S. L., Fay, M., Bruck, L. B., & Towns, M. H. (2013). What faculty interviews reveal about meaningful learning in the undergraduate chemistry laboratory. *Journal of Chemical Education*, *90*(3), 281–288.

Collins, A., Brown J. S., Newman S. E. (1988). Cognitive apprenticeship. *Thinking: The Journal of Philosophy for Children*, *8*(1), 2–10. https://doi.org/10.5840/thinking19888129

Collins, A., Brown, J. S. & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator*, *15*(3), 6–11.

Dawson, T. L. (2008). *Metacognition and learning in adulthood* (Prepared in response to tasking from ODNI/ CHCO/IC Leadership Development Office, Developmental Testing Service, LLC).

Day, T., & Tosey, P. (2011). Beyond SMART? A new framework for goal setting. *Curriculum Journal*, *22*(4), 515–534.

Devolder, A., van Braak, J., & Tondeur, J. (2011). Supporting self-regulated learning in computer-based learning environments: Systematic review of effects of Scaffolding in the domain of science education. *Journal of Computer Assisted Learning, 28*(6), 557–573. https://doi.org/10.1111/j.1365-2729.2011.00476.x

Duffy, M. C., & Azevedo, R. (2015). Motivation matters: Interactions between achievement goals and agent scaffolding for self-regulated learning within an intelligent tutoring system. *Computers in Human Behavior*, *52*, 338–348. https://doi.org/10.1016/j.chb.2015.05.041

Efklides, A. (2006). Metacognition and affect: What can metacognitive experiences tell us about the learning process? *Educational Research Review*, *1*(1), 3–14.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. *American Psychologist, 34*(10), 906.

Guo, L. (2022). Using metacognitive prompts to enhance self-regulated learning and learning outcomes: A meta-analysis of experimental studies in computer-based learning environments. *Journal of Computer Assisted Learning*, *38*(3), 811–832.

Hirumi, A. (Ed.). (2013). *Online and Hybrid Learning Design Fundamentals*. International Society for Technology in Education.

Ion, G., Cano-García, E., & Fernández-Ferrer, M. (2017). Enhancing self-regulated learning through using written feedback in Higher Education. *International Journal of Educational Research, 85,* 1–10. https://doi.org/10.1016/j.ijer.2017.06.002

Järvelä, S. (1995). The cognitive apprenticeship model in a technologically rich learning environment: Interpreting the learning interaction. *Learning and Instruction, 5,* 237–259

Johnson, G., & Davies, S. (2014). Self-regulated learning in digital environments: Theory, research, praxis. *British Journal of Research*, *1*(2), 1–14.

Jones, J. A. (2017). Scaffolding self-regulated learning through student-generated quizzes. *Active Learning in Higher Education*, *20*(2), 115–126. https://doi.org/10.1177/1469787417735610

Kukula, E. P., & Harbor, J. M. (2009). Biometric Technology Program to Promote Stem Education for the K-12 Environment. In VI *international conference on engineering and computer education* (pp. 200–204).

Lawrie, G. A., Schultz, M., Bailey, C. H., Al Mamun, M. A., Micallef, A. S., Williams, M., & Wright, A. H. (2016). Development of scaffolded online modules to support self-

regulated learning in chemistry concepts. *ACS Symposium Series,* 1–21. https://doi.org/10.1021/bk-2016-1235.ch001

Leonard, D. C. (2002). *Learning theories: A to Z.* London: Greenwood Press.

Marín, V. I., & Pérez Garcias, A. (2016). Collaborative e-Assessment as a strategy for self-regulated Scaffolding learning in higher education. *Formative Assessment, Learning Data Analytics, and Gamification,* 3–24. https://doi.org/10.1016/b978-0-12-803637-2.00001-4

Persico, D., Steffens, K. (2017). Self-Regulated Learning in Technology Enhanced Learning Environments. In: Duval, E., Sharples, M., Sutherland, R. (Eds,), *Technology Enhanced Learning.* Springer, Cham. https://doi.org/10.1007/978-3-319-02600-8_11

Pressley, M., Harris, K. R., & Marks, M. B. (1992). But good strategy instructors are constructivists! *Educational Psychology Review*, *4*, 3–31.

Quigley, A., Muijs, D., & Stringer, E. (2018). Metacognition and self-regulated learning: Guidance report. Education Endowment Foundation. Online resource: https://dera.ioe.ac.uk/id/eprint/31617/1/EEF_Metacognition_and_self-regulated_learning.pdf

Quintana, C., Reiser, B. J., Davis, E. A., Krajcik, J., Fretz, E., Duncan, R. G., ... & Soloway, E. (2004). A scaffolding design framework for software to support science inquiry. *The Journal of the Learning Sciences, 13*(3), 337–386.

Russell, J. M., Baik, C., Ryan, A. T., & Molloy, E. (2020). Fostering self-regulated learning in higher education: Making self-regulation visible. Active Learning in Higher Education, *23*(2), 97–113. https://doi.org/10.1177/1469787420982378

Schunk, D. H. (2012). *Learning theories: an educational perspective*. 6th ed. NY: Pearson Education, Inc.

Schunk, D. H., & Zimmerman, B. J. (Eds.), (1998). *Self-regulated learning: From teaching to self-reflective practice*. NY: Guilford Press.

Vygotsky, L. S. (1962). The Development of Scientific Concepts in Childhood.

Vygotsky, L. S. (1978). Interaction between learning and development. In Gauvain & Cole (Eds.) *Readings on the Development of Children.* New York: Scientific American Books, pp. 34–40.

Wolters, C. A., & Brady, A. C. (2020). College students' time management: A self-regulated learning perspective. *Educational Psychology Review*, 1–33.Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary educational Psychology, 25*(1), 82–91.

Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: An overview. *Educational psychologist*, *25*(1), 3–17.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into practice, 41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2

Zimmerman, B.J., & Schunk, D.H (2011). *Handbook of self-regulation of learning and performance*. Routledge/ Taylor & Francis Group.

CHAPTER 3:

HOW DIGITAL TECHNOLOGY CAN SUPPORT SRL

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The possibilities of technology. Bing Image Creator

Executive Summary

This chapter focuses on relevant technological and methodological tools that are applicable in distance and blended learning and are suitable for SRL practices. It is divided into two sections.

The first section discusses the application of Massive Online Open Courses (MOOCs) and Open Educational Resources (OERs) in educational settings. It explores the concept of MOOCs, their emergence, and their impact on distance education. This section emphasizes the strong connection between MOOCs and OERs. MOOCs provide open education to all students without any expenses, offering access to high-quality education through online platforms. On the other hand, OERs refer to materials and educational components available on the web for students and teachers to use, reuse, and adapt. The chapter demonstrates how OERs can be integrated into MOOCs and highlights relevant best practices in the field. Two projects, DigiTeL Pro and Blue Arrow, are specifically mentioned as examples of successful integration of OERs and MOOCs. The first section also explores the potential of micro-credentials and their applicability in distance learning.

The second part of the chapter discusses the application of video games and their effects on teaching and learning. It begins with a historical overview of video games and their use in education. The chapter introduces Gee's principles, which provide a deep understanding of the intersection between learning, video games, and digital media. These principles highlight the transformative power of games in creating meaningful and immersive learning experiences. In the final part of this section, the authors emphasize a specific subclass of video games relevant to the educational sector: serious games. Serious games are designed with an educational aim rather than solely for entertainment. While entertainment may still be a component of serious games, their primary focus is on improving one or more player skills. As most serious games are digital, they are well-suited for distance and blended learning and can be seamlessly integrated with MOOCs. Finally, we introduce three projects in which serious games are integrated in MOOCs: ACCORD (multicultural conflict management), BigFiveGame (learning a personality model called Big Five), and proTUce (operations and supply chain management).

Introduction of the chapter

Making better use of digital technology for teaching and learning is essential when it comes to benefitting from technological innovation and improving education. The pedagogical use of digital technologies depends on the availability, accessibility and quality of ICT resources. At the same time, improvements in infrastructure alone do not systematically lead to the integration and pedagogical use of digital technology in schools. If digital technology is to benefit pupils and educators, the right environment and support are needed (OECD, 2019).

The *'Education and Training Monitor 2020'* analysed the targets and benchmarks adopted under the strategic framework for European cooperation in education and training in 2020. The leading theme was monitor, teaching and learning in a digital age, which was planned well before the pandemic struck but was especially a timely topic.

In addition, the pandemic context stressed the importance of self-regulation of learning for teachers and students. In particular, the EU JRC report stated, as relevant recommendations for policy actions, that "Self-regulation competence development alongside socio-emotional learning at student and teacher training levels should be prioritised" (Carretero et al., 2021, p.52).

Although SRL did not receive large attention when physical schooling was mainstream, its importance has been amplified in distance education, especially after the pandemic. In fact, students' self-regulation competence can help them be more successful in remote schooling because it helps them manage tasks, plan work and maintain motivation. For successful distance learning, students and teachers need to be equipped with **both digital and SRL competences.** Moreover, students should acquire appropriate motivational and emotional competences to benefit from the increased autonomy that remote education requires.

In this context, we will explore the potential of massive online open courses (MOOC) and their intersection with game and gamification. This chapter considers the added value of gamification, here as applied through the implementation of a serious game embedded in the training, representing the laboratory component of the online course. In addition, the gamification aspect aims at increasing the engagement of the users with an immersive environment that is light and even fun. We aim to provide teachers with the skills and tools required to project and develop their own teaching methods, helping them manage teaching not only in an online environment, but also in every kind of environment, such as f2f, hybrid, augmented and blended learning situations.

MOOCs and OERs supporting continuous and inclusive learning

What are MOOCs?

The acronym MOOC stands for massive (i.e., mass, therefore, intended for a very wide audience) open (i.e., free and open attendance), online (i.e., remote online platforms) courses (i.e., real school courses of various types and levels), which indicates that MOOCs are related to distance learning experiences. The term MOOC was introduced in 2008 by David Cormier after Stephen Downes and George Siemens produced the course 'Connectivism and Connective Knowledge'. The first MOOC, 'Introduction to Artificial Intelligence', was launched in 2011 by Stanford University and enrolled more than 160,000 users (De Notaris et al., 2021). From the birth of these courses, in 2011/2012, some researchers estimated a massive disruption of traditional paradigms and didactic methodologies related to the frontal and transmissive lessons. It was considered one of the most important innovations in the field of learning. Before the 'revolution' of MOOCs, it was impossible to attend a high-quality course provided by, for example, Harvard University, from rural areas. However, with MOOCs, all that is needed is an internet network. This brings a real possibility of democratising knowledge access. The ambition is to overcome the hurdles between higher educational institutions and allow free access to the knowledge contents, even if learners suffer from geographical obstacles or any kind of disability or limitation. MOOCs can be arranged by companies or higher educational institutions or even large universities or museums that can offer specific content to their potential students. The strength of this approach is the possibility of opening the courses to all the users without any kind of limitation.

The MOOC has particular features. The most important one is the possibility to aggregate the lectures from different HEIs, allowing students to take the best courses from the prominent universities in the world with free and open access and no participation limit. The courses could vary in nature from formal and traditional university courses to those to improve transversal and soft skills. MOOCs give access to the enthusiasts of a specific topic: these people could attend a course to learn something new or improve a critical skill using a continuous model of learning update. Another possibility is to share open educational resources (OER) to provide teaching/learning 'pills' aimed at a specific topic. This has huge potential because it allows learners to acquire the knowledge for specific needs using open materials. In this vision, MOOCs can allow for personalisation of the learning approach.

