

A Theoretical Strategy for Enhancing Learning Through Metacognitive Practices on a Constructivist Methodology

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Abstract While there has been a shift to an education based in the development of competences, the current approaches following a constructivist educative model (described as ideal for competence acquisition) still lack a clear conjunction with metacognitive practices. The introduction of metacognition improves self-cognitive processes that are fundamental for assuring aware and long-standing learning, among other essential characteristics for later applications on social and professional contexts. Here, following a state-of-the-art evaluation of Latin American education, we present a conceptual model to form competent people which integrates key factors from metacognitive development linked to a constructivist approach. Theoretically, the proposed model improves competence development through self-knowledge as what students are capable of, and what is the best attitude to accomplish their aspirations. Final conclusions depict steps for practical applications, describing also how stronger efforts have to get done in a social and institutional scale for actually reaching a solid competence development.

Introduction

Current societies are strongly affected by technological and scientific advances in a dramatic way, with demands of specialized knowledge but, at the same time, a very practical one, requiring fast and efficient responses without knowing too much, given that information is reachable for everybody. This implicates that people must be flexible, self-critic and open to change (*Rejas et al., 2013*).

In order to form competent persons, universities had have to reformulate their curriculum and, along with it, their teaching models and methodologies. In consequence, an important portion of the occidental educational entities has adopted a formation based on the development of competences. Specifically, in Latin America there is a socio-formative approach, where there is a focus in forming an ethic compromise with the self, with society and the environment that surround us (*Tobón et al., 2010*).

Competences are defined as a set of knowledge, skills, values, and attitudes, either specific or transversal (or generic), that a graduate has to acquire in order to fully satisfy the social and professional demands. This set is put into play when a problem is confronted, and its especially interesting when it is an uncertain, complex problem. The specific competences (or technical ones) are such that are related to a knowledge about a particular area, and must be developed through learning from a specific discipline. On the other side, generic competences (also known as soft or transversal) are the ones that tackle the formation of a person as a socially inserted

individual, and that makes reference to personal attributes with cognitive, social, attitudinal or valuable characteristics, which enrich professional behavior, and increases the value of the specific competences (*Bellocchio Albornoz, 2009*).

Several authors have proposed that for developing competences is necessary to adopt a constructivist educative model, based in the formative process, aiming to promote a meaningful learning to ensure this competence acquisition (see for example the Tuning Latinoamérica project¹), leaving behind the approaches based on behaviorism.

However, there is a disjointed relationship between the developing of competences and the constructivist educative model, which has been considered as ideal for competence acquisition. The bridge between them can be based on a metacognitive development, a fundamental element for ensuring the appearance of ideal competences. Metacognition refers to the knowledge and regulation of self-cognitive processes, i.e., the regulation of how to acquire knowledge, how to perform, how to react to a specific situation, when to perform certain actions, etc.

Then, here we present a search and later description of the factors that play a role in metacognitive development as an integral part of the teaching-learning process, with the goal of achieving in students a permanent reflective and self-evaluative state. This, for introducing in them an awareness of what do they learn, and how to transfer that knowledge to other situations.

This article proceeds as follows: first, we describe the bases for meaningful learning, and how constructivist methodologies and metacognitive considerations can enhance learning. Then, a description of the proposed strategy is presented, including a detailed systematical view to facilitate its application. Finally, conclusions and possible extensions of this work are depicted.

Teaching for learning

In the seek of meaningful learning

Nowadays, the main focus on pedagogical actions is to develop in the student the capacities for producing meaningful learning by their-self, in a wide range of situations and circumstances, i.e., learning how to learn (*Coll, 1988*).

David Ausubel, who introduced the concept of meaningful learning, proposed a theoretical explanation of the learning process from a cognitive point of view, while taking into account motivational and affective factors. According to him, learning involves the organization and incorporation of cognitive information in a person, which happens when new information received by a subject is related (i.e., interact) with relevant ideas that support it, which are already part of the cognitive structure of the subject. This pre-existent structure is called *integrator concept*. In this sense, *Ausubel et al. (1980)* understands the storage of information as a highly organized process inside the human brain, where more specific elements of knowledge are anchored to more general and inclusive knowledge, a process which is called assimilation. Then, the cognitive structure is a hierarchical structure of concepts, which is a product of the experience of the subject.

Mechanical learning differentiates with meaningful learning because it takes into account the incorporation of new information without establishing any relationship with previous concepts or propositions, being stores in an arbitrary way.

