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Intervention Programs for improving Learning Competences in Higher Education.

Programas de intervención para la mejora de las competencias de aprendizaje autorregulado en educación superior.

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Abstract

This article tries to justify the importance of the self-regulation in the students learning process, especially in the present conditions and in higher education. In addition, some of most relevant programs of self-regulation of academic learning in the sphere of higher education were reviewed. The procedure consisted in an extensive search of databases, mainly Psyclit, EBSCO Online, EBSCOhost and Science @ direct and the Web of Knowledge (WOK), and Scopus, using thedescriptors self-regulated learning, higher education, Learning Strategies , Intervention Programs, learning process, ICTs. Although there are quite a few of them, we reviewed only the more relevant interventions and those that show empirical data about their results. Despite the encouraging results obtained in most of the intervention programs revised, the improvement of self-regulation competences is deeply influenced by variables that must be considered in afuture, particularly the increasing presence of the new information and human communication technologies in academic contexts.

Key words: *self-regulated learning, higher education, learning strategies,intervention programs, learning process, ICTs.*

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1. INTRODUCTION, OBJECTIVES AND JUSTIFICATION

Learning is one of the most constant and long-lasting human activities. We dedicate an important part of our lives to learn, and many aspects of this leaning take place in formal academic contexts. Educational institutions, in all levels, contribute to train professionals, but also, to train people. Based on this, the approach of these institutions to present their students education becomes relevant. During the last decades, the instructional process has experienced deep transformations, going from a teacher- and -content-based training process, to a student-based training process. However, we are still in the middle of this transformation process.

Accordingly, the level of demand in higher education is different and larger. The competences students need are those that allow them being self-learners during their entire lives. Besides, the learning achieved must be significant, which implies students must be capable of building their own knowledge. This requires a series of intellectual, attitudinal, motivational and emotional (among others) tools. From a psychoeducational point of view, autonomy refers to the capacity to learn how to learn*(Martín &Pozo, 2003)* and, hence, the capacity to regulate the learning construction process *(Zimmerman, 2002).*

Self-regulated learning, understood as a set of thoughts, feelings and actions, self-generated by learners that systematically orientate the accomplishment of goals *(Zimmerman &Schunk, 1989),* has become a fundamental concept, both for research and educational practice. Besides, experts seem to agree that the most effective learners are self-regulating *(Butler 6 Winne, 1995).* Regarding results, students with higher self-regulating abilities express a greater academic satisfaction and, more important, they learn more with less effort *(Pintich, 2000*). Once again, findings indicate there is a positive relationship between learning self-regulation processes and academic achievements *(Azevedo&Cromley, 2004; Pintrich& de Groot, 1990; Zimmerman, 1998).*

However, considering the latter and starting from real situations, the vast majority of university students are not adequately prepared to what is required of them in universities. They are not students capable of self-regulating their own learning processes *(Allgood, Risko, Alvarez & Fairbanks, 2000).* It has been clear for a long time that the lack of strategies and self-regulating processes to face learning is the principal factor of university failures *(Tuckman, 2003a).*

The last results from PISA 2009 indicate that, although Chile is rated first in Latin America for the second time in a row, one out of three Chilean students do not reach level 2 of performance, which means he or her does not reach the minimal competences to develop him or herself in the academic world and to integrate productively into society (OCDE, 2010). This situation becomes even more relevant in vulnerable sectors, because one out of two students is under level 2. This date correspond to many of the students whose next step in education is the access to the university, students that aspire to a higher education that implies an excellent, deep and specific training process, but also some demands they are not ready for. In Chile, just like in the rest of Latin-American countries, there are virtually no students located into level 5 and 6 of maximum competencies, only 1%, while OCDE countries have a 7%. And despite the fact that 15-year-old Chilean students got an average of almost 40 more points in reading competence that in the last PISA evaluation (OCDE, 2010); Chile is below OCDE average, ranking 44 among 65 countries. So, the argument that economic, social and educational policies condition these results does not absolve of responsibilities to the real protagonist of learning, the students. 2009 PISA results show that “the relationship between the wealth of a country and a good education is no longer working”, as ÁngelGurría, Secretary-General of OCDE, stated (EFE Agency, 2010). Therefore, two countries with similar levels of prosperity may produce very different educational levels.