Open Educational Resources and MOOCs

United Nations Educational, Scientific and Cultural Organization (UNESCO)[2] defined 'Open Educational Resources (OER) are learning, teaching and research materials in any format that reside in the public domain or have copyright with open license, permitting re-use, re-purpose, re-adaptation and re-distribution by others with no cost. Open license refers to a license that respects the intellectual property rights of the copyright owner and provides permissions granting the public the rights to access, re-use, re-purpose, adapt and redistribute educational materials'.

UNESCO considers that OERs can be a powerful tool for sharing and reusing the contents. Their guidelines[3] suggest how to boost the use of OERs including as follows:

- Ensure access to OERs, in particular to those resources that are more used or more interesting for the target learners or that focus on subjects for which they are being provided. It is important to underline that this also includes traditional materials, such as printed materials.
- Support the OER stakeholders in developing OERs with a localisation in the languages of the potential users, also for those languages that are less used, under-resourced and endangered.
- Ensure that the OERs are fair under all levels, including gender equality, nondiscrimination, accessibility and inclusiveness; this strategy should also be applied in the member states' programme of accessing, readapting and distributing OERs.
- Promote public investments and boost the entry of private funds to sustain the technological infrastructure that are essential for a wide application of the OERs to include low-income, rural and urban communities in this process.
- Boost the academic and informal research on the OERs, promoting actions that place this resource at the centre of the research activities, including some evidence-based standards that assure the quality of the OERs.
- Sustain the implementation of regular quality assurance mechanisms.
- Incentivise the development of structured methods that aim at the exploitation and sustainability of the OERs.

[2] https://www.unesco.org/en/open-educational-resources
[3] https://unesdoc.unesco.org/ark:/48223/pf0000373755/PDF/373755eng.pdf.multi.page=3

The process of creating an OER differs from that of creating educational materials intended for publication and distribution by a traditional publisher or solely for one's own students. By authoring an OER, you distribute your knowledge freely and openly to a global community. Once created, the OER becomes communal property, subject to use and modification, often without your permission. It is recommended that you are willing to share editable files of your OER, enabling others to make changes or additions in the form of adaptations. Additionally, you should maintain your OER by updating its content as necessary and correcting any errors to ensure its continued quality, relevance and sustainability.

How can we share our knowledge with the public through OER? The following steps can help you create and publish your OER[4]:

> **Step 1 - Plan**: The user has to design its educational resources and identify the educational goals from its teacher/instructor.
>
> **Step 2 - Select an OER authoring tool**: Browse the tool that is aligned with your teaching goals.
>
> **Step 3 - Create an OER**: Include all the resources you intend to apply (i.e., images, videos, slides, audios, references, etc.) for the specific educational tool and develop the OER as you planned in step 1. Remember to include all the supporting materials your students will need to complete the educational task.
>
> **Step 4 - Share**: Deliver the OER on free and open repositories. Very often, an authoring tool allows you to share your educational resources or any subpart of it. It is worth knowing that you have to decide which licence you want to use for sharing and how you want your work to be attributed.
>
> **Step 5 - Check the results of your OER**: Check if there are any bugs you should fix or any resources you should add. Keep the OER updated to sustain its use.

It is very important to pay attention to the fact that all intellectual property, including OER, are subject to copyright laws[5]. In some cases, the creators would rather share their work with some clauses than reserve all of their rights for themselves; for this reason, it is important to check the type of licence. For example, many OERs are licenced by Creative Commons (CC BY 4.0). Creative Commons licences are real, legal licences that help creators retain copyright

[4] For more details about creating OER: https://libguides.wpi.edu/oer/create
[5] For more details about copyright and licensing of OER https://garrettcollege.libguides.com/OER/copyright

while allowing others to copy, distribute and make some use of their work. They created tools to support creators of the original work in retaining a copyright and publishing OER with the correct attribution.

When using CC-licenced materials, it is crucial to abide by licence conditions, one of which is attribution. This means acknowledging the author and source of the material in a reasonable manner, including all relevant information provided by the licensor. Depending on the nature of your specific use, you can choose the most suitable form of attribution. It is recommended that the title, author, source and licence information be included when reusing CC-licenced works, whether in their original form or as an adaptation. To remember these elements, you can use the acronym TASL: **t**itle, **a**uthor, **s**ource and **l**icence.

OERs in blended and online education: The case of the DigiTeL Pro, Erasmus+ project

The DigiTeL Pro project (https://digitelpro.eadtu.eu/) is a project funded by the European Commission in Erasmus+ programme and coordinated by EADTU (European Association of Distance Teaching Universities) in response to the digital need for professionalisation for teachers, which was highlighted via and during the COVID-19 pandemic. DigiTeL Pro has provided several useful OERs about three delivery modes of education: blended, online and synchronous and hybrid teaching. For example, teachers can get to know key knowledge to implement these teaching methods, such as where to locate the resources, how to use them to develop a course, how to teach the course effectively, how to conduct webinars related to the course, how to assess participants and how to manage local certification of the course and so on. You can find relevant links of the materials as below:

1. Blended education:
    - Course programme: 'Blending your education' (https://digitelpro.eadtu.eu/course-programmes/blended-education).
    - User guidelines for blended education: https://digitelpro.eadtu.eu/images/IO3A6_Use_guidelines_for_reusing_IO3A6_Blending_Your_Education_course_resources.pdf
    - Teacher manual connected to the above-mentioned Continuing Education Professional Development (CEPD) course

https://digitelpro.eadtu.eu/images/IO3A6_Teacher_Manual__Blending_Your_Education_Course_Guide.pdf

- YouTube video: https://youtu.be/smJ_gT-5hB4

2. Online education:

- Course programme: https://digitelpro.eadtu.eu/course-programmes/online-education
- Guidelines for online education: https://zenodo.org/communities/digitelproproject/?page=1&size=20
- Compendium of best practices for online education https://digitelpro.eadtu.eu/images/IO4_A2_A_compendium_of_selected_best_practice_training_materials_and_or_resources_for_CPD_for_online_and_distance_learning.pdf

3. Synchronous and hybrid education:

- Course programme: https://digitelpro.eadtu.eu/course-programmes/synchronous-hybrid-education
- Access to course materials: https://zenodo.org/communities/digitelpro/
- User guidelines: https://digitelpro.eadtu.eu/images/IO2_A6_A_final_CPD_programme_for_digital_eduation_focusing_on_the_three_teachign_and_learning_scenarios_students_readiness_for_online_learning_and_institutional_change.pdf

Further important resources and outcomes of this project:

- Student readiness for digital learning: https://digitelpro.eadtu.eu/images/IO5_A1_Student_Readiness_for_Digital_Learning.pdf
- A report in open access providing a crowdsourced guide to being an effective online learner: https://digitelpro.eadtu.eu/images/IO5_A5_A_CPD_programme_for_teaching_staff_staff_support_services_and_leadership_1.pdf

- A report on recommendations on managing innovation in digital education at the policy level: https://digitelpro.eadtu.eu/images/IO6A4_report_on_recommendations_on_managing_innovation_in_digital_education_1.pdf

How to apply OERs in teacher education: The case of Blue Arrow

In the Blue Arrow project (https://www.bluearrowproject.eu), which was funded in the framework of the Erasmus+ programme, the project partners exploited OERs, allowing the teachers enrolled in preservice and in-service training teaching programmes in higher educational institutions to create and (re)use content. The project aimed to develop blended and distance learning with innovative methods for pre-primary and primary education teachers.

The Blue Arrow project applied storytelling as the main driver of teaching practice for teachers in kindergartens and primary schools. The stories could be performed using a new paradigm in the framework of mixed reality (MR) called tangible user interfaces (TUI). This paradigm merges the physical and digital worlds, applying tangible objects as the drivers of digital tools. The objects became the central part of the storytelling process, and children could directly use the objects aimed at interaction with the digital stories. This empowered a multisensory approach. Nevertheless, the potential of Blue Arrow was because of its ability to connect the MOOC and a storytelling process developed as a serious game. The MOOC provided all the information for the teachers, and the OER authoring tools developed in the framework of the Blue Arrow project enabled the teachers to apply what they have learned in the course into practice.

The Blue Arrow project's website provides stories as OERs that users can browse, view, download and adapt for their own purposes. At the moment, these stories are available in four languages: English, Italian, Spanish/Catalan and Albanian. Users are encouraged to take inspiration from these stories and make use of them in their own educational contexts. The project has also developed an OER template that assists teachers in implementing the same storytelling in their classroom by filling the necessary information. These kits have been designed to be modular and can be easily sourced from the market or created by users themselves. Some of these kits can be downloaded from the project's website, and teachers can print and cut them out for use in their storytelling activities.

Micro-credential and teaching in digital environments

Micro-credentials refer to a form of certification or credentialing that validates a person's knowledge, skills and abilities in a specific area or competency. Micro-credentials are typically smaller and more condensed than traditional degree programmes or certifications, and they are often earned through a short-term learning experience.

The concept of micro-credentials is not entirely new. One of the earliest examples of micro-credentials is the Microsoft Certified Professional (MCP) programme, which was introduced in 1992. The MCP programme offers certifications in specific Microsoft technologies and has become a widely recognised industry credential. Other early examples of micro-credentials include Cisco's Certified Network Associate (CCNA) and the Project Management Institute's Project Management Professional (PMP) certification. Although such professional, small-scale certifications exist around for decades, the rise of digital technology has enabled the development of new forms of micro-credentials. Online learning platforms and digital badging systems, for example, have made it easier to earn and display micro-credentials (e.g., Europass). In recent years, the popularity of micro-credentials has exploded, with many universities, employers and online learning platforms offering micro-credential programmes.

Teaching in digital environments is a rapidly growing field as an increasing number of educational institutions are adopting online learning as a means of providing education. Micro-credentials can be an effective way for teachers to acquire the specific skills and knowledge needed to be effective in teaching in digital environments. These may include skills such as the following:

1. Creating effective online learning experiences
2. Using digital tools for teaching and learning
3. Facilitating online discussions and collaboration
4. Assessing learning in digital environments
5. Adapting the curriculum for online delivery

Micro-credentials can be a valuable way for teachers to acquire the specific skills and knowledge needed to be effective in teaching in digital environments. By earning micro-credentials in areas such as creating effective online learning experiences, using digital tools and assessing learning in digital environments, teachers can systematically upgrade their skills and demonstrate their expertise to their employers. In addition, micro-credentials can be useful for teachers/learners to stay up to date with the latest developments in the topic.

Potential of MOOCs and video games in teaching practices—Supporting student motivation for learning

In this section, we explore the potential of MOOCs and their intersection with the game and gamification processes. We highlight video games, especially serious games, are useful tools in game-based learning and teaching practices.

What is a video game?

A video game could be defined as an interaction between players that takes place through a special monitor or a normal television screen through a story that is acted out by the players, but such a definition would be too simplistic because a video game is much more so (Toto & Limone, 2022).

Figure 3-1. Interactive Angry Birds game (https://www.dallasobserver.com/arts/deep-ellum-is-getting-an-interactive-game-room-14793182)

Today, video games allow for a truly impressive immersive dimension that is only possible in literature or comics. Just think of the cultural effect that video games have had in defining the rhythm and style of the language of digital communication or how film iconography and literature itself are influenced by video games; the timing of the narration and interactions between the characters in the context of the prose of contemporary novels are deeply conditioned by video games.

