

Implementation of training programs in self-regulated learning strategies in Moodle format: Results of a experience in higher education

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This paper tests the efficacy of an intervention program in virtual format intended to train studying and self-regulation strategies in university students. The aim of this intervention is to promote a series of strategies which allow students to manage their learning processes in a more proficient and autonomous way. The program has been developed in Moodle format and hosted by the Virtual Campus of the University of Oviedo. The present study had a semi-experimental design, included an experimental group (n=167) and a control one (n=206), and used pretest and posttest measures (self-regulated learning strategies' declarative knowledge, self-regulated learning macro-strategy planning-execution-assessment, self-regulated learning strategies on text, surface and deep learning approaches, and academic achievement). Data suggest that the students enrolled in the training program, comparing with students in the control group, showed a significant improvement in their declarative knowledge, general and on text use of learning strategies, increased their deep approach to learning, decreased their use of a surface approach and, in what concerns to academic achievement, statistically significant differences have been found in favour of the experimental group.

Implementación de programas de entrenamiento en estrategias de autorregulación del aprendizaje en formato Moodle: resultados de una experiencia en enseñanza superior. En este trabajo se contrasta la eficacia de un programa de intervención en soporte virtual para el entrenamiento de estrategias de estudio y autorregulación en estudiantes universitarios. El objetivo de la intervención es dotar a los alumnos de un conjunto de estrategias que les permitan abordar sus procesos de aprendizaje de una forma más competente y autónoma. El programa se implementó en formato Moodle a través del Campus Virtual de la Universidad de Oviedo. El diseño utilizado fue cuasi-experimental, con grupo experimental (n= 167) y grupo control (n= 206), y medidas pre y postest (conocimiento declarativo de estrategias de autorregulación del aprendizaje, uso de la macroestrategia de aprendizaje autorregulado planificación-ejecución-evaluación, uso de estrategias de aprendizaje autorregulado a través de textos, enfoques de aprendizaje superficial y profundo y rendimiento académico). Los datos obtenidos muestran que los alumnos que participan en el programa de entrenamiento, en relación a sus compañeros del grupo control, mejoran significativamente en cuanto al dominio de conocimiento declarativo, uso general y a través de textos de las estrategias de aprendizaje, se incrementa el uso de un enfoque de estudio profundo, disminuye el uso de un enfoque superficial y se obtienen mejoras estadísticamente significativas en el rendimiento académico.

Increasingly more attention is paid to the factors that differentiate successful students from those who are not. Although, traditionally, university learning had received the least attention, there is currently much concern about the quality of university students' learning and, in general, about their integral training (Allgood, Risko, Álvarez, & Fairbanks, 2000). Factors related to external aspects such as the amount of time dedicated to study (Plant, Ericsson, Hill, & Asberg, 2005), performing extra activities

(Cheung & Kwok, 1998), and the influence of contextual and environmental factors (Pike, 2005) have been studied.

From a broad perspective, successful university students are usually described as self-regulated students. Self-regulated students direct their learning by means of a series of cognitive, metacognitive, motivational, and supportive strategies that allow them to construct their knowledge; they are capable of regulating and controlling the entire process intentionally— they know their skills, the knowledge they possess, they know what to do to learn, they have learned to monitor their study behaviors, they match their behaviors and activities to study demands, they are motivated to learn and capable of regulating their motivation, etc. (Pintrich, 2000, 2004). What clearly identifies them as «self-regulators» of their learning is not so much their isolated use of learning strategies, but their personal initiative, their perseverance at the tasks and the

competences displayed, independently of the context in which the learning occurs (Bandura, 2001; Zimmerman, 2002).

Self-regulated learning (SRL) is essential for academic success, because it is very closely related to the accomplishment of personal work with an intense engagement in study time, and to the strategic self-regulation pattern used (Rosário et al., 2005). Moreover, SRL does not only affect performance but all other fundamental aspects in the university such as constancy and persistence (Nota, Soresi, & Zimmerman, 2005). In general, such competences allow students to be autonomous while learning meaningfully and constructively throughout their entire lives, as reflected in the new legislations presented in the *Declaration of Bologna* and other European documents (González & Wagenaar, 2003). Therefore, providing students with the necessary competences to learn autonomously is considered one of the great challenges of the European legislation.