In order to achieve meaningful learning, several conditions have to be met: the new information has to be related in a non-arbitrary and substantial fashion, which depends on other factors such as disposition, motivation, and attitude from the learner subject, and the nature of the matter being studied, or its contents (*Díaz and Hernández, 1999*). Moreover, the promotion of an auto-critic attitude on the student is necessary for ensuring meaningful learning, to acquire precise and integrated meanings across learning (*Arancibia, 2008*).

The predisposition of learning is also essential (*Bruner et al., 1966; Gagné, 1985*), and it can be achieved by mechanisms for triggering, sustaining and directing learning. This, by setting a situation with a certain degree of uncertainty (trigger), showing the benefits of exploring alternatives

¹Information about the Tuning Latinoamérica project can be found at <http://www.tuningal.org/>.

higher than the associated risks (sustain), and leading this discovering according to the ending goal and relevance of knowledge (direction). *Bruner et al. (1966)* and *Gagné (1985)* described also the importance of evoking what has been learned in situations of different domains than the original one. This reuse of the learned subject has to incorporate a feedback for measuring how well and precise was the learning.

The constructivist model of learning, developed at the ends of the XX century, and currently predominant in school environments, takes into account the described concepts for inducing meaningful learning.

Constructivism: foundations and fundamental characteristics

Constructivism was build as a need for understanding and integrating the complex multidimensional processes involved in learning. It aims to solve problems such as: identification and attention to the diversity of interests, needs, and motivations of the students in relation with the teaching-learning process; a re-description of the scholar curriculum for learning to learn; a recognition of different methods and types of learning, considering intellectual, affective and social dimensions; the relevance of promoting teacher-student and between students interactions; the role of the teacher and the student; among others (*Díaz and Hernández, 1999*).

By definition, constructivism is an approach that integrates the subject with cognitive, social and affective variables, factors that build the self day by day. Following this perspective, knowledge is not directly ground truth, but instead, a construction of the self that is built through its relation with the environment (*Carretero, 2000*).

The core characteristics of this educative model are that: it defines the learning process as an active situation, centered in the student; it promotes the interaction among persons; the teacher adopts a decentralized but active role; it promotes meaningful learning in all its shapes (self-learning, learning by discovery and reception); and, it establish that knowledge is organized in a base of conceptual structures that have to me remove or reshaped in function of later cognitive requirements (*Bellocchio Albornoz, 2009*).

Even while there is no constructivism without metacognition, the last one is often passed by (*Tobón et al., 2010*). Both, the teacher and the students, have to be conscious of the tools that are in use during the process of acquiring and constructing knowledge. This improves self-learning and didactic interactions (*Tobón et al., 2010*).

Metacognition as a tool for enhancing learning

Metacognition is the knowledge of self-cognitive processes (e.g., being able to determinate how capable is one for memorizing or for how difficult is a task) and the regulation of them (e.g., knowing how many times one have to read a sentence in order to remember it) (*Flavell et al., 1970; Flavell, 2000*). The use of metacognition impact in the development of diverse methodologies, techniques and didactic strategies in the process of learning. In any case, one uses at least an intuitive approach for it, which allows us to have an idea of the necessary means to achieve learning of a specific matter (*Bellocchio Albornoz, 2009*).

Metacognition is composed of three fundamental components, which allow us to act and control our self-cognitive activity: knowledge, experience and skills (*Flavell, 2000*). The metacognitive knowledge is, at the same time, separated as declarative knowledge (knowledge about the general skills that we possess), procedural knowledge (about how effective we are on solving problems) and a conditional or attitudinal knowledge (about when to apply specific strategies) (*Sperling et al., 2004; Mateos, 2001*). The use of metacognitive skills and strategies are useful and needed for acquisition, use, and control of our knowledge and other cognitive skills, which includes, e.g., skills for planning and regulating the effective use of our own cognitive resources (*Brown and Smiley, 1977*). Then, our metacognitive skills allow us to direct, monitor, evaluate and modify our learning and thought. Also, metacognitive experiences are conscious experiences that are focused somehow on our own cognitive performance. These experiences are thoughts, sensations or feelings that can

be interpreted consciously and that accompanies the cognitive activity (*Mateos, 2001*). However, the line between metacognitive knowledge and metacognitive experiences is not clear (*Arancibia, 2008*).