Figure 3-2. FIFA23 action allows multiplayer games. (https://www.ggrecon.com/guides/fifa-23-barcelona-ratings/)

Despite different projections, the market is growing rapidly,[6] and the estimates for the next few years suggest an increase in the growth trend. The most important factors of this market growth are the increased involvement of companies in using serious games in management and training procedures, as well as the exponential growth in the use of mobile devices for educational games and for learning purposes. The other driving force is the increase in the

[6] The reference market of serious games is part of the already thriving market of video games that, globally, was estimated at 151.06 billion dollars in 2019, with a projected annual growth of 12.9% from 2020 to 2027. This is a trend that is also confirmed for the global market of serious games, which represents only a slice of the video game market. In 2016, Allied Market Research estimated the value of this portion at $2.731 billion in 2017, with a 2023 estimate of $9.167 billion, with an estimated average annual growth of 19.2% from 2017 to 2023. Some agencies such as Market Watch have been more cautious assuming a volume reached of 8.005 billion dollars in 2027 with an annual growth of 10.9%.

digital skills of the population, increased digitisation and the exponential growth of social networks.

Interesting here is the statistic reported by Europe's video game industry (ISFE) regarding its 2020 report, which analysed the population that uses video games. Here, 51% of the population between the ages of 6 and 64 played video games, 59% used mobile devices (smartphones or tablets) to play, and 51% played on computers. The average video game player was 31 years old. The gender balance was also interesting: 45% of European video players were women, with 86% preferring single player. Regarding the use of video games with mobile devices, women represented 51% of the population of gamers.

Video games today

Video games represent the most coveted market in the entertainment industry. In 2020, for example, the estimated turnover of video games exceeded 100 billion dollars year over year, and new sectors of communication were colonised through video games: just consider the movement of social games on social networks, apps for video games, or simply the penetration they have had in portable devices such as smartphones.

Let us now consider the diffusion of video games in Italy. According to Toto and Limone (2022), the age distribution of players has been growing compared with a few years ago when the use of electronic devices was more widespread in the 6–24-year-old age group. Today, the number of gamers is spread out across all age groups and there is not a big difference between men and women, and from social, personal and demographic data. There are also gamers in the 40–55 age range and around 80.6–81.4% of them (at the time of the interview made by Italian National Statistics Institute[7]) stated that they had played video games at least once in the previous six months.

This is surprising but also a cause for reflection and concern. The data related to the high number of interviewees (71.1%) who started playing video games under the age of 18, while only 17.1% over the age of 25 years stated doing so. In general, habitual gamers were predominantly between the ages of 18 and 24, which is also because, in this age group, there are fewer work commitments and generally more free time (Toto & Limone, 2022).

Video games have massively colonised social networks, even those that least lend themselves to this type of approach. This is the case with Tinder. In 2020, the popular dating app

[7] http://dati.istat.it/Index.aspx?DataSetCode=DCCV_ICT#

developed the Swipe Night game (Figure 3-3). The game involved reliving a story as a first-person protagonist (a main character) and select actionable choices during events. The user was faced with choosing between critical decisions, often with real moral dilemmas. This example well represents the how video games have taken over in today's world.

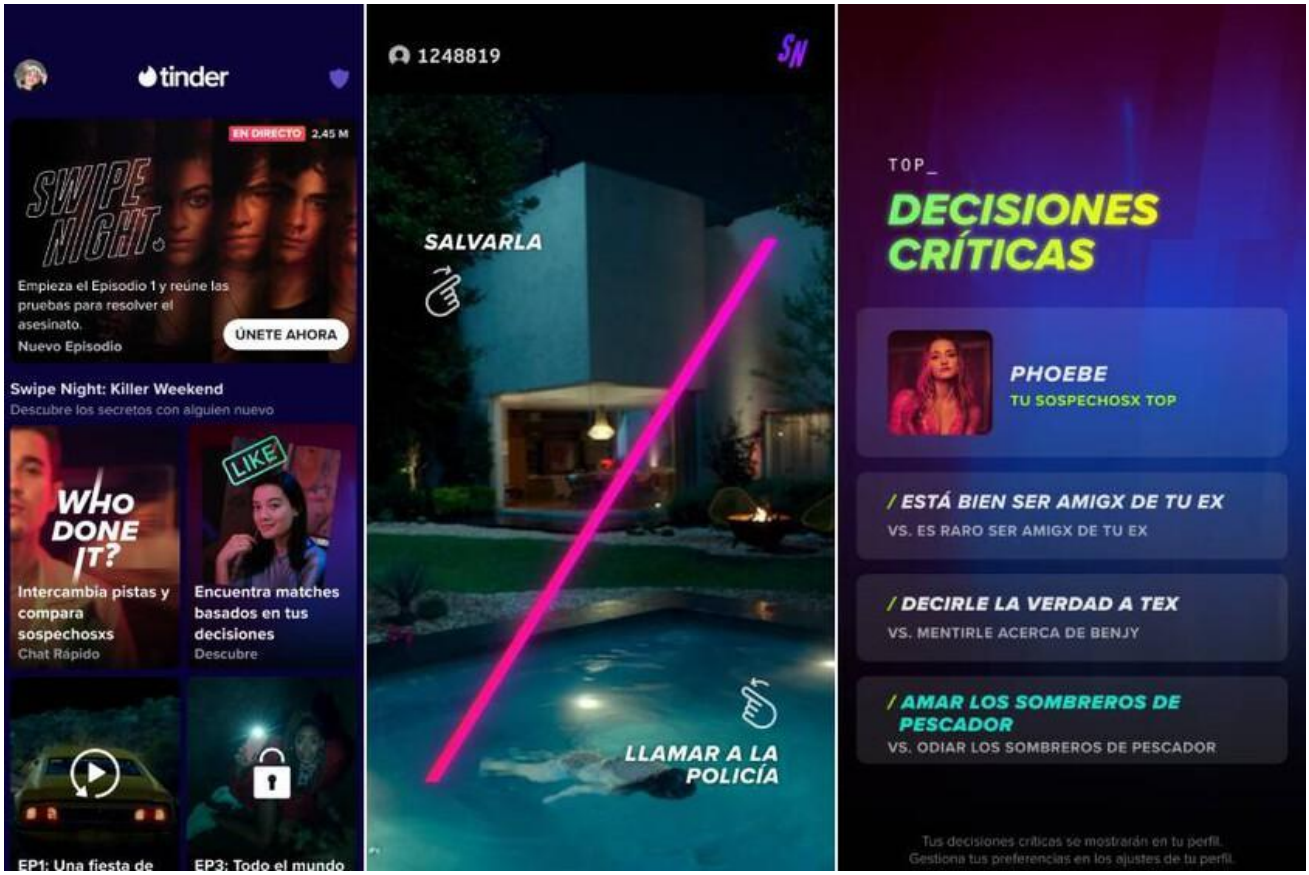

Figure 3-3. Tinder Swipe Night game

Videogames and education: Gee's principles

James Paul Gee, a Californian researcher and author of *Games for Learning* (2013), influenced the scientific community in the union between games and the education sector. The book was fundamental for the structuring of his principles, starting from the observation that video games are a complex tool that can instil fear or generate techno-addictions that do not have a genetic development basis (Toto, 2018).

Gee's principles (see Gee, 2005) encapsulate a profound understanding of learning and its intersection with video games and digital media. Gee crafted a set of principles that illuminate the transformative power of games as tools for meaningful and immersive learning

experiences. Here, we dive into these principles, uncovering their essence and impact, the dimensions are: identity, interaction, production risk-taking, customisation, agency, well-ordered problems, challenges and consolidation, just-in-time and on-demand, situated meanings, pleasantly frustrating, system thinking, explore, think laterally and rethink goals, smart tools and distributed knowledge, cross-functional teams, performance before competence.

Regarding the identity, the focus is on the learners that must feel involved and take a new identity in the game. It is necessary for the learning and to make an extended commitment because no deep learning takes place unless learners make an extended commitment of the self for the long haul. Also the interaction is crucial. The powerful part of the game is that it provides a strong interaction that allows the user to fully engage in the situation. The student/player needs to act, and the game changes only on the players' decisions.

Another asset is the production: in the games, players are co-designers of the activities by the actions they take and the decisions they make. The users produce content, elements and new challenges inside the game.

In the games, the role of risk-taking allows the player to make actions that in other ways would not do. The game is a safe environment where the user could take risks: wrong behaviours could be interesting to analyse the effect of failures and negative actions. The users are encouraged to take risks and explore and try new things because they can always restart the game.

Customisation is another crucial element: the games are designed based on the action and decision of the users, so the interaction can be personalised. Customisation also allows a player to proceed with the game at one's own pace and with their knowledge and skills.

In addition, in the game the players feel real agency, meaning that they have ownership over their behaviours and can control the gaming environment and could solve well-ordered problems. The problems are presented with a structure made by levels and other settings. Controlled problem provision can assist a player's mastery of the content and skills by leading one to another in a sequential manner.

Learners develop skills to solve problems at a certain level, and then, the game provides a new class of problems at the players that must overcame challenge and consolidates the knowledge. The challenge supports the acquisition of knowledge and improves the expertise on the specific skills that emerge in the game.

Another fundamental aspect are the 'Just in time' and 'on demand' features. Games give verbal information either 'just in time' or 'on demand'. A players can receive the information when they feel the need and feedback on each interaction at the right moment.

Games brings situated meanings because they situate the meanings of words in terms of the actions, images and dialogues they relate to. For example, players can learn how a certain word can be differently used across different situations.

An interesting aspect in the Gee's principles is the "pleasantly frustrating" Players are guided to face challenges that are possible to overcome with their skills and knowledge previously acquired. A challenge that is appropriately designed for a learner can motivate them to tackle with the problem and give them a growth opportunity.

Games trigger the system thinking because they provide background and external scenarios that should be solved to players. By doing so, games encourage players to think about relationships between the elements in the situation, cultivating the skills to model a complex phenomenon.

Additionally, according to the Gee's principles, games allow the exploration and the production of 'out-of-the-box' solutions, boosting creativity and divergent thinking. At the same time, games encourage players to explore thoroughly before moving on.

The characters and other aspects of the game world that one manipulates in a game are 'smart tools'. In a multiplayer game, the knowledge needed to play the game is distributed among a set of real people and their smart virtual characters.

Games can support collaborative learning approach with team-building actions. Players with a different set of skills are encouraged to communicate and exchange different areas of expertise to solve a problem together. This elicits the building of "Cross-functional teams".

Finally, another concept is crucial: performance comes before competence. Players are supported by the design of the game and other advanced players, which encourage them to perform before being competent. It reverses conventional learning in which learners first become competent to perform.

Gee's principles offer a compelling framework for understanding the transformative potential of games as vehicles for learning. By embracing these principles, educators, game designers and learners can harness the unique affordances of video games and digital media to foster deep engagement, critical thinking, collaboration and a love for lifelong learning.

What are serious games?

Serious games (SGs) are all games designed for a purpose other than pure entertainment, that have educational/training elements and are made for industry such as education, health, emergency management, engineering, military and so forth (Michael & Chen, 2006). Regarding its pedagogical aspects, SGs find their theoretical foundation in constructivist learning theories, according to which knowledge is created through experience while exploring the world and performing activities in the game (Krath et al., 2021). Currently, various pedagogical models, such as experimental learning, are used in the conception and implementation of SG. In fact, virtual and real experiences are characterised by the acquisition of information, which remain strongly impressed and allow the player to refine perception, attention and memory, favouring behavioural changes through a learning-by-doing approach (Dewey, 1938). Learning no longer takes the form of a mere passive transfer of knowledge between a teacher and learner, but it occurs in an active and conscious acquisition of new knowledge, through continuous and constant experimentation while being supervised and guided by an expert. These elements make learning an interesting and engaging experience that increases the motivation and willingness of users to complete their training path.