In this context, real and immediate, it is indispensable to assume, for once and for all, the responsibility to train our students to develop autonomous and quality learning, which refers to the need to train them to regulate their own learning. Quoting ÁngelGurría again, the report results indicate that “not only the way students are behaving now, but the way they will behave in the future”. Because of that, it is essential to raise interventions that promote the acquisition of competences university students needs in order to learn autonomously. The moment to do this is, at the latest, during the first years of their higher education. In this way, we will contribute to shorten the distance between the real situation of our universities and the desirable situation. The good news is subjects participate actively in their learning processes by monitoring and regulating product-oriented processes *(Pintrich&Schrauben, 1992; Rosario, 2003, 2004),* therefore, they can be taught how to do it and to intensify the abilities they have already acquire. On this line, research suggests that self-regulating processes can be trained and can lead to increasing student’s performance and motivation *(Zimmerman, 2002).* However, although scientific literature supports the importance of

using self-regulation, only a few students self-regulate adequately their own learning and, paradoxically, only a few teachers prepare their students to act like autonomous learners (Zimmerman, Bonner, & Kovach, 1996). This reality contrasts with the characterization of the successful university student as a “self-regulated student” *(Nota, Soresi& Zimmerman, 2004; Pintrich& de Groot, 1990; Williams & Hellman, 2004; Zimmeman& Bandura, 1994),* relating once again self-regulation with academic success *(Nuñez, Solano, Pienda& Rosario, 2006).*

The need to study how self-regulating capacities can be strengthened arises not only as an answer to the current situation, not only in Chile but in other countries as well, but as a consequence of the studies that highlighted the fundamental role of self-regulation in learning and academic success several decades ago (Zimmerman, 1994; Zimmerman, 2002). In order to do so, intervention actions have been developed and implemented, directed to train students with self-regulation strategies. Most of these strategies come from Anglo-Saxon educational contexts, and these first formal attempts to teach university students to be self-regulated students showed a remarkable success *(Hattie, Biggs &Purdie, 1996; Simpson, Hynd, Nist&Burrel, 1997; Zimmerman, 2000; Zimmerman &Schunk, 2989).*

This article aims to provide a brief review of the different competence-improving programs to develop authentic learning by an autonomous and self-regulated learning. Notwithstanding, before reviewing those programs, an introduction about what is understood by self-regulated learning from a socio-cognitive model is developed. Once the intervention programs are reviewed, some concluding comments are included, focusing in the possibility to use the new information technologies to manage those programs in an efficient way.

2. SELF-REGULATED LEARNING FROM A SOCIO-COGNITIVE PERSPECTIVE.

Learning self-regulation is a complex and multifaceted process that integrates key motivational variables and self-processes. Although there are different models to explain and conceptualize self-regulated learning, they all have similarities and they all defend the basic assumption that students can effectively regulate their cognition, motivation and behavior and, through these self-regulating processes, they can reach their objectives, increasing their performance and academic success *(Dembo& Eaton, 2000; Zimmerman, 1998). T*hat is to say, the student becomes the protagonist and active promoter of both his or her learning and performance *(Zimmerman &Schunk, 1989).* Besides, these models share an integrative learning conception that stresses the need to combine cognitive, metacognitive and affection-motivational components to explain learning and performance *(Boakaerts, 1999; Pintrich, 2000, 2004).*

