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How do students self-regulate? Review of Zimmerman's cyclical model of self-regulated learning

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Título: ¿Cómo autorregulan nuestros alumnos? Modelo de Zimmerman sobre autorregulación del aprendizaje.
Resumen: El uso de las estrategias de aprendizaje explica de forma crucial los resultados académicos de los alumnos. Un buen uso de estas estrategias permite un aprendizaje profundo y transferible. Los modelos de autorregulación se basan en teorías holísticas y comprehensivas sobre las estrategias de aprendizaje. En este trabajo se analiza el modelo de Zimmerman (2000; 2003; Zimmerman y Moylan, 2009), detallando los diferentes procesos recogidos en el modelo con ejemplos para ayudar a su visualización. El modelo de Zimmerman es uno de los más extendidos en la literatura científica en el campo siendo ampliamente citado por los especialistas en el campo. El trabajo de Zimmerman parte de una base socio-cognitiva, con especial cobertura de las influencias mutuas entre motivación y autorregulación. En este trabajo también se comparan otras teorías sobre aprendizaje autorregulado con la de Zimmerman para explicar el concepto de una forma más completa.
Palabras clave: Autorregulación; modelo autorregulación; Zimmerman; estrategias de aprendizaje; motivación; volición; autoeficacia; autoevaluación; atribuciones.

Abstract: The use of learning strategies is crucial for students' academic performance and promoting deeper learning approaches. The self-regulated learning models offer comprehensive theoretical backgrounds. These enable more holistic approaches to the use of learning strategies. In this paper, Zimmerman's (2000; 2003; Zimmerman & Moylan, 2009) cyclical model of self-regulated learning is described and analysed as one of the most comprehensive. The model is grounded in social cognitive theory and is comprised of three phases (forethought, performance and self-reflection) with a special focus on the influences of motivation on self-regulation. The different processes included in the model are analysed here in detail. Zimmerman's framework is considered in relation to other self-regulated learning models in order to recognize its importance in theory and practice.
Keywords: Self-regulated learning; self-regulation; self-regulation model; Zimmerman; learning strategies; motivation; volition; self-efficacy; self-assessment; attributions.

Introduction

The use of adequate self-regulatory learning strategies is fundamental for students to have academic success in primary (Dignath, Büttner, & Langfeldt, 2008), secondary (Dignath & Büttner, 2008) and higher education (Sitzmann & Ely, 2011). Due to this importance of self-regulation in academic performance, it is crucial to explore which of the different self-regulatory theories is better adapted to cover the pedagogic needs faced by students in classrooms (Dignath & Büttner, 2008; Heikkiläa & Lonka, 2006).

There are different theories that explain how self-regulated learning (SRL) works as presented by Puustinen and Pulkkinen (2001) and Zimmerman (2001). All these theories share the common ground that self-regulation is composed of different processes (e.g., monitoring, goal setting, etc.) and it is cyclical, meaning that each performance of the task provides feedback for the strategy used in future tasks. In the last years, the models by Zimmerman (2000), Winne (1996, 1997) and Boekaerts (1999; Boekaerts & Niemivirta, 2000) have received considerable attention. Even with the existing shared aspects between these models, there are still relevant differences. As an example, Winne's model (1996, 1997) is highly cognitive, Zimmerman's model comes from social-cognitive theory and Boekaerts' model (1999) is more situated, exploring the influence of the context in the type of goals the students pursue. Here we will provide and in-depth presentation of Zimmerman's cyclical phase model as it includes processes coming from other self-regulation theories (for example, volition) and has been widely used in the scientific literature. To have a more comprehensive understanding of the phenomena, we will also compare some aspects of the models that will be amplified with other self-regulatory model ideas. Before we move to the next section, we would like to mention that Zimmerman has two other SRL models: the triadic analysis of self-regulation, which represents the interactions of three forms of self-regulation from a social cognitive theoretical perspective: environment, behaviour and person (Zimmerman, 1989) and a multi-level model of self-regulation (Zimmerman, 2000) which explains the instruction and acquisition of the self-regulatory processes. Nevertheless, most research refers to the cyclical phase model as the main model from Zimmerman, for that reason we will refer to it as Zimmerman's model.

Concept and theories of self-regulation

The challenge we face as teachers is how to help our students learn intentionally, autonomously and effectively, which it is achieved using self-regulation. What exactly is self-regulation?

Definition

Self-regulation is the control that students have over their cognition, behaviour, emotions and motivation through the use of personal strategies to achieve the goals they have

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established. Initially, there is the "control of cognition," which it is the cognitive component of self-regulation also known as metacognition. In the past it was considered as the only process of the precursor of strategic learning (Boekaerts & Corno, 2005). These days, however, metacognition it is thought to be a component of self-regulation (Winne & Hadwin, 1998; Zimmerman & Moylan, 2009).

The definition also includes "behaviour control" as it is needed to control what the student is actually doing to achieve the goals, and "emotion control" as students experience emotions while performing academic tasks; thus, controlling the emotions is crucial, especially when the tasks could block the students' performance (Boekaerts & Corno, 2005). As students can also generate positive emotions while learning (e.g., pride, happiness), it is important to point out that emotion control refers not only to the regulation of negative emotions.

Finally, the definition contains "motivation control," which has received attention more recently (Kuhl, 2000; Wolters, 2003a). This type of control consists of being aware of one's motivation and generating self-motivation, maintaining interest and attention during a task. There is a line of research known as volition that argues that motivation influences attraction to a task, but once a student engages in learning or performance, volitional processes take over (Corno, 2001). In sum, as students can learn to control their motivation (Corno, 2008; Wolters, 2003a), it is necessary to include it in the definition of self-regulation.