Applying serious games in distance learning—Increasing learners' intrinsic motivation

When applying SGs in MOOCs, the SGs need to be strictly connected with the course structure and learning content to allow users to put what they have learned into practice (De Notaris et al., 2021). Research on the integration of SGs in a MOOC learning pathway is still in its early stages, but scholars have noted that educational gamification, such as SGs, puts users in a rule-based system, where they can experience cultural roles and emotions. As in traditional games, players can improve their cognitive (Bandura, 1986; Locke, 1991), emotional (McGonigal, 2011) and social skills (Squire, 2006). SGs drive intrinsic motivation that elicits curiosity and gives the perception to students that they are in control of their own learning (Barguillio, 2010). Games allow learners to interact with a multimedia environment more than books, audio or video. SGs also improve the growth of cognitive skills, procedural and declarative knowledge and thinking skills.

Cases of SG integration into MOOCs

In this section, we introduce three practical examples of SG integration into MOOC environments in the European context: ACCORD, the Big Five Game and ProTUce.

ACCORD

Within the ACCORD Erasmus+ EU Programme, the project partners performed a merging between a SG and MOOC (Marocco et al., 2019). The training methodology was based on developing an integrated platform that aimed to merge theoretical training material through a MOOC offering multimedia materials and video lectures by various experts on the topics and a SG in the form of a series of virtual role-playing game scenarios in which teachers could directly experience the dynamics of interethnic conflicts.

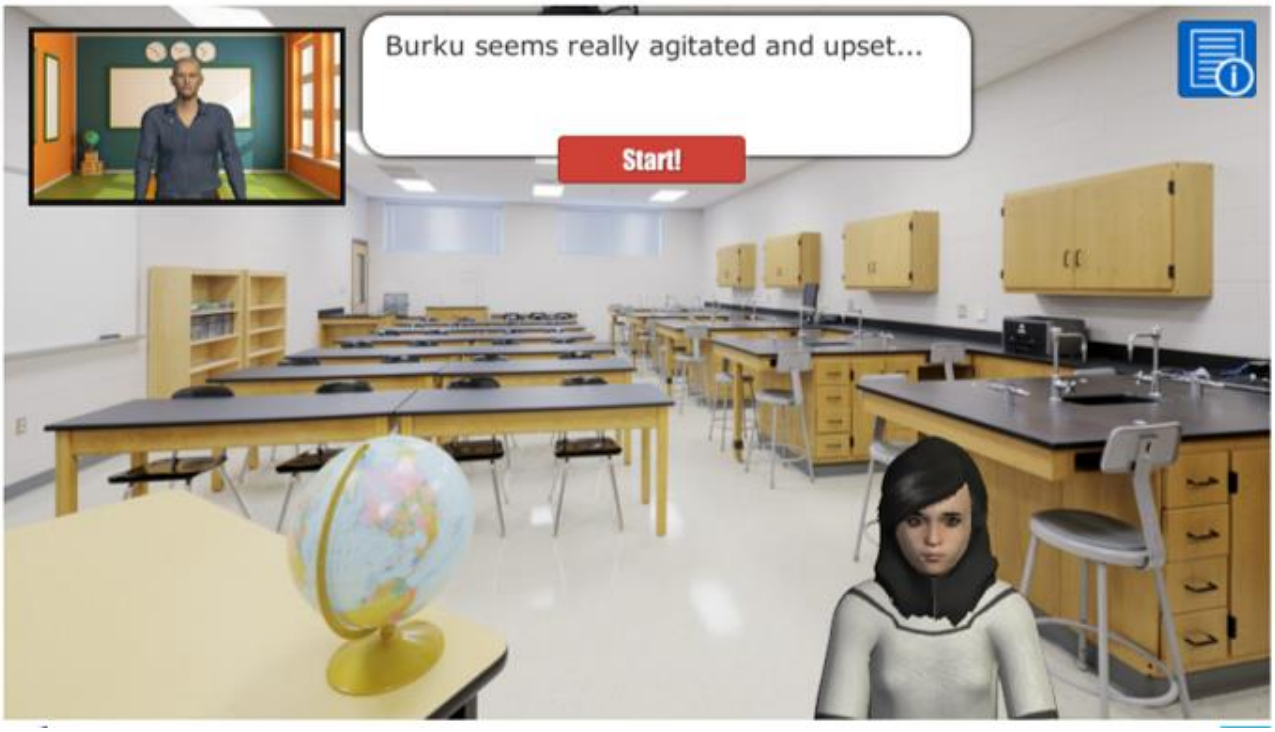

Figure 3-4. Screenshot of the ACCORD game from accorgame.com.

In the ACCORD project, an added value and one of the main elements was represented by the development of a MOOC coupled with a SG platform. The two tools were delivered online with a degree of interconnection. The MOOC addressed intercultural skills and the capacity to have tolerant and respectful dialogue with people from different cultural backgrounds. The interaction had the educational purpose of providing a realistic experience

of conflicts based on real-world scenarios. By using a dedicated authoring tool inside the platform, it was possible to create different simulation scenarios that allowed the user to have direct experience of mediation and conflict resolution. The user could execute every activity in autonomy so that they could experience role-play simulation without a tutor. The immersivity within the game was achieved by the use of realistic 3D models, animations, speech synthesisers and real voice recording. At the end of each session, the software provided a recording of the users' negotiation process and an assessment of the competences. This allowed a tutor to observe and analyse the student's learning process and outcome.

The Big Five Game

The Big Five Game[8] is designed based on the theory in psychology called the Big Five model of personality (e.g., Fiske, 1949; Norman, 1963; Tupes & Christal, 1992). It has the structure of a role-playing game in which students can test and train their knowledge about the Big Five theory through a realistic scenario. The aim is to improve students' skills and competences in both academic and working contexts. The environment in which the game is set is an HR recruitment office. Here, the user has to help the recruiter of a multinational society interview some applicants for a job position. A tutor provides step-by-step instructions and gives feedback to orient their choices throughout the interviews.

Figure 3-5. Screenshot of the Big5Game serious game from the Federica Web Learning MOOC provider. (federica.eu).

[8] You can download from here https://play.google.com/store/apps/details?id=it.smarted.b5g&hl=en_US&pli=1

When the game starts, the tutor introduces themself, the recruiter and the aim of the interview. In the following step, the user can choose which applicant he wants to interview. Applicants and their features are shown by labels. Once the applicant is chosen, the tutor suggests to the recruiter which dimension of personality they must focus on. The user must complete interactions by choosing, among three questions, the most representative of the interview's construct object (Ponticorvo et al., 2020).

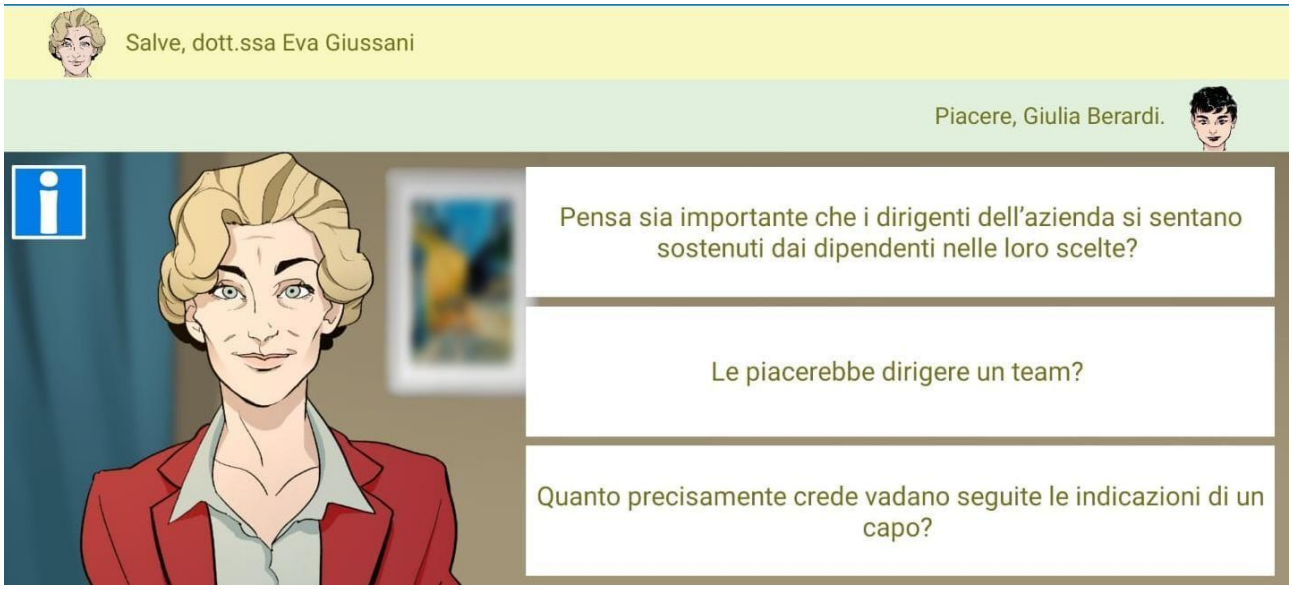

Figure 3-6. Screenshot of the Big5Game serious game from the Federica Web Learning MOOC provider. (federica.eu). On this screen, the user has to select one of the options.

The game is in Italian, and it is embedded inside the FedericaWebLearning MOOC (https://lms.federica.eu/enrol/index.php?id=118). Within a syllabus dedicated to students containing a large number of lessons, the project covered a topic related to the Big Five model. It represents a shared frame of reference for the evaluation of personality. The student can learn about the Big Five model in the MOOC, and after each lesson, they can train the acquired competences using the serious game, trying to understand the personality trait of the avatar in each discussion.

proTUce

The serious game ProTUce was developed within the ERASMUS+ project INSYSTED (https://www.alliance4tech.eu/insysted/). It targeted large, diverse introductory classes in operations management and advanced classes in the fields of operations and supply chain management. The project developed a page to fully integrate the game into the Moodle platform with a detailed step-by-step process.

The INSYSTED Platform is an open-source, e-learning platform in which students can train themselves on the topic of the production process and operation management. Operation management is a quantitative core area of industrial engineering and management education, and students need to tackle the stochastic-dynamic interdependencies of the processes within a supply network. To do so, students need to acquire a deep understanding of the underlying theoretical concepts, methods and tools. This is especially challenging for students who are at the introductory level. The heterogeneous knowledge and interests, as well as the sheer number of participants in typical introductory courses, requires new solutions for personalised learning.

The game includes a gaming module in which students can complete this part in groups through synchronous or asynchronous planning processes. They have limited information and must derive factors by analysing past model outputs. They can test their knowledge regarding capacity management, machine management and contract management. While competing, the students can also see how their team is doing compared with the other teams, as shown in the picture below. In subsequent game levels, students are confronted with different challenges of everyday production based on the progress of the course, experience system dynamics and improve their analytical skills. The complexity and difficulty of game levels can be freely adjusted by the lecturer (Langer et al., 2021).