However, and complementarily, the educational reform of higher european education have a scenario marked by the use of *new technologies*, a scenario in which our students will have to develop as learners and, at the same time, as citizens of the 21st century. Beyond the classroom, these new allies are present in the way we work, communicate, relate, and —of course— teach and learn; to conclude, in the way we live. Taking this into account, we cannot consider such a factor an added requirement for the student, but instead an adjustment of higher education to reality; we should not forget that the mission of the university is not just formative, but also social.

Essential allies to achieve this goal are the new Information and Communication Technologies (ICTs), which allow teachers and students to benefit from the advantages of these new learning environments (Kok, 2008) and fit higher education to the characteristics of the new millennium without affecting their goals and social ends. However, the research carried out to date shows that students of all ages have difficulties deploying their metacognitive skills —which play an essential role in the self-regulation process— when learning occurs in open contexts such as hypermedia (Azevedo, 2005b), which uses virtual support. Despite the fact that our students are quite familiar with this type of tools, they are not so familiar with their use for educational ends, and the motivation to use technological means does not always imply motivation for the learnings sought. From cognitive science, psychology, and even artificial intelligence, the results obtained show that these computer-based learning environments (CBLEs) add more difficulties to the learner from essential disciplines such as sciences, mathematics, and social sciences (Azevedo, 2005a). Convergent empirical results have also been found that endorse the idea that the reason for these difficulties is that students do not deploy self-regulating processes while learning (Azevedo, Cromley, & Seibert, 2004; Graesser, McNamara, & VanLehn, 2005; Quintana, Zhang, & Krajcik, 2005).

Learning that implies CBLEs requires more effort by the student when deciding what, how, and how much to learn, and how much time to invest, when to change or drop the strategy being practiced, when to increase or save effort, etc. (Azevedo, Cromley, Winters, Moos, & Greene, 2005). In this sense, the available data about learning in higher education indicate that most students are not adequately prepared for what is required from them in this context. Hence, the most important and urgent issue is to know how to provide university students with the necessary competences to allow them to study successfully and to learn meaningfully while using the new human communication tools that are currently available. As noted by Cerezo et al., (2010), although

much has been investigated and written about self-regulation processes of academic learning and the personal and contextual variables involved (i.e., Boekaerts & Corno, 2005; Brophy, 2004; De la Fuente, Pichardo, Justicia, & Berbén, 2008; Elliot, 2008; Moskowitz & Grant, 2009; Núñez, Solano, González-Pienda, & Rosário, 2006; Riggs & Gholar, 2009; Schunk & Zimmerman, 2008; Zimmerman, 2008), the great challenge that faces us may be to build and test instructional models that support and promote SRL within contexts that are full of new information technologies (Cardelle-Elawar & Sanz de Acedo, 2010; Rosário et al., 2010; Perry, Hutchinson, & Thauberger, 2008).

In order to respond to the needs observed, the objective of this work focuses on test the efficacy of a program for capacitating students for an autonomous learning using the new ICTs as support. On the basis of previous investigations, main variables to determine program's effect were declarative knowledge of SRL strategies, use of general SRL strategies and SRL strategies through texts, deep and surface approaches to learning, and academic performance.

Method

Design and participants

A pretest-posttest quasi-experimental design was selected, in which intact groups of subjects were used (groups of students that already existed, attending classes in two degree programs of the University of Oviedo, Spain). Participants were 9 natural groups of students, of which 5 received the habitual instruction (control group or comparison group, CG) and 4 groups that received habitual instruction plus the intervention program (experimental group, EG). The total sample was 372 subjects, all of them 3rd year students from the University of Oviedo, from the degree courses of Psychology and Education. Of the total sample, 83.9% ($n= 483$) were women and 16.1% ($n= 93$) were men. The total sample was made up of two groups:

Control or comparison group. Made up of 205 students from the Psychology (two groups) and Education degrees (three groups), of whom were 158 (76.7%) women and 48 (23.3%) men.