The last part of the definition is "to achieve the goals they have established." The students establish their goals and then self-regulate to achieve them but, unfortunately, these goals are not always orientated toward learning (Boekaerts & Niemivirta, 2000). The goal orientation research has identified three main orientations: learning, performance and avoidance (for empirical evidence and reflections about the three versus four goal orientations see Alonso-Tapia, Huertas, & Ruiz, 2010). Historically, self-regulation has been conceptualised as a process in which students use a number of positive learning strategies orientated toward learning (Paris, Byrnes, & Paris, 2001; Paris & Paris, 2001). However, students can also have avoidance goals and activate a number of strategies detrimental for their learning, such as, pretending they are sick, cheating on an exam, etc. (Boekaerts & Corno, 2005; Elliot, 1999; Elliot & Covington, 2001). This phenomenon, known as *self-handicapping* is also considered self-regulation as it is a response to the students' goal: avoid the task. Consequently, it is essential to promote learning environments in which the students feel safe and they activate learning goals (Alonso-Tapia, 2005b; Alonso-Tapia & Fernandez, 2008). As put by Paris, Byrnes and Paris (2001) note: "Self-regulated learning requires that students choose appropriate goals as the object of their effort" (p. 269) and, for that, teachers have a key role in creating a classroom climate that is motivationally positive.

Phases, processes and acquisition of self-regulation

Phases and processes

Zimmerman's is one of the most comprehensive models and presents specific information how the different processes work (Zimmerman & Moylan, 2009). In the next sections we will analyse the phases and processes of Zimmerman's model, indicating those with which we disagree (namely, three). First, some processes are not included in the model; second, the delimitation of the three phases; and, third, the absence of some emotional aspects included in Kuhl's model (Kuhl, 1994; Kuhl, 2000). Before that we will present a brief historic evolution of the model.

Historical evolution of Zimmerman's model

The cyclical phase model was presented in 2000 with the processes divided into each phase in a separated table (Zimmerman, 2000). In 2003, the processes were included in the figure (Zimmerman & Campillo, 2003) and in 2009 the model was revised (Zimmerman & Moylan, 2009) (Figure 1) including more processes in the performance phase and defining in more details all the processes and how they interact.

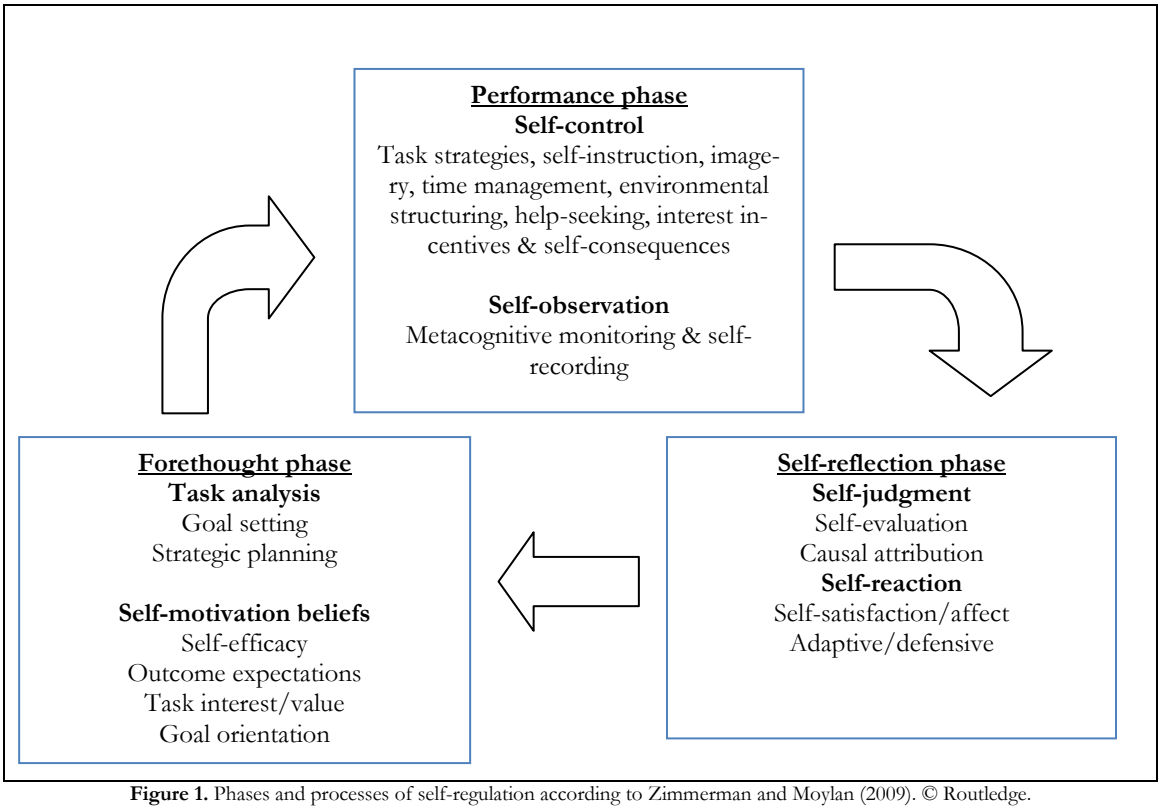

Figure 1. Phases and processes of self-regulation according to Zimmerman and Moylan (2009). © Routledge.

Forethought phase

It is the initial phase in which the students approach the task (see Figure 2), analysing it, assessing their capacity to perform it with success and establishing goals and plans regarding how to complete it. The task interest and the goal orientation play a crucial role to achieve adequate planning and performing the task appropriately. In this phase the students do two main activities. First, they analyse what the task characteristics are by creating a first representation of how it should be performed. Second, they analyse the value the task has for them, this conditions their motivation and effort, and therefore, the attention they will pay during the performance; in other words, their activation of self-regulatory strategies. Next, we present these two processes in more detail.