Then, the process of metacognition makes explicit the process of knowledge construction, implicit on learning, in order to achieve the desired performance and to know when and how that knowledge should be applied, in a specific context. Also, metacognition must be used in any didactic strategy applied in an educative context, given that a poor metacognitive formation in teachers and students blocks the success of any constructivist methodology. This idea is supported by the main focus of education, learn to learn, a complex function that is the base of all the other ways of learning: to be, to do and to act (*Bellocchio Albornoz, 2009*).

It is important to note that metacognition is not necessarily a conscious act, but it has to be explicit at the beginning for adopting its practices, which eventually becomes an automatized behavior, a habit, keeping its importance on performance (*Martí, 1995*).

Also, an important clarification is that the cognitive and metacognitive processes cannot be seen as separated entities, but as complementary for learning processes, taking into account where is an activity being developed and its features, constraints, and specificities. In this dynamic process of external regulation and self-regulation is that appears mechanisms of interiorization (abstraction and awareness, according to Piaget) and exteriorization (explicitation and accessibility to knowledge, according to Vygotsky) that can be supported by cultural means or devices (computers, writing, etc.) that are used as facilitators for regulating the cognitive activity (*Martí, 1992*).

Integrating metacognitive practices in a constructivistic environment

As exposed, it is highly relevant to take into consideration the practice of metacognitive activities during learning processes and, therefore, relevant for the development of school strategies for enhancing learning and later knowledge applications, at the student's personal and professional life.

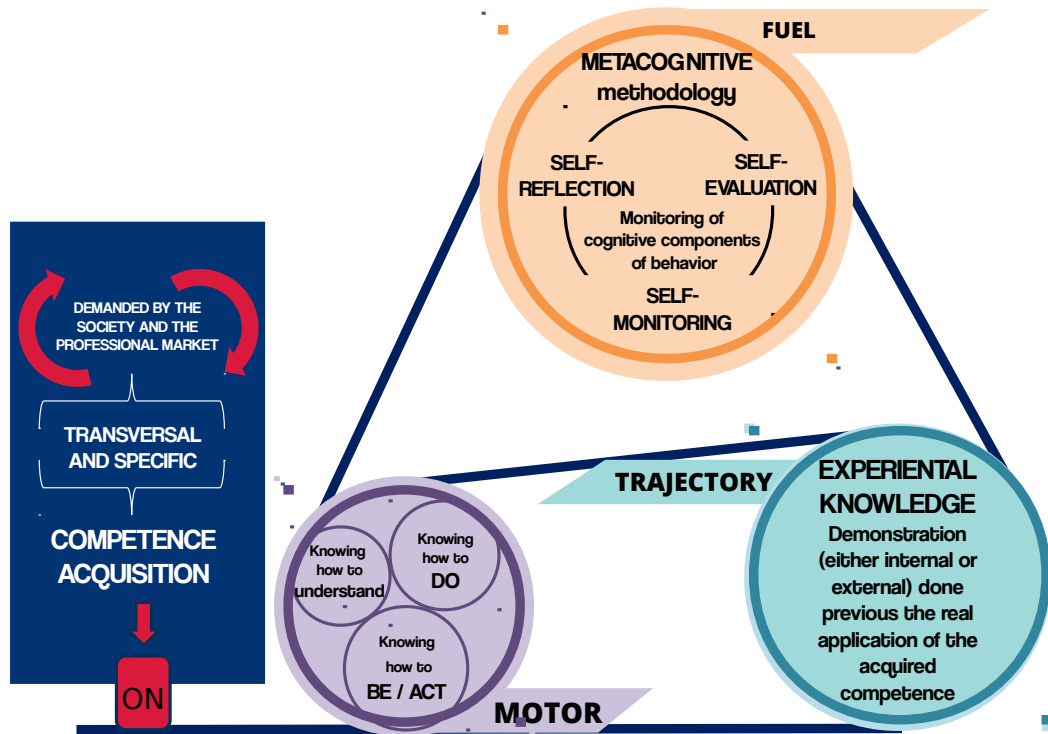
There are several specific metacognitive strategies (*Tobón, 2013*) as, e.g., the meta-conceptualization, which considers knowing how much do we know about a specific concept, or theory, for understanding a wider, more complex phenomenon, helping to decide what actions or precautions has to be taken for accomplish a knowledge acquisition. But, even with the current, wide establishment of different strategies, there is still a lack of integration in a transverse fashion over the process of teaching-learning of competences, specially at college education, which is reflected by the low aptitudes that students present when they are requested to recognize their knowledge levels, skills, and competences acquired during their formative process. This lack of abilities have a profound impact on the students intrinsic motivations, according to an analysis based on surveys answered by students from different levels from the Product Design Engineering career, at Universidad Técnica Federico Santa María, Chile (data not shown). The students also presented a reduced ability (along the years) for regulating their motivations. From these, one can infer that this happens mainly due to the great uncertainty experienced at the moment of applying their learned abilities in real industry scenarios, where they have to answer properly to the market needs.