In order to understand and organize the structure of self-regulating processes, as well as the relationship between strategies and processes used in motivational beliefs, Zimmerman (1998, 2000, 2003, 2008) developed a self-regulation cyclical model from a socio-cognitive perspective. According to this model, self-regulated students are active learners that get involved in several self-regulating processes (for example, establishing their goals, self-observation, self-evaluation), mainly through the use of a series of strategies related to academic tasks (like time management, information organization, etc.) and the regulation of different self-motivating beliefs (for example, self-efficiency, intrinsic interest) *(Cleary & Zimmerman, 2004).* It is assumed that these trainees regulate their learning through three cyclical stages: the first one would be the #previous stage", and it refers to the processes and beliefs that take place before the learning process and influence and predict student's efforts to learn, setting the pace and the level of that learning. The second stage is the self-regulating process, the "completion stage" or "volitional control". It is influenced by the first stage and it implies the processes occurring while learning takes place, affecting attention and action, the concentration level, and the objective management monitoring *(Zimmerman, 1998, 2002).* Finally, the third stage, "self-reflection", implies the processes occurring after the efforts of the completion of learning. This reflexive process has a cyclical nature and it influences the previous stage and the efforts leading to an effective learning. This completes the self-regulating cycle (Zimmerman, 1998, 2000, 2002). Thus, learning self-regulation is described as an open process that requires a cyclical active from the trainee. This activity occurs in three stages, within which a series of processes and sub-processes takes place *(Schunk& Zimmerman, 1998; Zimmerman, 2000).*

The previous stage of the self-regulation cyclical model implies a series of processes, beliefs and attitudes that the student has prior to the involvement in an academic activity, like studying or taking notes in class *(Cleary & Zimmerman, 2004).* These processes include the establishment of goals, objectives and the strategic planning, along with a set of motivational beliefs, like self-efficiency perception, goal orientation, and the value the student gives to the task. The establishment of goals has been defined as the decision about the learning result or the expected performance, while strategic planning implies the selection or the creation of a strategy to optimize the completion of tasks during the learning process *(Zimmerman, 2000).* Regarding motivational beliefs, this characteristic self-motivation that self-regulated students have comes from their beliefs about learning *(Zimmerman, 1998, 2000).* However, the motivational key of the self-efficiency process is self-efficiency, mainly because its validity when it comes to explaining and predicting student's effort and persistence *(Zimmerman, 1998).*

Secondly, the completion stage or volitional control refers both to the processes helping the student to center his or her attention to the learning task, and the use of a set of strategies aiming to optimizing their school accomplishments *(Zimmerman, 2000, 2003).* During this stage, students are actively involved in the task and use different self-control and self-observation processes to maximize their learning *(Cleary & Zimmerman, 2004).* Self-control processes imply the student implementation of a series of strategies, or other learning methods, that have been selected in the planning stage (for example, note-taking strategies, exam preparation, comprehensive reading, etc.), and the implementation control of these strategies through the use of different methods (for example, the use of mental images, self-instructions *(Zimmerman, 2000*). Regarding self-observation, it is defined as the systematic monitoring the student develops regarding his or her own accomplishments *(Zimmerman, 1989),* through the recording of personal facts to find the cause (for example, personal recordings about the use of time=, and experimentation regarding the insertion of changes in that organization according to observable mistakes or aspects that can be improved. According to Zimmerman, this is a vital process, because it facilitates the information about progresses and failures about a determined reference criterion (for example, school classification, designed school objectives, classmates' school success).

Finally, self-reflection refers to the reflection about the gathered information regarding completion itself. This information is destined to assess the results obtained with the

intention of changing them or modifying them en future learning situations. Two main processes are included in this stage: personal judgment and emotional reactions. Personal judgment consists of two sub-processes: self-evaluation and causal attributions.