Experimental group. This group comprised 167 subjects, all students from the Psychology degree. Assignment of the participants to the groups was not randomized; instead, we used four natural groups. With regard to sex, 143 (85.6%) of them were women and 24 (14.4%) were men.

Instruments

We assessed variables regarding self-regulation which could be define as *proximal variables* (knowledge of self-regulation strategies, level of general and specific competences in self-regulation), more *distal variables* affected by the SRL program indirectly (academic performance) and *medium variables*, not explicitly trained during the program but involved in the study and learning processes (surface and deep approaches to learning). We used the following assessment instruments:

Proximal variables

- a) *Declarative knowledge of self-regulation learning strategies.*
This variable was assessed by means of the Learning Strategies Knowledge Questionnaire (LSKQ) [Cuestionario de

Conocimiento de Estrategias de Aprendizaje (CEA), Rosário, Mourão, Núñez, González-Pienda, & Solano-Pizarro, 2006]. This test is based on the contents dealt with in the sessions, which consisted of 10 closed questions with 3 response options, 2 false and 1 true. The items refer to the 10 most important strategies we worked with during the intervention, divided into four groups: cognitive strategies, metacognitive strategies, motivational strategies, and resource management strategies. Cronbach's alpha of the total scale was .89.

- b) *Processes of SRL*. To assess the general competences of SRL, we used the SRL Processes Inventory (SRLPI), which is based on Zimmerman's model (2000, 2002). This instrument is made up of 12 items that represent the three phases of the process of SRL: planning, performance, and assessment, (Rosário et al., 2006; Zimmerman, 2000; 2002). The items were rated on a 5-point Likert-type format, ranging from 1 (*never*) to 5 (*always*). Cronbach's alpha of the total scale was .87. In addition, we assessed the competences of self-regulation of studying when working on texts by means of the *Escala de Evaluación de la Autorregulación del Aprendizaje a partir de Textos* (ARATEX) —in English, Scale of Assessment of Self-regulated Learning from Texts, SASRL-T; (Núñez, Solano, González-Pienda, & Rosário 2006; Núñez et al., 2009). This instrument was elaborated from a theoretical framework of the SRL carried out by university students when they attempt to understand a text in order to learn it. It has 23 items that are rated on a scale with five response options about the frequency with which they carry out the activity described in the item. Its Cronbach's alpha was .87.

Medium variables

- c) *Approaches to learning*. The approaches to learning were assessed by means of the Processes Study Inventory, (PSI) (Rosário et al., 2007), which is made up of 12 items that represent two factors or dimensions: a surface approach and a deep approach, according to the most recent tendencies in this vein of research (Biggs, Kember, & Leung, 2001; Rosário et al., 2007; Rosário et al., 2010; Struyven, Dochy, Janssens, & Gielen, 2006;). The items were rated on a 5-point Likert-type format, ranging from 1 (*never*) to 5 (*always*). The internal consistency of the subscales is not excellent, but it is higher than that obtained in other studies from diverse countries with similar questionnaires, specifically the SPQ (Study Process Questionnaire) and the LPQ (Learning Process Questionnaire) of Biggs (Biggs et al., 2001; Rosário et al., 2005, 2007). Cronbach's alpha for the deep approach was .72, and for the surface approach .70.

Distal variable

- d) *Academic results (academic performance)*. In this work, we obtained information about academic performance prior to and after the intervention. To know the participants' *prior academic performance*, we added an item to the *Initial Questionnaire of the Student's Personal Data* where we asked their access grade to the university. This score reflects the students' performance in educational stages prior to higher education and in the access test to the university. To

appraise subsequent academic performance, we used as the criterion the final grade obtained in the core course within which the program was implemented.

Procedure

The main characteristics of the training program and the intervention procedure are described below.

The tool that forms the core of the entire intervention program corresponds to a series of narrations by a (fictitious) student from the first grade of the university (Rosário, Núñez, & González-Pienda, 2006). In these texts, the student reflects about some of his experiences in the university, emphasizing the role of strategies and processes of self-regulation while learning. This tool is based on the conviction that SRL can be promoted by modeling and by experimenting with many opportunities to develop autonomous learning. For this purpose, we elaborated a series of letters expressed in a confidential and narrative tone, where a first-year student describes and reflects on his experiences and learning processes in the academic context. This way, students can experience vicarious learning through these narrations and inductively learn a self-regulated model to cope with their learning experiences.