Based on this perceived issues, here a model is proposed which can be extended later as a methodology aiming to accompany students throughout their formative process, encouraging awareness of the transference of knowledge, skills, and competences, into other domains. This, with the goal to properly educate students for their professional life, reaching a high level of knowledge about what are they capable of, and what is the best attitude for accomplishing their aspirations (context-dependent), at a personal and professional level.

Developing a competence

In order to develop a competence, it is necessary a knowledge transference that could articulate theory and action. There is a shift from a general knowledge to a concrete extramental situation, which affects our conduct efficiently to "do something". Then, a competent action is such that is

Figure 1. Conceptual model for competence development. Theoretical model that articulates knowledge and action through the development of competences, which are mediated by the different metacognitive dimensions for achieving awareness and knowledge transference.



performed by a subject who master it in all its domains: what has to be done (cognitive knowledge), how it has to be done (procedural knowledge), how do I must react (attitudinal knowledge) and, at which moment the action has to be started (conditions). This is all shown by how a subject performs.

Following this, a competent subject is a person who is able to use all these relevant knowledge in a pertinent, efficient, and long-lasting fashion (*Le Boterf, 2001*).

An integrative model

Taking all the relevant concepts here described, associated to achieving knowledge acquisition and transference, and development of competences, here we present a conceptual, theoretical model as a base for developing a metacognitive methodology, transversal to the comprehensive learning process, aiming to improve the use of competences in social and professional contexts. The model is presented in figure 1.

The model articulates in conjunction the knowledge that composes a competence (to know, to do and to act) as a *motor* for an experiential knowledge. This knowledge introduces a specific way of evaluating and proof to the self (the student), and the surrounding community (teachers and classmates), the competences acquired in the integral formative process of a given course. The experiential knowledge is also able to feedback what has been learned previously, producing awareness about the competences that are mastered by the student, acquired through its educative process, and its meaningful learning in all the addressed areas. It prepares the student for competence behaving, which is required once their formative process ends.

The *fuel* that makes possible this swinging between knowledge is a metacognitive methodology that must involve a reflective and self-critic attitude, through self-questioning what is known (reflective dimension), what is controllable (managing dimension) and, what can be modifiable and valuable (evaluative dimension). This three dimensions, besides integrating procedural and cognitive elements, integrate emotional, affective, attitudinal elements, among others (*Tovar-Gálvez, 2005*). It is important to clarify that while these three dimensions are generally called as “moni-