Task analysis

According to Zimmerman & Moylan (2009), the self-regulatory cycle starts with the task analysis where this is fragmented into smaller pieces and the personal strategies for the performance are chosen based on previous knowledge and/or experience (Winne, 2001). This is the phase in which the goals and strategic planning are established, which are key conditions for self-regulation to occur.

Students consider two crucial variables when establishing their goals: the assessment criteria and the performance level they want to achieve (Winne & Hadwin, 1998). The assessment criteria are the standards against which the performance will be assessed (e.g., a criterion for a summary is that it should contain the main idea from the text that is being summarised). The problem comes when the students do not know these criteria; this is the case many times as teachers do not always state explicitly how the tasks are going to be assessed. When this happens, students have more difficulties establishing appropriate goals. This is supported by research that has found positive effects on students' learning when assessment criteria are explicitly stated (Andrade & Valtcheva, 2009; Jonsson, 2013; Panadero & Jonsson, 2013).

The second factor that influences goal setting is the students' desired level of performance, which interacts with the assessment criteria (Pintrich & de Groot, 1990). We provide an example to help the reader visualise this interaction. For one particular task a student knows that to achieve an excellent level of performance he or she has to put forth a lot of effort. However, the student's interest for that task is low and having an outstanding performance is not a goal. Even if the teacher communicates the assessment criteria, this student does not value the activity as much to do the effort needed for an excellent level thus, he or she will perform averagely.

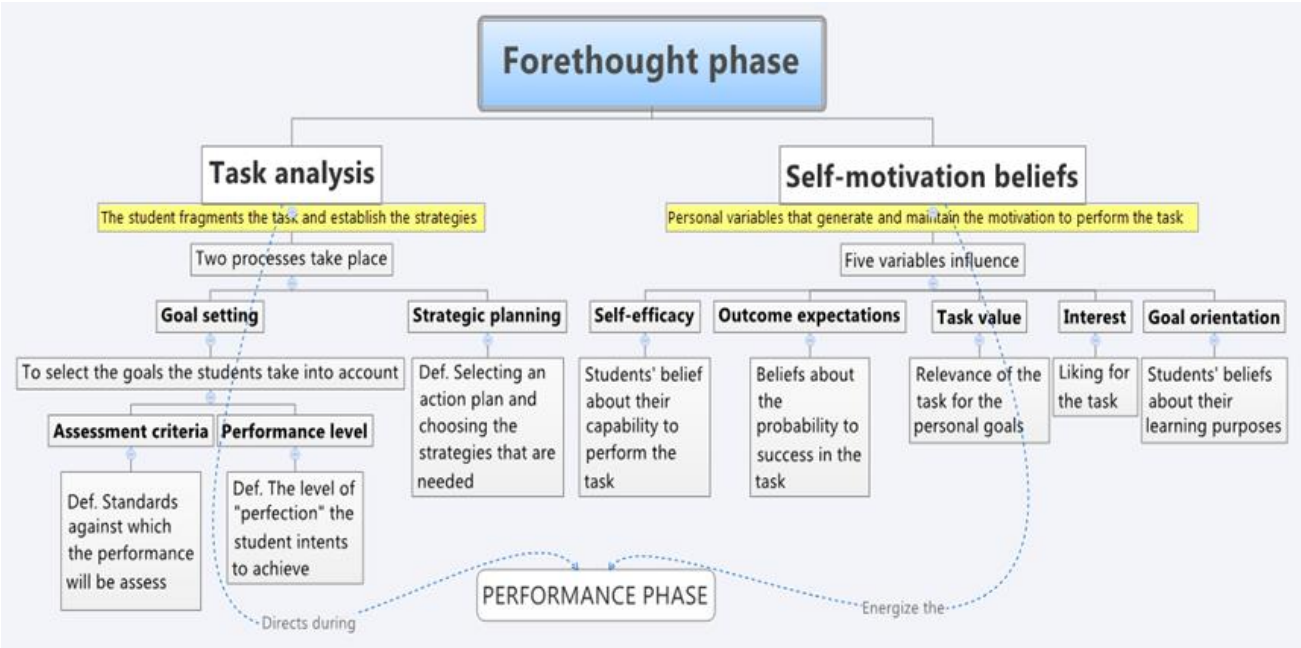

Figure 2. Forethought phase.[1]

Regarding strategic planning, this is elaborating an action plan by choosing the strategies needed to succeed in the task (e.g., setting steps). Planning is a key self-regulatory process and is a good predictor for success (Zimmerman, 2008). It is also one of the main differences between experts and novices, the former spending more time planning, which has shown to be crucial for their higher achievement (Ericsson, Charness, Feltovich, & Hoffman, 2006; Zimmerman & Kitsantas, 2005).

In sum, task analysis helps with planning that is crucial for self-regulation. Nevertheless, the implementation of the planning depends on the students' motivation to achieve the established goals, this will be analysed next.

Beliefs, value, interest and goals

The beliefs, values, interest and goals are the personal variables that generate and maintain the motivation to perform a task. The motivation to perform a task is the result of the interaction of these variables.

First, *self-efficacy* expectations are beliefs about the personal capability to perform a task. They are key for students' motivation, for example, if a student does not consider him or herself capable, his or her motivation will decrease and he or she will not want to make any effort foreseeing his or her failure (Pajares, 2008). On the contrary, if the self-efficacy expectations are high, the students are more motivated and use the strategies needed to face the difficulties during the performance.