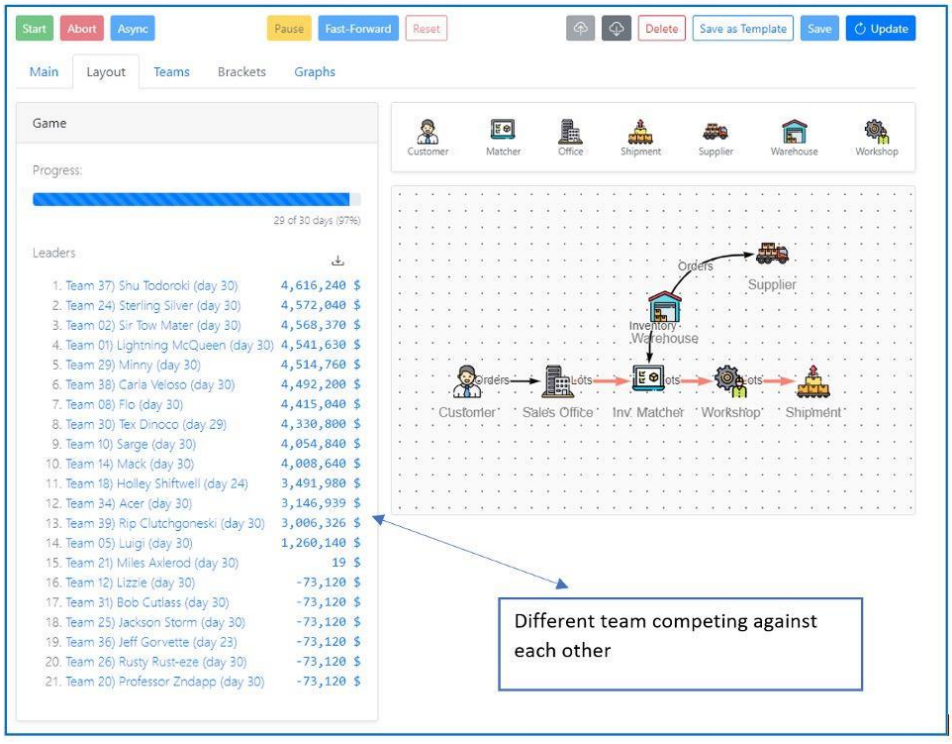

Figure 3-7. A screenshot of the ProTUce game (https://www.alliance4tech.eu/insysted/)

References

Bandura, A. (1986). *Social foundations of thought and action.* NJ: Englewood Cliffs.

Carretero Gomez, S., Napierala, J., Bessios, A., Mägi, E., Pugacewicz, A., Ranieri, M., Triquet, K., Lombaerts, K., Robledo Bottcher, N., Montanari, M. and Gonzalez Vazquez, I. (2021). *What did we learn from schooling practices during the COVID-19 lockdown? Insights from five EU countries.* EUR 30559 EN, Publications Office of the European Union, Luxembourg. doi:10.2760/135208.

De Notaris, D., Canazza, S., Mariconda, C., & Paulon, C. (2021). How to play a MOOC: Practices and simulation. *Entertainment Computing, 37,* 100395.

Dewey, J. (1938). Experience and Education. New York: Macmillan Company.

Fiske, D. W. (1949). Consistency of the factorial structures of personality ratings from different sources. *The Journal of Abnormal and Social Psychology*, *44*(3), 329–344. https://doi.org/10.1037/h0057198

Gee, J. P. (2005). Good video games and good learning. *Phi Kappa Phi Forum*, *85*(2), 3437

Gee, J. P. (2013). Games for learning. *Educational Horizons*, *91*(4), 16–20.

Krath, J., Schürmann, L., & Von Korflesch, H. F. (2021). Revealing the theoretical basis of gamification: A systematic review and analysis of theory in research on gamification, serious games and game-based learning. *Computers in Human Behavior, 125,* 1–33. *https://doi.org/10.1016/j.chb.2021.106963*

Langer, Lissy and Weibezahn, Jens and Tolstikhin, Konstantin and Volling, Thomas, INSYSTED – An Open-Source Platform for Blended Learning Based on Serious Games in Operations Management (June 7, 2021). Proceedings of the Conference on Learning Factories (CLF) 2021. http://dx.doi.org/10.2139/ssrn.3861629

Toto, G. A., & Limone, P. (2022). *Manuale TIC per una didattica inclusiva*. Mc-Graw Hill.

Locke, E. A. (1991). Goal theory vs. control theory: Contrasting approaches to understanding work motivation. *Motivation and Emotion, 15*(1), 9–28.

Marocco, D., Dell'Aquila, E., Zurlo, M. C., Vallone, F., Barajas, M., Frossard, F., Di Ferdinando, A., Di Fuccio, R., Lippens, M., Van Praag, L., Protopsaltis, A., Swertz, C., Arslan P., Y., & Mazzucato, A. (2019). Attain Cultural Integration through teachers' Conflict Resolution skills Development: The ACCORD Project. *Qwerty-Open and Interdisciplinary Journal of Technology, Culture and Education*, *14*(2), 11–30.

McGonigal, J. (2011). *Reality is broken: Why games make us better and how they can change the world.* NY: Penguin.

Michael, D., & Chen, S. (2006). *Serious games: Games that educate, train, and inform.* Boston, MA: Thomson Course Technology PTR.

Norman, W. T. (1963). Toward an adequate taxonomy of personality attributes: Replicated factor structure in peer nomination personality ratings. *The journal of abnormal and social psychology*, *66*(6), 574.

Ponticorvo, M., Ferrara, F., Mugione, M., & Barbaranelli, C. (2020). The Big Five game of personality: a digital role-playing game to assess and train students on Big Five Theory. In *PSYCHOBIT*.

Squire, K. (2006). From content to context: Videogames as designed experience. *Educational researcher*, *35*(8), 19-29.

Toto, G. A. (2018). Effects and consequences of media technology on learning and innovative educational strategies. *Online journal of communication and media technologies*, *9*(1), *e201902.*

Tupes, E. C., & Christal, R. E. (1992). Recurrent personality factors based on trait ratings. *Journal of personality*, *60*(2), 225-251.

CHAPTER 4:

HOW TO MONITOR AND ASSESS STUDENTS' LEARNING PROCESSES AND CULTIVATE SRL SKILLS IN DISTANCE LEARNING

Azusa Nakata, Hanna Järvenoja

What goes on inside a student's mind. Bing Image Creator

Executive summary

The final part of this guidebook focuses on how teachers can monitor and support students' learning processes in online and blended learning environments. This chapter emphasises the importance of SRL, providing strategies for teachers to help students develop their SRL skills through distance learning.

The chapter begins by summarising the previous chapters, which have discussed the significance of teacher scaffolding in developing students' SRL skills and the use of digital content and environment to create engaging learning experiences. Building on these ideas, the chapter discusses how teachers can support students by optimising scaffolding and utilising digital tools. Although it acknowledges the challenges of not being physically present with students, the chapter emphasises the advantage of online environments where students leave traces of their actions. Teachers can use these traces to assess students' progress and engagement and scaffold when students are facing challenges. The chapter suggests designing the learning environment or tasks in a way that guides students to make decisions and evaluate their learning so that teachers can promote student autonomy and agency in the learning process. For example, setting regular check-ups, implementing different assessment formats such as formative assessments, self-assessment and peer reflection and utilising digital tools and platforms that are useful for monitoring are all suggested.

As useful tools to support students' distance learning, this chapter introduces the concept of a learning diary for self-reflection and goal setting; it emphasises the importance of providing students with an understanding of SRL and the purpose of learning diaries before its implementation. Teachers are advised to structure a schedule for writing diaries, establish clear rules and provide feedback to students during and after the study course. Additionally, the chapter discusses the use of learning analytics dashboards (LADs) and group awareness tools (GATs) to support students' self-monitoring and collaborative learning processes. These tools can provide visualisations of students' learning progress, engagement and social dynamics within a group.

Overall, Chapter 4 provides practical strategies and tools for teachers to monitor, evaluate and support students' learning processes in online and blended learning environments. It emphasises the importance of promoting students' SRL skills and provides guidance on how to implement these strategies effectively so that they can keep on track in distance learning situations.

Introduction of the chapter

In the previous chapters, we introduced some practical examples of designing active, engaging learning with the help of digital tools. Chapter 2 discussed the significance of teacher scaffolding in developing pupils' SRL skills and various approaches to the implementation. It also introduced a pedagogical framework called the *5E model,* which can help structure learning activities to allow students to engage in the topics, explore them with experimental approaches, explain and elaborate on their gained knowledge and evaluate their learning. In Chapter 3, there were innovative digital learning designs, such as using serious games as a learning tool. Such playful, gamified learning materials can motivate and engage students in problem solving by giving them realistic scenarios and environments.

In this chapter, we provide universally applicable ideas (nonsubject specific) to help teachers monitor, evaluate and support their students' learning processes, particularly in online and blended learning scenarios. By following up on the students' progress in a timely manner, teachers can provide scaffolds and give prompts to make their students aware of the challenges and issues hindering their learning progress. Awareness of one's learning process and possible obstacles that disturb smooth learning is the first and most crucial step towards self-regulated learning. This is central in activating the agency of the learning process, enabling one to take charge of one's learning decisions made by defined criteria of the self-regulated learner. This does not imply, though, that teachers should not do more than increase metacognitive awareness in their students. Teachers can also provide help and assist in coping with different obstacles, particularly by providing support for adaptive regulation that can cumulate into the development of self-regulated learning skills. Teachers' ability to support students' SRL skills is built on an understanding of SRL and teachers' own SRL skills. These knowledge and skills create the grounds for applying SRL support in all phases of teaching, from planning to evaluation.

Supporting students' distance learning through monitoring and assessment

The ways to monitor student learning processes and cultivate self-regulated learning skills

In distance learning environments, it can be challenging for teachers to monitor their students' learning processes because they are not physically present in the same classroom or learning space. However, the advantage of these environments is that students leave traces of their actions, and these actions (or lack thereof) can indicate teachers on many aspects of their students' learning process. There are several useful strategies that teachers can use to capture their students' progress and engagement. By following the students' learning path, teachers can scaffold the students' learning process in different SRL phases and increase awareness of the challenge and assist them in addressing the issue, which can help develop students' SRL skills. Teachers can also, for example, design the learning environment or task in such a way that it explicitly or implicitly guides students to make decisions that support their learning, for example, by emphasising the role of planning and setting goals or prompts to evaluate progress in certain subphases.

Zimmerman and his colleagues (1996) stated that the pedagogical decision the teachers make should (gradually) shift the responsibilities of learning to students by changing students' mindsets towards learning; they are not passive takers but should be encouraged to become active controllers of their own learning. Student's autonomy is a key, particularly in distance learning situations, where the active, agentic learner is often a requirement for successfully completing the course or task. Therefore, alongside information providers, teachers should act as facilitators of the self-regulated learning process by, for example, doing the following:

a. Asking students to set goals and plans before a lecture, task, project and so forth.
b. Encouraging and supporting students to self-monitor their learning progress along the task.
c. Scaffolding (see Chapter 2) students in the face of challenges by assisting their analysis and helping with new goal setting and strategy selection.
d. Prompting awareness of motivational and emotional issues influencing learning decisions.

The important thing is when to intervene and how to detect when the students are facing challenges. To capture the students' temporal changes, we encourage teachers to design a systematic monitoring structure with different evaluation formats in the study course. Digital tools are also useful to collect data on student engagement and feelings towards the learning task. We propose the following practical strategies:

1. Set regular check-ups

Teachers can communicate with students regularly via email, video conferences or online discussion boards to ask how they are doing and offer support if needed. It can help teachers identify any problems or challenges that students are facing, but it can also give students feelings of being supported even in distant environments.

2. Use formative assessments

Teachers can use formative assessments, such as quizzes or short assignments, to check students' understanding of the learning materials and identify any areas where they may be struggling. In a MOOC environment (see Chapter 3), a teacher can set small assignments and tests after each section to track the students' progress and understanding of the topic. Providing step-by-step assessments can structure the learning path by dividing the wide content into smaller components.