Regarding the first one, self-evaluation of school results, it implies the comparison of the information extracted from self-monitoring with a specific educational objective (for example, the confrontation of the result achieved with the results given in the exercise manual), although it can also be compared with the results of others. This comparison drives to the realization of attributions about the causal meaning of those results (the causes to which one attributes success or failure), like believing that low performance is due to a limited ability or insufficient effort. Causal attribution processes play a very important role in self-reflection processes *(Weiner 1979).* Students that self-regulate their learning face school results as a consequence of their effort, attributing, for example, a determined academic failure to causes that can be modified (for example, by increasing the amount of time of individual study), which will lead them to improve future completions by engaging and putting more effort into it.

With regard to the second sub-process, all students' causal attributions are related with a series of emotional reactions that he or she will experience. These reactions refer to personal satisfaction feelings and the adaptation to learning tasks. On one side, attributions involve positive or negative satisfaction feelings in relation to the obtained results. So, while an increase in the personal satisfaction to learn increments motivation, a decrease in the personal satisfaction undermines the efforts to learn*(Zimmerman, 2002).* On the other side, these reactions adopt the form of defensive or adaptive answers to learning. The first ones refer to the efforts to protect the self-image by avoiding being exposed to learning activities or tasks (for example, absenting exams). On the contrary, adaptive reactions refer to the adjustment related to the increase of the effectiveness of the learning methods by altering, or just modifying a learning strategy that is not helping to reach the objectives *(Pintrich&Schunk, 2002).* So, causal attributions centered in learning strategies do not only influence reactions, but they also help students in the identification of the source of their mistakes and in the adaptation of its completion. Self-regulated students usually present a higher adaptation capacity to learning tasks, because they evaluate their school completion more frequently and adequately*(Zimmerman &Ringle, 1981)*.

Finally, the cyclical perspective of this model implies that, when completing the cycle of the self-regulation process, favorable emotional reactions influence the previous stage, promoting positive beliefs about one self as a student, increasing more objective-centered learning orientations *(Dweck, 1998)*, and the intrinsic interest in school tasks *(Zimmerman &Kitsantas, 1997).* In short, the self-regulation previous stage prepares the student to the volitional control stage and this one, for its part, affects the processes used in the self-reflection stage that interact with the next previous stage, increasing the learning quality. Therefore, it is possible to affirm that these stages tend to create a movement that can facilitate or difficult the next stages of the cycle *(Zimmerman, 2008).*

3. LEARNING STRATEGY AND SELF-REGULATION TRAINING PROGRAMS.

Introduction.

In an attempt to deepen and classifying the intervention programs in this matter, different investigations have been conducted about those university student improvement proposals. For example, Cole, Babcock, Goetz & Weinstein (1997) created a classification matrix, distinguishing from those courses that simply orientate students about the services and resources in the campus, to those that, from a theoretical framework, focused in teaching strategies, try to teach students to be independent trainees. Simpson et al. (1997) presented a literature review about classroom interventions regarding study competences, choosing as the organizing criterion the transfer of learning strategies to other contexts. In this respect, they introduced a taxonomy organized in five general categories *(Simpson et al., 1997):* "learn to learn courses; courses similar to the previous ones, but focused on the mastering of a specific learning; "palliative"-orientated punctual interventions to cover some lagoons;reading-and-writing-competence centered courses and; lastly, assistance services in the area of study competences offered by experts. For their part, Hattie, Biggs &Purdie (1996) developed a meta-analysis about the research in learning teaching strategies, concluding that interventions vary from short-term laboratory studies, focused on the training of a specific strategy (like using mnemonics, underlying, etc.), to more global interventions focused on different cognitive strategies (like underlying), metacognitive (like self-questioning), or motivational (like making adaptive attributions). All these research conclude that there are many courses and methods to work with students at risk of academic failure or a low performance in university, and their instructional content varies tremendously.

The contribution and perspective of this work pretend to investigate and describe the ingredients that favor self-regulated result in the selected programs, rather than focusing the attention on theoretical models that sustain these interventions or on the search for differentiating or non-differentiating criterion. Of course, after the implementation of change or improvement programs, an optimal evaluation of the results obtained must be conducted (mostly in comparison with the expected results). However, a not insignificant number of intervention programs do not present data about the valuation of the results obtained. In the cases that do provide data, it is common that the usefulness and efficiency of the program is proven by comparing students' performance before and after the intervention, or with respect to whether

there are changes in the amount of strategies that claim to use, or in motivational variables (intrinsic motivation, achievement expectation, perceived usefulness, etc.).