Second, *outcomes expectations* are beliefs about the success of a given task (Zimmerman, 2011). Similarly to self-efficacy, if students have low outcome expectations they will not make the effort needed to succeed. Even though self-efficacy and outcome expectations might seem like the same construct they are not, this is a common misconception as pointed out by Pajares (1997, 2008). As an example, one researcher can believe that she is able to do excellent research (high self-efficacy expectations), but at the same time she is aware that she can formulate wrong hypotheses and that success depends on external evaluations that do not always consider the quality of the research alone (e.g., significant results bias). For this reason, her outcome expectations can be low even if her self-efficacy expectations are high. Nevertheless, both types of expectations are highly correlated and the higher the self-efficacy expectations the higher the outcome expectations tend to be.

Third, *interest* and *task value* are variables that energise the students' initial approach to the task. We consider that these two variables have different characteristics. On one side, we have the *task value* (utility), which is the importance that the task has for the students' personal goals. If the students perceive that the task is useful, their *motivation to perform it and to learn from it* will raise and they will activate more learning strategies (Wigfield, Hoa, & Lutz Klauda, 2008). This is the reason why it is recommended that when teachers introduce an activity, they mention or help to perceive its utility to increase students' motivation. On the other side, we have *interest* to perform a task –an emotion activated by this one (Hulleman, Durik, Schweigert & Harackiewicz, 2008; Renninger & Hidi, 2011). Interest can be personal –activated by

[1] In Figures 2, 3 and 4 the different sub-processes from the model are presented. However, we want to point out that some of those processes can occur in more than one phase. As an example, sometimes the standards are not established at the forethought phase but they become explicit during performance.

the personal meaning the task has for the person- or situational –activated by task characteristics- (Renninger, Hidi & Krapp, 1992). Even though interest has similarities with task value, and though Zimmerman does not make a distinction between them in his model –at least explicitly-, we separate them, as their effects can be distinguished. For example, there are tasks we do not have any intrinsic motivation to perform, but due to their high instrumental value, we are motivated to do them. Let us imagine writing a CV for a job position, a task that usually does not have much intrinsic value: we are not interested in the task itself, as writing a CV can be boring. Nevertheless, we will put our full attention to it if the position we are applying for is highly valued. It is clear that personal interest and task value can sum effects to enhance the energy invested in a task. However, they do not always energise action in the same direction. Using the same example of the CV, motivation is extrinsically energised by task value on the base of a long-term goal -a good position-, but there is not personal intrinsic interest in the task itself. In sum, task value seems to be a modulator that contributes to the increase or decrease of the interest and so, motivation moves in the intrinsic-extrinsic continuum, as Hulleman et al. (2008) have shown.

Fourth, another important variable for motivation is the *goal orientation*, which is the students' belief about the purposes of their learning. The researcher that first emphasised the relevance of this was Pintrich (Pintrich & de Groot, 1990; Puustinen & Pulkkinen, 2001), Zimmerman later incorporated it explicitly into his model. There is controversy in the research community whether there are three goal orientations or four (Alonso-Tapia et al., 2010). In any case, it is common ground that goal orientations have an effect on self-regulation even if this is a general judgment of their learning, based on previous experiences. There is empirical evidence that students with learning goals choose and use strategies that promote deeper learning, have more advanced reflection processes, recover faster from academic failures and have more intrinsic interest in the tasks (Grant & Dweck, 2003; Harackiewicz, Barron, & Elliot, 1998).

The five processes just presented -four according to Zimmerman- are interrelated and they interact during the self-regulatory process, especially in the initial phase: forethought. Their influence can happen in milliseconds (Kuhl, 2000), therefore, students might not even be aware of them happening. However, their relevance is extremely high as they determine the initial movement, the "crossing the rubicon:" the moment in which students move from analysing and visualising the tasks to actually performing it. In addition, depending on the level and type of motivation coming from these five variables, the students' self-regulation is completely different (Zimmerman, 2008; Zimmerman, 2011).

Critique of the model

One critique of the model is that it is cognitive oriented and the emotions do not have a major role in the planning phase. If we consider Kuhl's model (1994; 2000), if a student is "state-oriented" while planning, emotions play a bigger role. State-oriented students are unable to regulate their emotions, thoughts and behaviours to achieve their goals. In this way, these students might suffer from blocks based on their doubts about their ability to perform the task or even to start it. Nevertheless, this is a concept close to Bandura's self-efficacy (Bandura, 1997) that it is included in Zimmerman's, but Kuhl adds a more emphasized vision of how emotions could affect this phase.

A bigger role of emotions can also be found in Boekaerts' model (1999; Boekaerts & Corno, 2005), which then adds information to Zimmerman's model about goals and how students manage them. According to Boekaerts, students struggle to balance growth and well-being goals. Depending on how students manage their goals and emotions, their self-regulation can be top-down (related to growth goals) or bottom-up (related to well-being goals). Therefore goals have a different taxonomy in Boekaerts' model, they are more influenced by the students' emotions.

One of the reasons why Zimmerman might have not included emotions in the forethought phase in such details as other models is that the motivational effects of emotions are difficult to measure. Emotions are complex: (e.g., pity, anger, fear, pride, frustration, etc.). Anxiety has been studied the most, and its effects on behaviour range from positive to negative. For example, some actors or athletes like anxiety to perform optimally whereas others find that anxiety detracts from their performance. Furthermore, efforts to measure emotions physiologically have revealed poor predictions of behaviour, while self-efficacy has proven to be a good predictor for performance and it is included in Zimmerman's model (van Dinther, Dochy & Segers, 2010).

Performance phase

In this phase the performance takes place (Figure 3). During performance, it is important that the students keep their concentration and that they use appropriate learning strategies for two reasons. First, so their motivation does not decrease, second to keep track of their progress towards their goals. Both implicate different actions and processes that are different depending on the self-regulation model used. According to Zimmerman and Moylan (2009), the two main processes during the performance are self-observation and self-control, and in order for them to work successfully a number of strategies can be followed.