3. Encourage self-assessment

Teachers can encourage students to self-assess their learning by asking them to reflect on what they have learned, what they still need to work on and how they can improve. This can help students take ownership of their learning and develop metacognitive skills, cultivating the students to become self-regulated learners. A learning diary is a good tool for encouraging student self-reflection!

4. Facilitate peer reflection

In addition to a self-assessment, a peer reflection moment after each (online) classroom session or end of the short-term course can be provided. This allows students to share their learning outcomes, thoughts and struggles with peers. For example, students can share their progress or evaluate each other's engagement through GATs. GATs also make it visible to teachers how students are progressing with the task by visualising student engagement and feelings in the collaborative learning activity.

5. Use learning management systems

Learning management systems (LMSs) allow teachers to monitor students' progress and engagement. Teachers can see when the students have accessed course materials, completed assignments or participated in online discussions. For example, Moodle can visualise student interaction on a particular course page, their completion of the task and the log data of accessing the system.

The impact of formative assessment and advantages of self- and peer evaluation are more deeply discussed in Chapter 2. By combining the different assessment modes and learning facilitation tools, teachers can follow their students in distance and scaffold students to increase awareness of their learning processes. Example models of implementation can be seen in Figure 4-1.

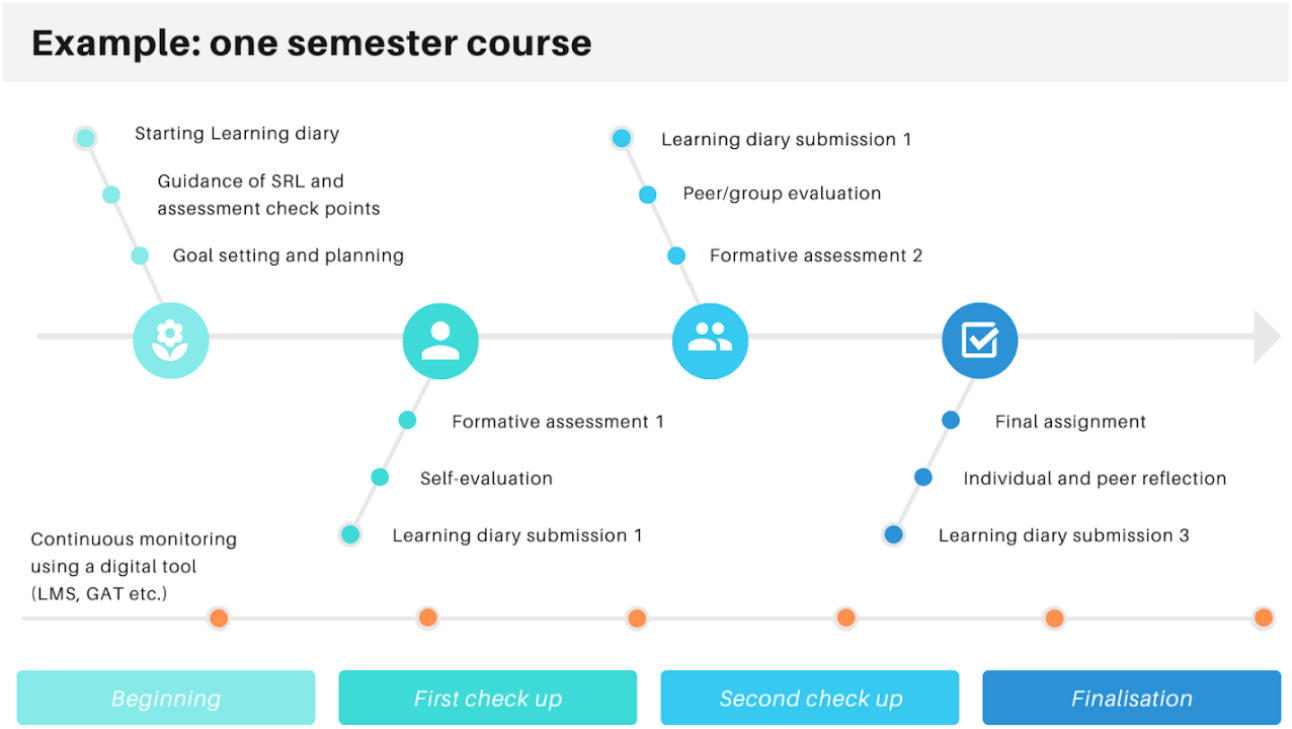

Figure 4-1. An example of the implementation of different assessment approaches

Assessing students' SRL skills

Here, we focus on assessing students' SRL skills. As a teacher, you should acknowledge and be aware that an SRL assessment is tightly tied to the decisions you make when designing the learning task, course and activities. When you plan your teaching, you define what type of data or information you have available for informing you about SRL and what kind of traces students leave behind regarding their SRL activities. When the focus is on the evaluation of SRL skills and processes, it is not enough to focus on the final products, but instead, it is important to involve information on individuals' ability to plan, monitor and evaluate their own learning processes, which are influenced by one's metacognitive skills, motivation, goal setting, self-monitoring and reflection. We suggest some concrete approaches, pedagogical tools and methods that can be used to tell students' SRL skills, as follows:

Self-report measures: Surveys, questionnaires or checklists can be used to gather self-reported data, for example, on an individual's self-regulated learning strategies, goal setting, time management, self-reflection and perceived level of self-regulation.

Leading question: *What are the needs and focus of your teaching?*

Learning Diary: Similar to self-report measures, asking students to write a learning diary in which they document their learning goals, experiences and takeaways and reflect on their progress is a good way to support students' SRL and assess their strategies. Learning diaries can also provide information on student's metacognitive processes.

Leading question: *How can you structure the diary to prompt the student's awareness of their SRL?*

Observation: Observing learners in real time can provide valuable insights into their self-regulatory behaviours. In distance learning situations, educators can observe how students are progressing using digital traces. However, be aware of what these traces actually indicate and help you interpret the situation!

Leading question: *What traces do you focus on to see some aspects of SRL?*

Reflection interviews: Teachers can ask students about their learning strategies and experiences during or after the study course. We recommend using learning diaries as a means to provoke self-reflection about their goal setting, applied strategies and learning

experiences and outcomes. It could be very educational to use learning diaries or some other material as a stimulus in the interview.

Leading question: *How can you structure the interview to prompt the student's reflection of their SRL?*

Performance assessment: Although it is not solely indicative of SRL, academic performance can be considered one of the outcomes of effective self-regulation. Assessing learners' academic achievements in relation to their self-regulatory behaviours can provide indirect evidence of students' SRL skills.

Leading question: *How can you design the performance measures that inform you on some aspects of SRL in addition to the content learning?*

It is important to understand that assessing SRL skills is a multifaceted undertaking that requires careful planning. It is not possible to separate the learning design from the SRL process because they are interconnected. The learning design influences the desirable SRL processes, the motivational and emotional challenges students may encounter and the cognitive learning strategies they employ. Therefore, it is crucial to consider in advance which aspects of SRL you wish to emphasise and then evaluate this.

Previous research has shown that motivational and emotional challenges often go unnoticed, making it reasonable to address these aspects separately. By intentionally combining different approaches and assessment methods, it becomes possible to gain a more comprehensive understanding of an individual's ability to regulate their learning. To simplify this complex task, we have developed an example assessment rubric that considers both the learning task design and students' processes. The example rubric is presented below. However, please note that it is only an example, and you should customise it according to your specific goals and requirements. The more concrete you plan about different sources that inform you about the various SRL aspects, the more specific you can trace students' SRL processes.

Teachers can use this type of rubric before (when designing learning activities), during (when students are doing activities) and after the study course. Because the rubric is editable for a particular need and context, it is applicable for any subject and at any educational level, regardless of the study format, either in a classroom or distance. In addition, teachers can customise the questions according to their contexts and needs. A blank template can be found in the Annexes.

(EXAMPLE)

BEFORE LEARNING: Designing the course/task/activity

		From cognitive (metacognitive) perspective	From motivation perspective
How your course/task/ activity design addresses...	Forethought phase?	Let students divide one task into small steps and set specific goals for each step.	Ask students to write down each concrete step and cross it out when accomplished.
	Performance phase?		
	Reflection phase?		
What are methods, tools, pedagogical structures help you capture students' SRL in…	Forethought phase?	Use a flipped-classroom approach with guiding questions. Ask students to answer the questions to see how they understand the task.	Before each session, let students rate their motivation level towards a lecture and give reasons for it.
	Performance phase?		
	Reflection phase?		

Please write down concrete plans to support each SRL phase from both cognitive and motivation perspectives.

Please check what tools and methods you use to facilitate students' goal setting, strategic planning, monitoring, adapting strategies and reflection?

What type of evidence will you have on the students' use of different learning strategies?					
	Self-report measure ☐		Learning diary ☒	Observation ☐	
	Reflection interview ☐		Performance assessment ☒	Other (specify)	

DURING LEARNING: Students' performance and their awareness of the SRL process

Forethought phase					
What type of goals your student set? The goals are …					
From cognitive (metacognitive) perspective	specific and concrete	☒	From motivation perspective	related to mastering the content	☒
	divided into small steps	☒		related to developing the personal growth	☐
	reflected with one's own prior knowledge and skills	☐		related to performance (e.g., good grade)	☐
	consistent with one's current capacity	☐		related to external stress (e.g., pressure from parents etc.)	☐
	structured with good time management plan	☐		related to something else (e.g., avoiding failure)	☐
How did the student understand the task? What indicates that?					

Please check how students' goals and strategies worked during performance.

Performance phase					
How effective were the students' learning strategies towards the task?	Not effective ☐	25% effective ☐	50% effective ☐	75% effective ☒	Very effective ☐
When did the student seek help?					
How did the student commit to leaning when facing challenges (motivation wise)?					

This sheet (during learning) can be used for evaluating an individual student or a whole classroom as a general view.

Reflection phase					
How accurate is the student self-evaluation towards their learning outcomes?	Not accurate ☐	25% accurate ☐	50% accurate ☐	75% accurate ☒	Very accurate ☐
How does the student explain their failure/success (motivation)?	Student XX estimated to get scores over 80, but the result was 65. He attributed this to a lack of time because of underestimation of master content in Unit 3.				

Learning diary

A learning diary is a tool that can trigger a student's goal setting, strategic planning and self-motivation towards the task. Students can reflect on, analyse and evaluate their own learning experiences through the writing process of the learning diary. Doing so enhances metacognitive skills, such as becoming aware of the challenges and controlling the situation at hand. Learning diaries also lead to students' cognitive development, such as enhancing comprehension, elaboration and critical thinking by asking them to state main points of the lecture in light of their takeaways. For teachers, doing this can visualise what and how the students have learned in a lecture/course, which helps them understand the situation of the students.

The key of a learning diary is to speak with your own voice. Students write what they have heard and learned and find interesting from their own perspectives, instead of repeating what was taught in the classroom. Importantly, writing a learning diary should be systematic and require less effort. We encourage teachers to set certain rules for a learning diary: the timing of writing and submitting the diary and the amount of words.

However, some empirical studies demonstrated that applying a learning diary alone barely improves students' use of SRL; however, combining it with supporting training enhances those skills (Broadbent et al., 2020; Dörrenbächer & Perels, 2016; Fabriz et al., 2014). For example, Dörrenbächer and Perels (2016) found that the implementation of a learning diary with training positively influenced students' goal setting, volitional control, adaptive self-reaction (with medium effects), planning, self-efficacy and task strategies (with large effects). This emphasises the importance of prior knowledge about SRL and teacher's intervention. Systematic scaffolding and structured reflection can improve students' self-monitoring skills, which enhances the effect of the learning diary and, in turn, develops students' SRL skills (Fabriz et al., 2014).