The narrations follow an outline in accordance with the Zimmerman self-regulated theoretical framework, developing in each letter a series of learning strategies corresponding to each phase of the process of SRL that is analyzed. The proposed work based on the diverse letters suggests performing the reverse task: to identify the strategies and procedures underlying the discourse, constructing the personal «history» from the self-regulated narration offered by the main character of the stories. Each letter is organized around a series of strategies of SRL (i.e., establishing goals, organizing time, taking notes, test anxiety, comprehensive memorizing strategies, etc.). With regard to the process of self-regulation and the type of strategies proposed, the program includes 13 letters or narrations that are distributed according to the diverse phases of the process of SRL and that suggest working on different strategies that are shown in table 1.

The platform that support e-CAPA program is Moodle (figure 1), a Learning Management System (LMS) that allows the integration of a broad range of educational resources depending on the learning goal. Besides this advantage, it has an interface that allows surfing through its contents intuitively (Brandl, 2005). Therefore, this intervention combines the facilitating capacity of a medium like Moodle with direct training of an effective program to promote SRL.

As can be seen by the distribution of the material, the program was designed to allow students to select the learning strategies to work on depending on their demands. Its flexible nature is aimed at conforming to the two principles of the process of SRL: selection and control. In the e-CAPA, the students had the texts of each topic in PDF documents, their corresponding summaries and activities —which, once carried out, they up load to virtual space so the teacher can supervise them—and a forum for each topic— the basic tool for communication between teachers and students of the course (Cerezo, Núñez, Rosário et al., 2009).

The program was structured in 13 weekly sessions (units of content and activities) that were available to the students for a 15-day interval. Each Monday, the participants had access through internet to the new letter and the corresponding material to expand the information (summaries), train the selected strategy (activities

Table 1
Distribution of the strategies trained in eCAPA program according to the narrations of «Letters from Gervasio»

Letters	Contents	Trained strategies	
		Macro-strategies	Micro-strategies
Zero	(...) «if you read these letters carefully, you will understand my experience as a novice in the university and share my experience» <i>Have a good trip.</i>	Understanding the learning process	Student's role in the learning process
nr. 1	(...) <i>By the way, what does adapting well to the university mean?</i>	Adapting to the University	Organization and time management
nr. 2	(...) <i>What are my goals? What really guides me in my behavior, my studies, in the University, in my hobbies, in my relations with others, in my laziness...?</i>	Establishing goals	Goal characteristics (CREVA) Long-term and short-term goals Goals oriented towards learning and oriented towards results
nr. 3	(...) <i>How can I take better notes?</i>	Organizing information	Summaries, outlines, concept map Taking notes Cornell technique Controlling distracters
nr. 4	(...) <i>Do you know how to overcome putting off tasks?</i>	Putting off tasks	Time management TTD (Things to do) Lists Structuring the environment Procrastination Relaxation techniques
nr. 5	(...) <i>Why do we forget things?</i>	Information processing	Short-term memory Long-term memory Forgetting Instrumentality of learning
nr. 6	(...) <i>Who controls your learning? Do you know how to distinguish academically successful students?</i>	Self-regulated learning	Cyclical model of SRL Establishing goals Monitoring Volition
nr. 7, 8, 9	(...) <i>Which of these statements is true?</i> (...) <i>How are problems solved?</i> (...) <i>I am counting on you to solve it</i>	Problem solving	Steps in the process of problem solving Exercises in logic
nr. 10	(...) <i>How do you manage to get this subject so well organized? How do you manage to prepare the exam so intensely?</i>	Preparing exams	Time management Establishing goals Organization of information Reviewing/going over the subject Inquiry Doing previous exams
nr. 11	(...) <i>The way you study should be different depending on the type of exam?</i>	Coping with exams	Types of questions (short answers, tests, and long answers) Controlling distracters Reviewing answers Working in groups
nr. 12	(...) <i>Lastly, what is test anxiety?</i>	Test anxiety	Dimensions of anxiety Internal and external distracters Plagiarizing and copying Relaxation techniques
nr. 13	(...) <i>How are your studies going?</i>	Reflecting on the learning process	Assessment of the experience