Programs.

The following is a review of some of the more widespread and relevant international intervention programs. McKeachie, Pintrich and their collaborators elaborated an intervention program (Learning to Learn). This initiative has been offered as an introductory course for university students through the Department of Psychology of the University of Michigan since 1982. Based on the research that advises to consider jointly motivation and cognition in self-regulation models *(García&Pintrich, 1994; Pintrich& de Groot, 1990; Wolters, Yu, &Pintrich, 1996),* this program focuses in the instruction of cognitive, metacognitive and motivational strategies for the purpose of teaching university students to be self-regulated students *(McKeachie, Pintrich, & Lin, 1985; Pintrich, McKeachie, & Lin, 1987).* The special attention to cognitive, metacognitive and motivational strategies is in line with those self-regulated models that give importance to motivation and metacognition. Among those, we can find P. Pintrich's, "you need the will as well as the skill" *(Murray, 2000).* The results provided by these authors seem to indicate that students that have been instructed by this kind of work show a significant increase in the average of their performance (GPA – Grade Point Average), as well as in the self-report of the use of strategies *(Hofer, Yu, &Pintrich, 1998).* In another of the experiences evaluated with this program, students, aside from increasing their mastering in their learning process, self-efficiency and the use of cognitive strategies, present an anxiety decrease by the end of the fourth-month period *(Pintrich, Smith, García, &McKeachie, 1993).*

From a similar perspective, Tuckman develops an intervention model (Strategies-for-achievement: "Individual learning and motivation: strategies for success in college") throughout a course initially offered by the Ohio State University in 2000. Subsequently, it was implemented in different institutions like the Columbus State Community College, Coyahoga Community College, Ivy Tech and Gateway Community College. It is conceptualized as a course to "learn how to learn", based on strategy teaching *(Tuckman, 2003a, 2003b)* developed from a theoretical framework that emphasizes strategic and self-regulated learning. The final aim is to teach university students learning and motivational strategies with the purpose of increasing their academic

success. The course efficiency was evaluated by checking the expected significant increase in performance with the GPA. The obtained data point out students that were trained had a significantly higher performance after the course than prior it *(Tuckman, 2003a).*

Claire Ellen Weinstein and her colleagues from the Cognitive Learning Strategies Project of the University of Texas, have elaborated an intervention program that was implemented in 1977. This program was offered as a course of studying abilities, in the format of a 3-credit subject, imparted three hours a week *(Weinstein & Underwood, 1985).* At that moment, it had two objectives: a) to serve as a research practice to the Cognitive Learning Strategies Project in the Department of Educational Psychology of the University of Texas and b) to provide a support service to the students having academic problems in the university. Based on the model of strategic learning, design by the research group, nowadays, and as a result of the investigation conducted in the project, the EDP-130 course has evolved to become a class about strategic learning. Through the oral presentation of each of the strategies 4 central learning areas are emphasized: “Skill” (the use of learning strategies, the identification of important studying information to study and prepare exams), “Will” (the establishment and the use of goals and the generation and maintenance of motivation), self-regulation (time management, stress control, concentration control and procrastination management) and context variables (teacher’s expectations and the use of resources that can help to reach academic goals). The effect of the intervention program has been estimated by three measurements: academic performance measured by GPA, a reading comprehension measurement; measured by the Nelson-Denny Reading Comprehension Test; and strategic learning, measured by LASSI. Authors point out positive effects in the three areas. One of the greatest virtues of this program is that the trained abilities are useful both in the moment the students starts the course, and during his or her entire life, contributing to the desirable “lifelong-learning”. Many of these trained abilities may seem basic, but students present more difficulties to face academic tasks when they use or are required to use them.