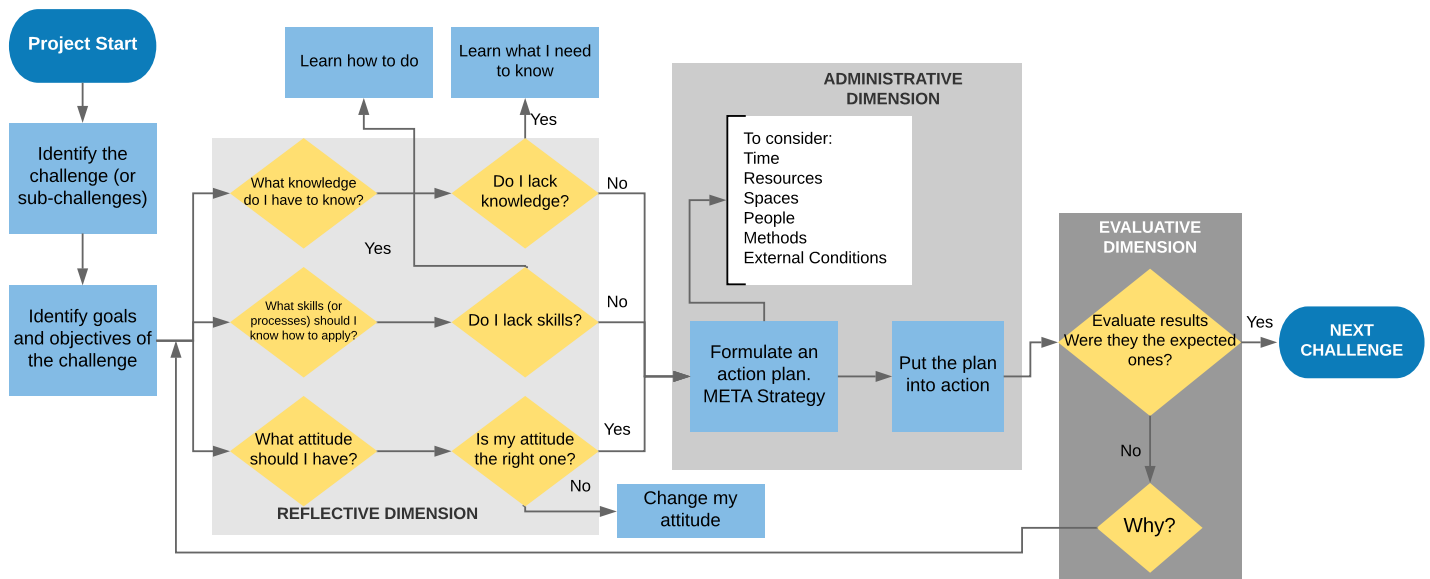


Figure 2. Flow diagram for applying the metacognitive methodology. The model is presented under a systematic view to show how to apply the monitoring of cognitive components in a non-specific learning situation, starting by a challenge that can be analyzed in a higher (macro) level, or by decomposing it on sub-challenges.

toring of cognitive components”, they are a set of elements with multiple featuring components: methodologies, procedures, processes, skills, motivations, interests, etc.

Finally, what triggers the dynamics of learning, called here as the *button*, is the need for developing competences (either generic or transversal and technical or specific). This needs are directly associated with what is required in the social and professional context, and have to be developed inside a given course.

Applicability

To describe how to apply the model, figure 2 introduces a flow diagram with separated steps and questions to self-analyze, prepare and complete the acquisition of knowledge. The reflective dimension has as objective to raise awareness of acquired theories and knowledge. The administrative dimension has to guide for understanding how to use the acquired knowledge. The evaluative dimension has to invite to analyze tangible results (experiential knowledge) to consolidate the learning process. While the three dimensions are crosswise to the whole experience, the systematic view proposed simplifies the planning of the learning experience.

It is important to note that the diagram exposed in figure 2 can be complemented with other methodologies, tools or strategies in all its stages, in order to foster the effects on each dimension (e.g., learning strategies as creative thought (De Juanas Oliva and Lozano, 2008), or 10 metacognitive actions (Tobón, 2013)).

Also, while the model can be fully or partly applied in different contexts, given the extension, complexity, and amount of concatenated challenges in a project-based methodology, the steps and analyses fit better in that context.

Conclusions

The described approach is the first step for a metacognitive methodology that can be transferred to diverse contextual scenarios. But, to achieve that, it is important to promote the concepts of participatory education, stimulate the redesign of educative curriculum and their evaluative systems, and promote as a high priority the research on education and the training of teachers as educative entities. Also, there has to be a permanent supervision and advising in this processes of

transformation.

A metacognitive methodology builds upon the proposed model might act as a driver and promoter for meaningful learning which, according to what is exposed herein, would end up with an integral formation of the student, with incorporated metacognitive skills, facilitating each confrontation of future challenges. The main highlight of the proposed strategy is that generally the tools for acquiring metacognitive skills are introduced to the students in a parceled fashion, and not as a complete, single and continuous strategy.

A natural extension of this work is the development of a concrete methodology, which could incorporate specific tools depending on the learning process. This, introducing the two fundamental instances for the developing of competences: an individual instance, and a group instance. Also, this work can be extended introducing the roles played by the teacher and the student following this new metacognitive dynamic. Some examples for doing these extensions are the use of tools like a portfolio, activities with gaming cards, or a personal book with established activities, supporting introspection (personal stage). In a second instance, the tools have to integrate social elements supporting interpersonal feedback, as methods including simulations and games, confronting real case situations or, fomenting multidisciplinary projects of innovation and entrepreneurship in bachelor studies for consolidating the development of competences in personal valuable situations (interpersonal stage).

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