Recommended implementation of learning diary

In this section, we would like to give a recommended implementation flow of a learning diary in a study course. You can also see the visual flow in Figure 4-1.

STEP 1. Provide students with an introductory session of writing a learning diary

As suggested above, students must learn the concept of SRL and the importance of self-monitoring before starting to write a learning diary. The main reason is to help students understand the longitudinal benefits of writing a learning diary so that they can proactively self-monitor and self-motivate to write. According to Fabriz et al. (2014), students may decrease their motivation in activating learning strategies when they are assigned only a learning diary without understanding the benefits. Thus, it is a crucial step at the start.

STEP 2. Structure a schedule for writing a diary

Ideally, students write a diary every time before and after the lecture to encourage them to set goals and reflect on their learning for each lecture. However, teachers can adjust the frequency, depending on the course structure and given workload for the students (e.g., each time before and after a small module consisting of a series of lectures). The key point is to structure the timing of writing to follow a regular routine. Teachers can ask students to submit their diaries in the middle of the course, for instance, at the first and second check-up points.

STEP 3. Make clear rules for writing

It is a self-reflection tool but still needs some regulation to avoid confusion. For example, minimum and maximum lengths, submission deadlines, avoiding writing people's and organisation's names and so forth. It is also important to clarify that the content of the learning diary will not be assessed for grading.

STEP 4. Provide the students with feedback during and after the course

We encourage teachers to scaffold students by reviewing their learning diaries during the study course. Teachers could, for example, help them understand unclear concepts, encourage them to use different strategies, listen to their concerns and assist them to overcome challenges at hand. It is also effective to set a reflection time at the end of the course by letting the students review their diaries and evaluate their learning. With a teacher's intervention, students can find a learning diary more valuable and sustain their motivation to keep writing.

An example template of a learning diary can be found in the Annex. The guiding questions are designed to fit higher education students by default but can be adjusted to the target students.

Useful digital tools supporting teachers in monitoring students' learning processes

Learning management systems

LMS are software applications used to deliver educational materials and manage students' learning progress; these can collect various data of the learning activity, for example, student interaction in a particular course page, their completion of the task and a log data of accessing the system. With the system, teachers can monitor their students' engagement and progress in their learning and scaffold them when they seem to be stuck. More specifically, teachers can do the following:

- Understand students' learning difficulties
- Support the students' learning goals and paths
- Detect personal characteristics of learning
- Adjust courses to fit different learners
- Provide continuous assessment
- Prevent potential dropouts

Similar to LMS, the LAD also helps students gain insights into their academic performance and prompt actions towards their desired goals. Schwendimann et al. (2016) defined LAD (in their study, they call learning dashboard) as 'a single display that aggregates different indicators about learner(s), learning process(es) and/or learning context(s) into one or multiple visualizations' (p. 37). Prior studies have shown that learners benefited from regular feedback from the dashboard and improved their academic performance and resilience to study (Russell et al., 2020; Van Horne et al., 2018). According to Corrin and de Barba (2014), students used the dashboard information to reflect on their progress and make a plan, which, in turn, improved their motivation towards the subject.

However, Matcha et al. (2019) revealed through their systematic review that most of the LADs they found and included in their final review did not ground theory of SRL and did not support student metacognitive awareness or strategy use. Similarly, a systematic review by Heikkinen et al. (2022) claimed that only a few LADs positively impacted SRL and supported all three phases of the SRL cycle (planning, performance and reflection). This emphasises that teachers' additional intervention is essential in supporting students in activating regulation of learning when utilising digital prompts, such as LMS and LAD.

Group awareness tool

GAT is a computer-mediated system designed to support collaborative learning processes by giving the group members relevant information. The information covers a variety of behavioural, social and cognitive input from the individual group member, for example, one's characteristics of learning (e.g., interest, expertise, prior knowledge, etc.) or situational elements (e.g., location, availability, engagement, feelings and so forth; Bodemer et al., 2018). Although GAT is meant to support group learning processes, the information focuses on individual cognitive and social behaviours (Bodemer et al., 2018; Phielix, 2012); hence, GAT can increase awareness of individual SRL and, in turn, enhance group-level monitoring and regulation by visualising members' situations and potential challenges in the group (Järvelä et al., 2015). We introduce two GATs that are designed to enhance students' self-monitoring and evaluation and group-level regulation of learning during collaboration.

The S-REG tool (Järvenoja et al., 2020) is an application designed to support SSRL (see Chapter 1) in CSCL environments. The system collects group members' input of cognitive, motivational and emotional states during collaborative learning, displaying the overall state of the group through the use of a traffic light. This facilitates the individual assessment about their interests, task understanding, motivation and emotion for the task, eventually prompting the group to discuss the collective results and take active action to use regulatory strategies in case of poor status (Järvenoja et al., 2020).

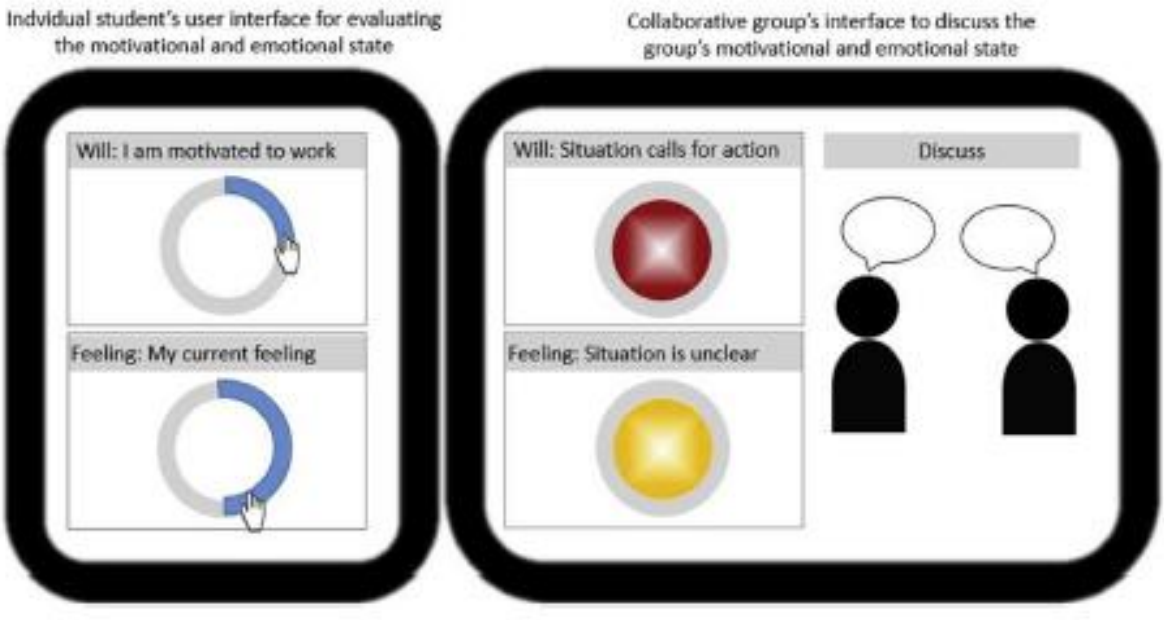

Figure 4-2. S-REG user interface (Järvenoja et al., 2020)

Feedback and Reflection in Online Collaborative Learning (FROCOLE) is an application designed to facilitate students' social interaction in online, distance learning settings. The idea of the visualisation of feedback is built on Phielix's work (see Kirschner et al., 2015; Phielix, 2012). The app aims to support group processing (see Johnson & Johnson, 1999, 2009), requiring regulation of each member's own learning behaviour (self-regulation) and of the other group members (co-regulation) and group as a whole (socially shared regulation) to achieve the collective learning goals (Kirschner et al., 2015). According to the developers (see Henderikx & Kreijns, 2022), the FROCOLE app facilitates two diagrams: IPF-RD (individual evaluation) and GPF-RD (group evaluation), which can contain up to nine performance indicators (a new version 2.0 has added a product diagram and includes history awareness). The IPF-RD provides feedback to each group member by rating them on individual performance indicators (e.g., reliability, productivity), while the GPF-RD provides feedback on the group as a whole by rating group performance indicators (e.g., purposeful communication, group climate).

Figure 4-3. The FROCOLE app's feedback screens (left: IPF-RD / right: GPF-RD) (Henderikx & Kreijns, 2022).

Practical use of digital supporting tools

Although the above-mentioned LMS and LAD and awareness tool are useful prompts, the data itself do not provide an understanding of the situation. Therefore, teachers and students need to interpret and make sense of the data to better understand real situations. When implementing such tools, it is also important to explain the purpose and benefits of using the tool to students. Some students may feel uncomfortable collecting data from them and tracking their learning activities. Thus, teachers need to provide clear guidance and training sessions to utilise the tool before the study course. Accordingly, ethical considerations, data management policies and legal restrictions must be considered when implementing learning analytics, but we do not discuss these aspects in this guidebook.

References

Bodemer, D., Janssen, J., & Schnaubert, L. (2018). Group awareness tools fo computer-supported collaborative learning. In F. Fischer, C. E. Hmelo-Silver, S. R. Goldman, & P. Reimann (Eds.), *International handbook of the learning sciences* (pp. 351–358). Milton: Routledge.

Broadbent, J., Panadero, E. & Fuller-Tyszkiewicz, M. (2020). Effects of mobile-app learning diaries vs online training on specific self-regulated learning components. *Educational Technology Research and Development*, *68*, 2351–2372 https://doi.org/10.1007/s11423-020-09781-6

Corrin, L., & de Barba, P. (2014). Exploring students' interpretation of feedback delivered through learning analytics dashboards. *Proceedings of ASCILITE 2014 - Annual Conference of the Australian Society for Computers in Tertiary Education, February 2015*, 629–633.

Fabriz, S., Dignath-van Ewijk, C., Poarch, G., & Büttner, G. (2014). Fostering self-monitoring of university students by means of a standardized learning journal—A longitudinal study with process analyses. *European Journal of Psychology of Education*, *29*(2), 239–255. https://doi.org/10.1007/s10212-013-0196-z

Heikkinen, S., Saqr, M., Malmberg, J., & Tedre, M. (2022). Supporting self-regulated learning with learning analytics interventions–a systematic literature review. *Education and Information Technologies*, 1–30.

Henderikx, M. A., & Kreijns, C. (2022). Development and evaluation of the 'feedback and reflection in online collaborative learning' (frocole) App. In Luis Gómez Chova, Agustín López Martínez, & Ignacio Candel Torres (Eds.), *INTED2022 Proceedings* (pp. 1582-1590). IATED Academy. INTED Proceedings https://doi.org/10.21125/inted.2022.0474

Järvelä, S., Kirschner, P. A., Panadero, E.,Malmberg, J., Phielix, C., Jaspers, J., Koivuniemi,M., & Järvenoja, H. (2015). Enhancing socially shared regulation in collaborative learning groups: Designing for CSCL regulation tools. *Educational Technology Research and Development*, *63*(1), 125–142.

Johnson, D. W., & Johnson, R. T. (1999). *Learning together and alone: Cooperative, competitive, and individualistic learning* (5th ed.). Boston, MA: Allyn and Bacon.

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, *38*, 365–379.

Kirschner, P. A., Kreijns, K., Phielix, C., & Fransen, J. (2015). Awareness of cognitive and social behaviour in a CSCL environment. *Journal of Computer Assisted Learning*, *31*(1), 59–77.

Matcha, W., Gašević, D., & Pardo, A. (2019). A systematic review of empirical studies on learning analytics dashboards: A self-regulated learning perspective. *IEEE Transactions on Learning Technologies*, *13*(2), 226–245.