In 2006, Schloemer and Brenan implement a program especially designed and directed to performance improvement through the learning process self-regulation: “From students to learners: developing self-regulated learning”. There are three objectives that guide this intervention: building awareness about the importance of an adequate goal establishment, promoting a frequent learning monitoring (self-monitoring) and

stimulating the implementation of performance improvement strategies. Results indicate that after the implementation of this program, students show a significant increase in enthusiasm, in the number of students that complete a daily register of the time and effort dedicated to studying, in the help given to their classmates and received from their teachers. Results also show: a higher number of hours per week dedicated to preparing classes and reviewing notes; a major consistency between the student self-evaluation and teacher evaluation; a significant decrease in absenteeism and in failing to do homework *(Schloemer& Brenan, 2006).*

Nücles et al., in 2009, started an intervention to improve SRL through writing Learning Protocols: "Enhancing self-regulated learning by writing protocols" *(Nückles, Hübner, &Renkl, 2009).* This program postulates that writing protocols, the ones related with trainees expressing their reflections about previously presented contents and, at the same time, self-questioning about the things they do not understand and fin the way to surmount their understating difficulties, may stimulate the use of self-regulated learning essential strategies (Berthold, Nückles, &Renkl, 2007). The student will externalize his or her thoughts expressing them in the protocol and taking a metacognitive position towards his or her own learning process. This is precisely what will activate self-regulation essential strategies, such as comprehension monitoring or learning result evaluation *(Nückles et al., 2009).* After the learning protocol analysis, an increase in elaboration and organization strategies, as well as in student's efforts to regulate the comprehension of the studied material, was observed *(Nückles et al., 2009).* Other worth mention interventions are the Thinking Aloud Together (TAT), thinking to promote metacognition and self-regulated learning through cooperative learning in an small group *(Hogan, 1999),* or the Peer Instruction Program, developed by Eric Mazur in Harvard University. This program is based in the success of the collaboration between classmates and teachers when it comes to promoting learning self-regulation strategies *(Webb &Palincsar, 1996).* Lan's intervention (1998) is also worth mentioning. It was implemented with university students as a statistical subject. It proceeds by given students some protocols to guide them in the monitoring of their studying process, by collecting data about how much time have they invested to study a specific concept, how the value their self-efficiency regarding learning this concept, etc. *(Lan, 1998).*

As it was observed, outside the Anglo Saxon context, the situation has been quite different, because this tradition of training studying abilities is not the same. So, for

example, in Spain, we can find some isolated courses proposed by different university instances with diverse objectives and whose content varies widely. Below, a small summary of the most significant interventions, classified by their content, is discussed. In the first place, the group is formed by programs called OrientaciónUniversitaria (University Counseling) *(Rodríguez &Manzano, 2002).*This programs are described as "an instruments that allows to direct student needs and systemize their intervention so the student realizes that his or her studies are their main tool to build a professional future *(Rodríguez &Manzano, 2002, pp.369).* In any case, although there is an enormous diversity among them, regarding theoretical approaches, intervention models, contents, methodologies, evaluations, etc., they do not aim to promote a student autonomous learning. In general, they are far away from being counseling about strategies with an integrator theoretical model, but they are techniques packages and isolated studying strategies.

Secondly, another type of intervention is constituted by the so-called "zero courses". Their main objective is to prepare students that are going to start university by providing them the necessary knowledge they supposedly do not have. These courses assume the idea that getting into the university world is a decisive moment in a student academic journey. However, in the transition from high school to university, there are huge differences with learning specific subjects, as it has been said in this article. This is the main reason why "zero courses" are implemented in Spain, as they try to give freshmen the knowledge about basic aspects of their purpose as students.