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and audiovisual material), and express an opinion and discuss some topic related to the letter (discussion forums). Once the 15-day interval was up, the material was no longer available and the system blocked the reception of activities. Firstly, the students were invited to read the corresponding letter and then to carry out the proposed tasks. To perform the activities and complete the training of the session, they were encouraged to use and consult all

the material available in the unit (summaries, videos, etc.). Lastly, they had to participate in the discussion forum, where topics that were related to the strategy addressed were proposed, exchanging ideas and experiences. The program also includes three presential sessions: introduction and closure, where the pretest and post-test assessments were carried out, and an intermediate follow-up session.

Figure 1. Aspect of the interface of the e-CAPA program implemented in Moodle.

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Data analysis

The data contributed by the two samples of university students were analyzed to verify that there were no values outside of the scale, missing values, or with parameters that indicated a clear non-normal distribution. Once the descriptive study was carried out, we executed multivariate analyses of variance (MANOVAs) to determine whether we could assume an overall significant effect of the intervention. Subsequently, we performed an analysis of covariance (ANCOVA) for each one of the dependent variables, using the pretest levels as covariates in order to statistically control the effect of the initial level on the post-test level and to obtain more accurate information about the real effect of the intervention.

Results

The study of the aforementioned aim in terms of efficacy of the intervention will be addressed by the analysis of the post-test differences among the two groups of subjects in the dependent variables. Since the allocation of subjects to groups was not random, and as some pretest differences between the control group and the experimental group were found [proximal variables (Wilks' Lambda= .967, $F(3, 367) = 4.12, p = .007, \eta^2 = .033$) and academic performance ($F(1, 371) = 25.85, p < .001, \eta^2 = .065$)], we included the pretest measures as covariates in the analyses of variance. As mentioned, this procedure allows us to determine more accurately the effect of the intervention while controlling for—at least statistically—the effect of the initial pretest group differences.

Table 2 displays information about the means and standard deviations, pretest and posttest, of the six dependent variables (*level of knowledge of self-regulation strategies, use of general self-regulation strategies—planning, performance, assessment—, use of strategies of self-regulation when working with texts, surface approach to learning, deep approach to learning, and academic performance*), as a function of the two levels in the independent variable (CG, EG).

The MANOVA was performed only with the five dependent variables (since there is no academic performance information of all students). The data obtained from the multivariate analysis indicated that, taking the five variables conjointly, there were statistically significant differences among the two groups: control and virtual format (Wilks' Lambda= .381, $F(5, 366) = 52.76, p < .001, \eta^2 = .419$). With regard to the level of impact of the intervention on the dependent variables, the effect size was important, as the explained variance reached 41.9%. It is therefore assumed that the differences in the intervention modality are responsible for a large part of the variability of these five variables at post-test.

But, it is interesting to know whether the intervention had the same impact on all five variables, or whether, in contrast, the impact was significantly different depending on the type of dependent variable.

The results of the multivariate analysis show that the intervention had a significant impact on all variables although more on some than on others. Thus, important effects were obtained on the *level of knowledge of self-regulation strategies* ($F(1, 370) = 99.97, p < .001, \eta^2 = .213$) and on the *surface approach to learning* ($F(1,$

370)= 201.44, $p<.001$, $\eta^2= .353$), whereas the effect was lower, albeit statistically significant, for the *use of general strategies of self-regulation* ($F(1, 370)= 13.01$, $p<.001$, $\eta^2= .034$), the *use of specific strategies self-regulation for work on texts* ($F(1, 370)=$

9.65, $p<.05$, $\eta^2= .025$) and for the *deep approach* to learning ($F(1, 370)= 30.78$, $p<.001$, $\eta^2= .077$). As for the academic performance of the two groups of students in the posttest, the data provided by the ANOVA showed statistically significant differences between groups, favoring the experimental group ($F(1, 229)= 81.66$, $p<.001$, $\eta^2= .263$). The results described confirm the achievement of the objectives, indicating that after the intervention the students from the experimental group, in comparison to the control group, displayed more knowledge about self-regulation strategies, reported more use of the macro-strategy planning-performance-assessment, reported more use of self-regulation strategies when working with texts, they used a less surface and deeper approach to learning in their studies and academic learning, and obtain a higher academic performance at the end of year.