Self-observation

A prerequisite to control the task process is that students have a clear understanding of the adequacy and quality of what they are doing, so if it is correct they can continue and if not they can change it. For students to self-observe successfully, there are two types of actions they can perform; one of a cognitive nature and the other of external help. The first type of action is *self-monitoring*, also known as metacognitive monitoring or self-supervision. Self-monitoring is compares what it is being done against criteria that assess the quality of the process being followed (Winne & Hadwin, 1998). According to some authors (Panadero & Alonso-Tapia, 2013; Samuelstuen & Bråten, 2007; Weinstein & Mayer, 1986; Winne & Hadwin, 1998) it is a similar process to self-assessment only in that this happens once the task has been finished and self-monitoring occurs during the performance. This way as it is possible to have standards to assess the final "self-assessment of the product" and it is possible to have standards regarding how to perform the task "self-assessment of the process."

The second type of action that favours self-observation is *self-recording,* which is coding the actions that are being done during the performance. It is then an external strategy to help monitor and enhance reflection once the task has been done. Using self-records, students can be aware of things that could have gone undetected before. For example, registering how much time they expend reading a text would help them realise how much time it takes in reality. It is important to remember that during the performance, an overload of cognitive processing can happen impeding the mental registering of all the actions performed (Kostons, van Gog, & Paas, 2009).

Self-control

Maintaining concentration and interest during performance it is not effortless, it actually requires the use of a series of strategies. The eight strategies that are presented next can be classified as metacognitive strategies (the first six) and motivational strategies (the last two), being that the purpose of the first ones is to maintain concentration and the purpose of the latter to maintain interest and motivation.

First, if the students have a clear understanding for the task, they can use *specific strategies* to perform the task. For example, underlining a text while reading helps to remind them of the most important sections.

Second, on the same basis, students can use *self-instruction,* which are self-directed orders or descriptions about the task that is being performed. For example, asking themselves during a math exercise about the steps to take and if they are correct. These types of verbalisations improve learning and are crucial for self-regulation (Schunk, 1982).

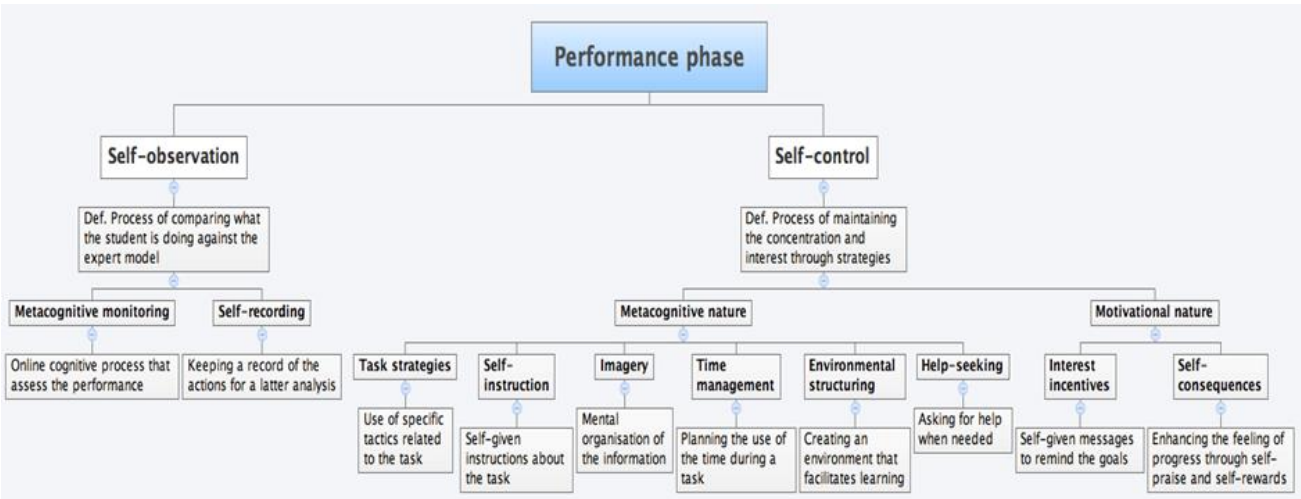

Figure 3. Performance phase.

Third, students can use *imagery,* which is the use of mental images that organise the information and help to focus attention on enhancing learning and memorisation (Zimmerman, 2011). For example, creating a concept map. Additionally, images increase interest as they allow the students to visualise situations (e.g., while describing a landscape they visualise it mentally).

Fourth, students need to use *time management,* having a perspective of all the aspects of the task they need to perform. If they do not manage their time, their performance will be affected, especially if they start to experience that there is not enough time to finish the task, their outcome expectations could decrease, as they do not feel capable to be successful. Therefore, time management is done using strategies that monitor the performance of a task to finish at the established time (Dembo & Seli, 2008; Zimmerman, Bonner, & Kovach, 1996). One example is to set intermediate goals in the writing of, for example, a dissertation.

Fifth, to maintain the attention and interest in the task a *structured learning environment* is needed (Corno, 2001); creating an environment with less distractions and which facilitates learning can accomplish this. For example, one strategy to avoid distractions is not to sit down by the side of a classmate who talks during class. Another strategy that enhances concentration and efficiency is to have all the needed materials at hand before starting the task.

Sixth, students experience blocks to their learning processes that can be solved through *help seeking* (e.g., asking the teacher how to solve a problem). There are two aspects of help seeking as a self-regulatory strategy that need more attention. First, help seeking might appear as a bad indicator or self-regulation, as it might indicate lack of success completing a task. However, on the contrary it is an excellent indicator for self-regulation when a number of conditions are given (Newman, 2008). Precisely, the students with low grades are the ones that are more reluctant to seek help when they are facing problems (Karabenick, 1998; Newman, 2008), influenced by their doubts about what, when, how and who to ask, and trying to avoid look incompetent (Zimmerman & Moylan, 2009). Second, some students use the strategy of asking "massively" so that the asked person gives them the answers or performs the task for them. This behaviour is a way to avoid performing the task and, therefore, it is not self-regulation oriented to learning. For help seeking to be a learning strategy, the students need to have the intention to learn from the answer and not to avoid the activity (Newman, 2008).