Phielix, C. (2012). *Enhancing collaboration through assessment & reflection* [Unpublished doctoral dissertation]. Utrecht University, Utrecht, The Netherlands.

Schwendimann, B. A., Rodriguez-Triana, M. J., Vozniuk, A., Prieto, L. P., Boroujeni, M. S., Holzer, A., Gillet, D. & Dillenbourg, P. (2016). Perceiving learning at a glance: A systematic literature review of learning dashboard research. *IEEE Transactions on Learning Technologies*, *10*(1), 30–41.

Van Horne, S., Curran, M., Smith, A., VanBuren, J., Zahrieh, D., Larsen, R., & Miller, R. (2018). Facilitating student success in introductory chemistry with feedback in an online platform. *Technology, Knowledge and Learning*, *23*, 21–40.

Zimmerman, B. J., Bonner, S., & Kovach, R. (1996). *Developing self-regulated learners: Beyond achievement to self-efficacy*. American Psychological Association. https://doi.org/10.1037/10213-000

CONCLUSION

The school of the future. Bing Image Creator

CONCLUSION

This guidebook has attempted to provide readers with useful pedagogical theories and their practical implementation to support distance and blended learning. The first chapter introduced SRL theory, the role of motivation in SRL and the extended conception of SRL to collaborative learning. The second chapter addressed teacher intervention—namely scaffolding—to enhance students' SRL skills while providing different types of scaffolding and assessment methods. The third chapter discussed the benefits of the digital environment, such as the inclusiveness and flexibility of MOOCs and the playfulness and authenticity of leaning through video games. Finally, the fourth chapter provided practical tips for monitoring and supporting students in distance learning situations by combining different assessment approaches and digital tools.

Although the pandemic has been on a downward trend, as stated by the World Health Organization (WHO) in May 2023, we can easily anticipate that distance and blended modes of learning will continue because of its pedagogical impact and great flexibility. In this era in which such complex educational means are normal and even encouraged, it is not enough for educators just to become capable of using digital tools and platforms. Instead, they need to know how they can take advantage of technological empowerment in cultivating students' skills required for today's world, such as taking control of their own learning to become lifelong learners. In this regard, we hope that our guidebook can provide you with some insights and practical tips for orchestrating successful online and blended learning.

ANNEXES

Laptops dreaming skies. Bing Image Creator

Chapter 2: Practical lesson — Case of online learning

Here, we describe how an instructor could apply the 5E model by using the structure of the lesson proposed by Hirumi (2013). The lesson that we propose is on the 'theory of mind' and 'metacognitive learning'. The lesson has been proposed within an educational psychology setting; however, the lesson structure could be applied in every field and for each subject. As an online learning platform, Moodle forum is suggested; however, this could also be done on a website or other interactive tools.

The first aim is to engage the users with innovative resources and with triggers; the second step is to allow for the exploration of the main topic with further discussion and inquiry. Next, the focus is on the explanation of the contents going in deep with the activities that anticipate the elaboration and the transfer of knowledge. Finally, the last part covers the evaluation of the results with online tools.

Engagement 

The mind is our way to analyse and know reality. Think about your day. When have you used your mind today? List five moments where your mind was key today. Write a sentence to explain which mind resource you have applied in these moments. After you have posted your lists on Moodle, respond to at least one classmate's postings. You may wish to ask a question, or you may simply make a comment.

Hint: You may need to analyse each simple activity you performed during the day.

Example: My bus was delayed; my mind was central to finding a solution to ensure that I arrived in time to the morning meeting.

Exploration 

After engaging learners, the lesson exposes them to key concepts related to theory of mind. Exploration consists of one activity taking place in an online environment. The online discussion asks learners to make a distinction between cognitive and noncognitive skills. In this online discussion, we advise the instructor to participate actively, encouraging learners to use examples to explain their answers and redirect the discussion as necessary. To explore this concept, the proposal is to play with the 'guess who' game.

The "guess who" game is a fun, interactive activity for a group and could be considered a serious game. It requires at least two players, but it is more powerful with multiple people. The teacher, who represents the leading person, will select a participant, which will be written on a card.

1. The person leading the game should welcome everyone to 'virtual guess who' and ask them to mute themselves.
2. Everyone should make sure their Zoom's on gallery mode and that their cameras are on.
3. Everyone should put at least one item of fancy dress, an item like glasses, hats, masks, scarfs, etc.
4. The person leading the game should choose someone and write it on a card. They shouldn't tell other participants whom they have chosen.
5. The person leading the game should say another player's name. That person should unmute themselves and ask a question to help them figure out who is chosen. The teacher could decide to give the floor to each student in turn. The question should be able to be answered with 'yes' or 'no' and should be based on things everyone can see. Once they have asked their questions, they should mute themselves again.

   For example, they can ask *'Are they wearing sunglasses?'* or *'Are they wearing their hat back to front?'*, but they cannot ask *'What colour is their hair?'* etc.
6. The person leading the game should answer 'yes' or 'no' and choose someone else to ask a question.
7. Everyone should keep track of the answers. When they think they know who the chosen player is, they should type their guess into the chat.
8. The person leading the game should reveal who guessed correctly.

The instructor will then lead a discussion related to the serious game. You are to share your notes with the class during the discussion. Obviously, the serious game could also be in virtual mode.

- What skills does the game trigger?
- How is the mind involved in the process?
- Which cognitive resources do you integrate?
- Which are the cognitive and noncognitive skills?

Explanation

In the third instructional activity, the instructor asks learners to explain in detail the issues and challenges related to false beliefs. The first activity proposes the vision of a video on false beliefs (https://www.youtube.com/watch?v=LAfk4M0nC3M)

Questions:

1. What do the children think when the presenter of the activity changes the setting, more specifically, after telling the Children that Kealy takes the muffins using the shoes of her brother while her mum is away?

2. Why do the children go wrong with the replies regarding the scenarios proposed?

3. How many years are the children in the video?

4. Which cognitive resources do you need to be in 'the shoes of another person'?

Elaboration

The fourth instructional event of this lesson provides an opportunity for students to use and elaborate on what they have learned. More specifically, learners can apply what they have learned in the previous sections to complete an extension activity. In this activity, learners will work in teams; this activity consists of learners developing an informed response to a specific problem or question. This activity may begin in the classroom and then may be

completed as homework to be presented later to the online class or posted on the course's website. The role of instructors is vital to the success of this step because their feedback will support learners' deepening understanding of the topic and synthesis of ideas already addressed in the previous instructional events.

Exercise: Working with your group, complete the following task and then present your results to the class. In your group, record your possible responses to the assigned prompt and then develop a plan or presentation that satisfies the prompt requirements. This activity may be completed over two class periods or may be assigned homework.

Task: Create a presentation proposing a false belief task on the life of Vygotsky and describe how the theory of mind interferes with learning by referring to metacognitive learning.

Evaluation 

This event consists of two activities to evaluate learners' mastery of the lesson's objectives. The first activity presents learners with an online opportunity to review materials associated with theory of mind and metacognitive skills. The second activity is carried out using an gamified test Quizizz.

Background for Teachers: Quizizz (https://quizizz.com/) is a learning platform that offers multiple tools to make a classroom fun, interactive and engaging. As a teacher, you can create lessons, conduct formative assessments, assign homework and have other interactions with your students (for all grades) in a captivating way. Quizizz (opens in a new tab) is primarily an online-based quiz tool that operates like a gameshow. Hence, it is a question-and-answer platform that works across web browsers and Chrome, as well as iPhone and Android devices, with dedicated apps for both. From a student's perspective, this makes learning more fun with the addition of game-based interactions and the possibility to work through a quiz using their own devices. For teachers, there is a host of prebuilt quizzes to pick from, as well as the option to edit and create their own from scratch.

TEST (Individual Online Activity): Create your own test or take one from the library. A suggested solution could be to use the following link with a ready quiz on the topic (https://quizizz.com/admin/quiz/635e9f8f726653001e2673ae?source=quiz_share). However, it depends on the content of the discussion and the additional materials you provided for your class group. At the end of the test, you could evaluate your group and make a debriefing, studying the questions the class considered more difficult or they had not replied to properly.

Chapter 4: Assessment tool for students' SRL skills

BEFORE LEARNING: Designing the course/task/activity

How your course/task/ activity design addresses...		From cognitive (metacognitive) perspective	From motivation perspective
	Forethought phase?		
	Performance phase?		
	Reflection phase?		
What are methods, tools, pedagogical structures help you capture students' SRL in…	Forethought phase?		
	Performance phase?		
	Reflection phase?		
What type of evidence will you have on the students' use of different learning strategies?		Self-report measure ☐	Learning diary ☐
		Reflection interview ☐	Performance assessment ☐
			Observation ☐
			Other (specify)

DURING LEARNING: Students' performance and their awareness of the SRL process

<table>
<tr><td colspan="6"><u>Forethought phase</u></td></tr>
<tr><td colspan="6">What type of goals your student set? The goals are…</td></tr>
<tr><td rowspan="5">From cognitive (metacognitive) perspective</td><td>specific and concrete</td><td>☐</td><td rowspan="5">From motivation perspective</td><td>related to mastering the content</td><td>☐</td></tr>
<tr><td>divided into small steps</td><td>☐</td><td>related to developing the personal growth</td><td>☐</td></tr>
<tr><td>reflected with one's own prior knowledge and skills</td><td>☐</td><td>related to performance (e.g., good grade)</td><td>☐</td></tr>
<tr><td>consistent with one's current capacity</td><td>☐</td><td>related to external stress (e.g., pressure from parents etc.)</td><td>☐</td></tr>
<tr><td>structured with good time management plan</td><td>☐</td><td>related to something else (e.g., avoiding failure)</td><td>☐</td></tr>
<tr><td colspan="2">How did the student understand the task? What indicates that?</td><td colspan="4"></td></tr>
<tr><td colspan="6"><u>Performance phase</u></td></tr>
<tr><td colspan="2">How effective were the students' learning strategies towards the task?</td><td>Not effective ☐</td><td>25% effective ☐</td><td>50% effective ☐</td><td>75% effective ☐</td><td>Very effective ☐</td></tr>
<tr><td colspan="2">When did the student seek help?</td><td colspan="4"></td></tr>
<tr><td colspan="2">How did the student commit to leaning when facing challenges (motivation wise)?</td><td colspan="4"></td></tr>
<tr><td colspan="6"><u>Reflection phase</u></td></tr>
<tr><td colspan="2">How accurate is the student self-evaluation towards their learning outcomes?</td><td>Not accurate ☐</td><td>25% accurate ☐</td><td>50% accurate ☐</td><td>75% accurate ☐</td><td>Very accurate ☐</td></tr>
<tr><td colspan="2">How does the student explain their failure/success (motivation)?</td><td colspan="4"></td></tr>
</table>

Chapter 4: Learning Diary Template

BEFORE LECTURE ANSWER TO THESE QUESTIONS	**Lecture name:**
	Date
What is your learning topic?	
What do you think about the learning topic? *Is it familiar to you?* *Is the topic interesting to you?*	
What is your task?	
Do you have any goals related to this week's topic?	
How do you feel about the task?	

AFTER LECTURE ANSWER TO THESE QUESTIONS	**Lecture name:**
	Date
What did you learn? What was new to you?	
How did the lecture relate to your prior learning and life experience?	
How did you actually work? *Did you achieve your learning goals?* *Did you manage to follow your plans?*	
What did you not understand? What was unclear or against your view?	
What is the feelings towards your learning process and outcomes?	

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