In the third place, there is another kind of courses organized by the Counseling and Information Centers (COIEs by its Spanish initials), the Educational Guideline Services (for example University of A Coruña), the University Offices (like the University Medical Office of the University of Valladolid), and even by Departments that usually cover specific aspects such as studying techniques, anxiety control before exams, etc. A "Learning to Learn" course and another one called "Academic Performance Improvement Techniques", offered by the University Student Guideline Service of the University of Salamanca, and "Learning to learn" and "Autonomous Learning Competences Program", offered by the European University of Madrid, are amongst the programs related with autonomous learning and self-regulation. That last program offers the possibility to develop three key competences (planning, team work and public speaking) for students to become autonomous and independent regarding their learning as university students and, besides, during their professional career.

Lastly, it is worth stressing those strategy intervention programs in the framework of empirical research. In most of the cases, those interventions are part of research about some specific strategies or components. The intervention “Meaningful Text Reading Strategy” *(Román-Sánches, 2004)* would be inside this group. This is a learning self-regulation procedure for university students. It starts as a theoretical model of learning strategies, the ACRA model *(Román, 1990.* It considers 32 learning strategies over areas of metacognitive and support strategies, and acquisition, codification and recovery cognitive strategies. This intervention focuses on reading and understanding texts in a meaningful way and it is taught in two or three classes, so it can be used later in instructional activities focused on autonomous learning. The strategy consists of a “flexible and recurring sequence of five mental operations to process written information that ease the semantic storage of conceptual and theoretical knowledge: linear underling, paraphrase development, textual structure identification, self-questions, and conceptual maps” *(Román-Sánches, 2004, pp. 114).* Regarding valuation of results, intervention presents positive data regarding training in three criteria: more knowledge in the strategy worked; a transfer of the training effects, which is assessed by an objective performance test, which is designed for that purpose; and the durability of the effects, which is measured three months after the intervention.

Also inside this research framework, Rosario et al. (2007) analyze of a program that promotes learning processes and strategies for university students. The program is organized around a series of letters written by Gervásio, a freshman *(Rosario, Mourão, Nuñez, Gonzáles-Pienda, & Solano, 2006),* about his reflections, difficulties and successes experienced in this new stage of his academic life. The program was contrasted with a small sample of university students, showing the pre-test and post-test results in both experimental and control group, program efficiency, for both teaching and self-regulation training strategies in university. Specifically, students from the experimental group improve the declarative knowledge about learning strategies. Besides, the use of a superficial learning approach decreases in these students and the quality of the tasks evaluated with the SOLO taxonomy *(Biggs & Collis, 1989)* improves after participating in the program. On the other hand, despite the fact that there are significant statistical changes in the experimental group regarding the use of a deep learning approach, the observed tendency shows an increase in this kind of approach. Finally, changes in the self-regulation process and in the instrumentality perceived to self-regulate learning are not observed. With respect to the control group,

there were no significant statistical pre-test/post-test differences in any of the studied variables, which were interpreted as an indicative that this would be the guideline for the experimental group if the intervention had not been introduced. This program was contrasted again with students in Portugal and Spain *(Rosario, Núñez et al., 2010)* with the purpose of proving the consistency of the data from the precious study. The obtained results are very similar to the ones mentioned. In particular, during the post-test, students from the experimental group show a higher knowledge about less superficial strategies, in comparison with students from the control group. The differences are statistically significant in the three cases, while those differences are not significant when it comes to a deep learning approach (although the level in this measurement variable is higher in the students that have received the program), regarding the utility perceived and self-efficiency.

4. IN CONCLUSION: SELF-REGULATED LEARNING AND ICT

Despite the encouraging results these interventions have given, as Simpson et al. mentioned, the increase in self-regulating competences, though important, is not deeply influenced by variables that are not contemplated by the initial research design. These variables should be considered during the implementation of these actions in the future *(Cerezo et al., 2010).* One of these relevant variables is the work format, which in almost all programs corresponds to tutorial face-to-face sessions, with materials like notebooks or manuals, pens and paper. However, in the current knowledge society, Information and Communication Technologies (ICT) are becoming one of the critical variables in formative scenario, offering, among other possibilities, the creation of more flexible settings for learning *(Cabero, 2010),* and, despite the fact that there seems to be some disagreements *(Jonassen, Howland, Moore, &Marra, 2003),* they might be more motivating for students. But this is not only a matter of advantages, but also requirements. Knowledge access depends, more frequently, on new information technologies, which implies digital competence: a decisive factor when learning and teaching.