Seventh, and first of the motivational strategies, students can use *incentives to enhance or maintain their interest* during the task. This is done through self-directing messages that remind them of the goal to achieve or the challenge they are trying to solve (Corno, 2001). For example, "I will find a way to solve this problem" or "I won't get distracted, it is important to understand this exercise." There are then actions that as they have an effect on motivation they are regulated, affecting indirectly the performance on normal basis but when the students are facing difficulties to a crucial extent (Wolters, 2003a).

Eight, if students do not experience progress they can quit the task. However, if they use *self-consequences* they can overcome this difficulty. Self-consequences enhance the feelings of progress through self-praise and self-rewards. These strategies, if used when one goal is achieved, keep the willingness to put in effort and interest high, increasing the possibility of activating strategies to progress in the task (Corno, 2001; Zimmerman & Martinez-Pons, 1986).

Critique of the model

We go back to Kuhl's model (Kuhl,1994; Kuhl, 2000) according to which if a student is state oriented, the hesitation about the appropriateness of the procedure can also occur during the performance. If the students do not overcome that hesitation, they experience anxiety that could lead them to abandon the task, as they would not feel sure about their success. In Zimmerman's model the emotions are in the background; emotions appear if the students do not activate the adequate strategies and do not experience progress. In Kuhl's volitional model (2000) emotions are in the forefront being that their control is necessary to the success of the task when students are state-oriented. According to Kuhl (2000), self-regulation and motivation fluctuations are affected not only by possessing the knowledge necessary to perform the task but also by four basic psychological processes linked to volition.[2] These are: (1) *Attention control*, focusing the attention on the relevant information for the goals and not on distracting one; (2) *Motivation control*, enhancing the appealing of the goal to achieve and the actions that lead to it; (3) *Emotion control*, being able to "disconnect" the negative mood status that interferes with cognitive processing and concentration on the task; and (4) *Failure control*, facing the occasions of failure as opportunities to learn. The degree in which the students activate these processes are related to a personality trait that Kuhl calls 'state-orientation' -focus on results and the emotions they trigger- vs. 'action-orientation' -processes and knowledge relevant to performance of the task and control of the emotions (Kuhl, 1987). In sum, emotions can have a crucial role during performance, being able to even stop the execution of the task.

Another aspect that could be amplified in Zimmerman's model is time management. There is research that indicate that time management is composed of more complex strategies than the ones presented in the model and that are crucial for academic success (van der Meer, Jansen, & Torenbeek, 2010). One of the most studied aspects is procrastination, the practice of carrying out less urgent/pleasurable tasks in preference to more urgent/pleasurable ones, and thus putting off impending tasks to a later time. The research regarding procrastination demonstrates the different relationship between goals, time management and deadlines (Krause & Freund, 2013), having explored productive ways to use procrastination (Chu & Choi, 2005).

Self-reflection phase

During this phase students judge their work and formulate reasons for their results (Figure 4). While justifying their success or failure, they experience positive or negative emotions depending on their attributional style. These emotions will influence their motivation and regulation in the future.

[2] Volition is the process by which an individual decides on and commits to a particular course of action, including aspects related to affection, motivation, and cognition. Volitional processes can be applied consciously or it can be automatized as habits over time.

Self-judgment

Self-judgment is the process through which the students assess their performance. It is composed of self-evaluation and causal attribution.

Self-evaluation is the students' assessment of their own performance based on the assessment criteria and modulated by their performance level goal (Panadero, 2011). The assessment criteria can be established with the teacher's help before starting the task so that the students can assess their own work with more accuracy and have better knowledge on how to correct their mistakes. Unfortunately, many times, students do not know these criteria and they wait until the teachers give them their graded work to make a judgment about the quality of their work. In this way, when students receive a score and there is no opportunity to reflect on their correct answers and mistakes, there is no self-evaluation but the students directly attribute their success or failure based on teachers' feedback. For this reason, if the teachers want their students to learn how to self-assess they should give them the opportunity to reflect on their mistakes (Andrade & Valtcheva, 2009; Dochy, Segers, & Sluijsmans, 1999; Pardo & Alonso-Tapia, 1992). For a more detailed discussion about the relationship between self-assessment and self-regulation see Panadero and Alonso-Tapia (2013).

It is important to emphasise that self-evaluation it is not only done based on the assessment criteria but also on the goals that the students set up at the beginning of the task and on the performance level they want to reach (Winne, 1997; Winne, 2011). In this way, two students with the same assessment criteria and similar quality of their products can judge their work very differently based on their goals and performance level. The importance of the goals and performance level can be noticed, for example, when a score of 8 out of 10 can be an excellent score for a student that was expecting to fail but a catastrophe for another who was expecting a score of 10 out 10.

These desired performance level standards or judgment standards are the ones in which students base their self-evaluation and are influenced by the assessment criteria which can be established in three ways (Bandura, 1986). First, based on an analysis of the competence that the students are about to learn (objective criterion); second, based on previous performance levels (progress criterion); and third, based on comparison with others' performance (social comparison criterion). Obviously, the goals established during the forethought phase directly influence the standards against which students evaluate their work and whether they consider whether or not they have been successful (Winne & Hadwin, 1998). Consequently, the judgment standards (or desired performance level standards) influence the attributions that students do (Zimmerman & Moylan, 2009). For example, if a student makes progress and she is using the progress criterion, she will have a positive interpretation of her performance. On the other hand, if she chooses social comparison criterion, she will focus on how well the others have done, which is a less adaptive manner to interpret her success or failures.

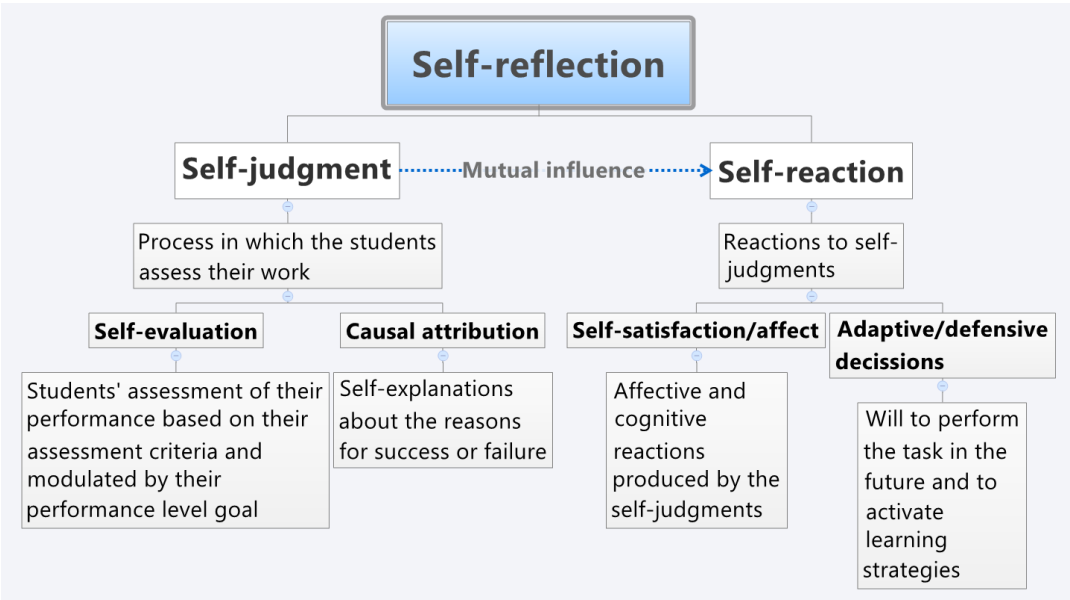

Figure 4. Self-reflection phase.

Causal attributions are the explanations that students give to themselves about their success or failure in a task. Whether the result is negative -not the expected one- or positive the students make inferences trying to answer the question: "Why has this happened?" These inferences imply attributing responsibilities to different factors about the results

obtained, such as, ability, effort, luck, support from others, control, etc. (Weiner, 1986). The attributions, as they are explanations of success or failure, trigger emotions that affect the motivation and expectations for future task performance, as is described in the next section.

Self-reaction

As we just pointed out, attributions usually activate emotions -positive or negative- that influence self-efficacy and outcome expectations (Pintrich, 2000; Zimmerman, 2011). Both emotions and expectations influence the motivation and the way of approaching the task in the future. This means that the students react emotionally and cognitively to their own attributions, for this reason this process of self-regulation is called *self-reaction*. These reactions might look automatic in nature and not controllable, but that is not the case (Schunk, 2008). If students learn how to judge their success and failure as opportunities to improve and learn they can then control their attribution style so that it is more adaptive and, as a result, control better their emotions.

For this reason, Zimmerman and Moylan (2009) pointed out that there are two processes that need to be taken into account when it comes to self-reaction: self-satisfaction/affect and adaptive/defensive decisions. The first, *self-satisfaction,* is defined as the affective and cognitive reactions that students experience when they are judging themselves (Zimmerman & Moylan, 2009). This process has been researched in great detail: the activities that generate positive affect produce higher levels of motivation for future performance, and the ones that generate negative effects are conducted to avoid the task (Bandura, 1991; Pintrich, 2000). The second process is taking *adaptive/defensive decisions*. When students make adaptive decisions, the willingness to perform the task again is maintained whether keeping the same strategies or using new ones to obtain better results. On the other hand, when defensive decisions are taken, students try to avoid performing the task again so as not to experience new failures (Wolters, 2003a; Wolters, 2003b). Among the effects of the defensive decisions are: apathy, lack of interest, procrastination or even learned helplessness.

In this manner, self-regulation is cyclical: the students take into account and are influenced by their previous performance for the next one (Zimmerman, 2011). Thus, the type of attributions adopted, the emotions experienced and the inferences about being successful in the future directly affect the motivational variables described in the planning phase: self-efficacy expectancies, outcome expectancies, interest and task value, and goal orientation. If the student "failed" and make defensive decisions he or she will believe that they have fewer possibilities to success in the forethought phase for the next performance, decreasing his or her interest and outcome expectations, and he or she will lean towards performance or avoidance of goals. On the other hand, if the student "failed" and makes adaptive decisions looking for feedback to correct the mistakes in the future or when attributing he or she does so based on adaptable causes and under his or her control he or she will maintain learning goals and motivation will be higher (Alonso-Tapia, 2005a).

Critique of the model

Going back to Kuhl's model (1994, 2000), the students that fail and are state-oriented can experience rumination, a state in which the students get stuck on their mistakes and wander around them without learning how to find a solution. This state generates anxiety if the students have to perform the task again, as they have not learned how to solve the problems and thus, they worry that they will again be unsuccessful. Evidently, students do not like to fail repeated times in a task as this could lead to a decrease on their self-esteem; this perspective of the emotional factor in the self-reflection phase was later added to the model by Zimmerman but it is currently present on his model.