Following this line, PISA report has put to the test for the first time the capacities of students to manage themselves in the digital era through a reading text in electronic format: *"the student puts a memory stick in the computer. He will find in it the questions and, surging in the computer as he would in the internet, he will find the answers to solve those questions. Once he finishes, the students will return the memory stick to the examiner" (Aunión, 2009).* This decision represents how important the digital competences have become in today's world and, therefore, in the academic sphere. Thus, the objective of this test goes beyond reading competences, but, as Andreas Schleicher, director of PISA report states, "it is not only about technologies, but also about cognitive competences that are need for an effective use of technology". According to Schleicher, this new challenge would imply building new knowledge from electronic texts, something "quite different that doing it with printed texts" *(Aunión, 2009).* This is only one more example of traditionally producing and transmitting information that are overcome by the present socio-cultural scenario, so universities must adapt to this new situation and answer the new challenges to fulfill their new educational and social function. From this approach, research about the promotion of autonomous learning must focus towards the intervention design that addresses to main issues: the contribution to the development of the so-called student digital

literacy *(computer and digital literacy)* and the integration of ICT into de design of those programs. This last one is one of the most relevant current and future research lines in the field of learning (in general) and self-regulation (particularly).

When consulting the recent literature, a clear tendency to involve new technologies in the design of intervention programs to promote self-regulated learning has been observed *(Cerezo, 2009).* In contrast with this information, research evidences show that students of all ages have some problems when using their meta-cognitive abilities, which play a fundamental role in the self-regulatory process, especially when learning takes place in open contexts, like hypermedia *(Azevedo, 2005).* Therefore, it is precisely in this open and collaborative context, where self-regulation becomes more necessary than in a traditional classroom. Studies indicate that those students that lack of meta-cognitive strategies and self-regulating abilities do not benefit from this kind of educational support. Computer Based Learning Environments (*CBLEs)* require a certain competences when it comes to deciding *what* he is going to learn, *how* and *when*, how much *time* he is going to invest on it, *when* to change of strategy, *when* to put more effort into it, etc. *(Azevedo et al., 2005).* A self-regulated trainee would analyze the situation, would establish goals, would dispose of strategies to face the learning challenge, determining what is the most valid for each situation and he would assess the results according to the expected results; in conclusion, it would be the key elements to successfully handle the CBLEs. The controversy arises when these same difficulties might affect those interventions about self-regulated learning that are carried out through CBLEs [nowadays, most of the cases (*Cerezo et al., 2010)*] when one of its objectives would be, paradoxically, to palliate the added difficulties that this kind of environments assume to the students' learning process.
One of the possible ways to face this issue is the evaluation of the intervention programs. Literature about the promotion of self-regulated learning in university students gives us only a few examples about the evaluation of the intervention's efficiency *(Azevedoo&Cromley, 2004; Graesser et al., 2004; Hofer & Yu, 2003; McNamara, Levenstein, &Boonthum,2004; Nückles et al., 2009; Pintrich et al., 1987; Román-Sánchez, 2004; Román&Gallego, 1994; Rosário, 2010; Rosário et al., 2007; Schloemer& Brenan,2006; Tuckman, 2002, 2003ª);* in many of other cases, programs are proposed and implement with actually knowing if they produce the results expected. A differential contrast between the efficiency of those implemented interventions through presential formats and those carried out in Computer Based Learning Environments, may shed light about the current disagreement about the virtues of CBLEs en relation to learning processes.

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