A crucial aspect to consider: the social aspects of the regulation of learning

One aspect that Zimmerman's cyclical phase model does not cover in detail is the social instructional aspects of self-regulation. These issues were dealt with using two related models: First, Zimmerman explored these aspects in his triadic model from a socio-cognitive perspective (Zimmerman, 1989) and second, the multi-level model describes the social origins of self-regulatory processes. It draws on Zimmerman's extensive research on cognitive modelling and how social control can be gradually phased out as self-regulatory control is phased in. By contrast, Zimmerman's cyclical phase model focuses on how metacognitive and motivational processes and beliefs interact during successive feedback cycles. Thus, the cyclical phase model focuses primarily on the description of self-regulatory processes and not how they are acquired or how the social interaction influences (i.e. of course, help seeking is a social form of self-regulatory control in the cyclical phase model). Nevertheless, we will present briefly Zimmerman's multi-level model and the two lines of research that are currently exploring the social aspects of the regulation of learning.

First, in Figure 5 we present the multi-level model of Zimmerman. "I theorized that there were four levels in a social cognitive path to self-regulation -with the first two levels being social and the last two being self in focus" (Zimmerman, 2013, p. 140). In this model Zimmerman emphasizes the importance of the social aspects for the development of self-regulation. At the first level the student obverses a social model, then tries to emulate what the model has done in the task, the self-control occurs when the student masters the use of the skill without having models around, and finally the self-regulation is reached when the student has automatized some aspects of the performance and it is able to act strategically adapting his/her performance to contextual factors. Zimmerman points out that, even if in the

two first there is more social support, it can also be present in the two last phases (e.g. asking for advanced feedback to experts once the student has reached self-regulation level). Zimmerman and colleagues (see Zimmerman 2013 for a summary) have tested empirically the sequence of the difference phases.

Figure 5. Zimmerman's multi-level model.

	Features of regulation			
Levels of regulation	**Sources of regulation**	**Sources of motivation**	**Task conditions**	**Performance indices**
1- Observation	Modelling	Vicarious reinforcement	Presence of models	Discrimination
2 - Emulation	Performance and social feedback	Direct/social reinforcement	Correspond to model's	Stylistic duplication
3 - Self-control	Representation of process standards	Self-reinforcement	Structured	Automatization
4 - Self-regulation	Performance outcomes	Self-efficacy beliefs	Dynamic	Adaptation

Extracted from Zimmerman (2013, page 140).

Second, there is a line of research that focuses on the role of the environment in the development of self-regulation. There are two main traditions: Vygotskian and constructivist (influenced by Piaget's work) (Panadero, 2011). In the first, the key to the development of self-regulation is the acquisition of private speech that allows children to self-regulate using the same procedure throughout which their environment regulated for them (e.g., parents speaking to them) (McCaslin & Hickey, 2001; McCaslin & Murdock, 1991). The second one, the constructivist, maintains that there are changes needed for learners to become self-regulated and these are facilitated through social activities in which the students participate. Paris and Paris (2001) mention that children have an understanding of self-regulated learning that can be enhanced in three ways: (a) through authentic or repeated experiences in school, (b) through explicit instruction coming from the teachers, and (c) through engagement in practices that require self-regulation.

Third, there is a line of research that investigates how self-regulation happens in collaborative interactions among peers (Hadwin, Järvelä, & Miller, 2011). Here, the focus is not only on how the students self-regulate but also how they do it as a group, exploring the synergies and interactions that also belong to the regulation. This line distinguishes among three types of regulation (Hadwin et al., 2011): (a) *self-regulated learning*: self-regulation at the individual level, the environment is considered but the focus is on how the students adapt to it to achieve their goals; b) *co-regulated learning*: the focus is on the interaction between two or more individuals (pupils, teacher, etc.) being an explicit intervention of one of them directing in an strategic way to achieve the goals; and (c) *socially shared regulated learning*: when there is a joint negotiated management of all the group members to achieved negotiated and shared goals. The latest is a recent line of research with the first study published barely a decade ago (Vauras, Iiskala, Kajamies, Kinnunen, & Lehtinen, 2003). Nevertheless, it is receiving increasing attention due to the need to understand how the groups and their members regulate learning. There are different aspects that have been covered such as the role of the age (Grau & Whitebread, 2012), the effect of emotions and motivation and their regulation (Järvelä & Järvenoja, 2011), and the effect of the working environment (e.g., collaboration via computer: computer supported collaborative learning) (Saab, 2012). It is, therefore, a line of research that will improve our understanding of self-regulation in the coming years.

Conclusions

Zimmerman's models of self-regulated learning are important contributions to the field. Considering the definition we presented at the beginning, Zimmerman's cyclical model covers cognitive, behavioural and motivational aspects, being that the model explains in greater detail the relationship between motivation and self-regulation. The other aspect that was included in the definition, the emotional one, is that Zimmerman's model can be amplified with additions from other models, mainly Kuhl and Boekaerts, as has been detailed in the article. In the same fashion, another aspect that is not covered by this model -as it is not its aim- is the importance of the social environment (peer, teachers, parents, etc.) in self-regulation and its development and that Zimmerman addressed in his two other models. Nevertheless, even if there are other models with a bigger emphasis on the cognitive processing during the task (e.g. Efklides, 2011; Winne, 1996) or with a bigger emphasis in the role of emotions (e.g. Boekaerts & Nievimirta, 2000, Kuhl, 2000), Zimmerman's model is very comprehensive as it covers the majority of key processes that play a role when a student is studying in great detail and offering a theoretical framework that determinates what aspects are relevant if we want to improve students' self-regulation.

Note from the authors: Our initial purpose was to present Zimmerman's model to a Spanish-speaking audience. When we were asked to translate the article into English we considered that, because we had also explored what other models could add to Zimmerman's, the paper could be of interest to English-speaking readers too. Nevertheless, Zimmerman & Moylan (2009) present a detailed explanation of Zimmerman's self-regulation model and it is the original source for our work. In addition, this is our humble tribute to Barry J. Zimmerman for all his work in the self-regulated learning field. We would also like to thank him for his feedback on an earlier version of the manuscript.

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