Table 3 displays the results of the analyses of covariance, using as covariate the pretest level of the dependent variable. With this information, we not only have data about the effect of treatment after controlling for the autoregressive effect, but we also know the extent to which the change in the dependent variable is related to variables other than its pretest levels (which will inform us about the degree to which this variable is malleable or stable).

Again, the results contributed by the analyses of covariance are not substantially different from those described above. The novelty of this analysis with regard to the MANOVA is that it provides information about the autoregressive effect of each variable (that is, the capacity of the pre levels to predict the post levels for each one of the six variables). In this sense, we observe that, as logical, the level of knowledge of strategies is very malleable and, moreover, the intervention implemented has an important impact on the levels reached at post-test. However, it is surprising that the surface approach also has a relatively small autoregressive effect, which is very good in view of the improvement of the students' processes of study; modifying the deep approach is more difficult.

Discussion and conclusions

Interest in SRL responds to the needs underlying the setting in which the teaching-learning process (T-L) takes place. Two of the main conditioners of this context are the educational reform that higher European education is undergoing and the constant and unstoppable advance of the new technologies in our lives. This, along with the need to really change the educational paradigm —about which there seems to be a total agreement at the theoretical level— places us in an awkward situation to which SRL is the answer.

The general goal that guided this work was to test the efficacy of the intervention «Letters from Gervasio» program (Rosário at al., 2006) using the ICTs as support. The results indicated that the program has shown its efficacy to promote change in all the variables of interest. It would be expected a higher effect of the intervention in the variables directly trained during the program but self-report methodology would be conditioning the results. In despite of the widespread use of these instruments, the validity of this methodology has been questioned (Pike & Kuh, 2005). Most of the aspects that take place during the self-regulation process are not observable so the use of on-line and qualitative measures would be indicated in future studies. Micro analytic measures are a suitable alternative, this approach involves assessing learner's responses before, during and after learning (Zimmerman & Moylan, 2009); it is trying to be sensitive to change using an event measure on SRL.

Table 2
Descriptive statistics of the variables at pre and post-test for the two levels of the independent variable

		Pretest		Posttest	
		M	SD	M	SD
Proximal variables					
<i>Knowledge of SRL strategies</i>	CG	7.89	1.57	7.75	1.88
	EG	8.30	1.01	9.51	.95
<i>SRL Macro-strategy</i>	CG	3.67	.48	3.75	.51
	EG	3.70	.49	3.92	.40
<i>SRL strategies on texts</i>	CG	3.62	.50	3.72	.55
	EG	3.71	.49	3.90	.48
Medium variables					
<i>Surface approach</i>	CG	2.47	.61	2.71	.45
	EG	2.42	.63	1.97	.56
<i>Deep approach</i>	CG	3.41	.60	3.50	.61
	EG	3.45	.60	3.82	.50
Distal variables					
<i>Academic performance</i>	CG	6.83	.80	2.71	.45
	EG	7.26	.86	1.97	.56

Minimum and maximum scores of each variable: knowledge of SRL strategies: 0-10; macro SRL strategy: 0-5; SRL on texts: 0-5; surface approach: 0-5; deep approach: 0-5. Prior academic performance: 0-10. Final grade: 0-4. Control group (CG) $n = 206$; Experimental group (EG) $n= 165$. *

Table 3
Analysis of covariance (control vs. experimental): variables and pretest levels as covariates

	df	df error	F	p	η^2
Knowledge of SRL strategies					
<i>Pre knowledge</i>	1	370	12.59	.000	.033
<i>Condition (CG-EG)</i>	1	370	90.22	.000	.196
SRL macro-strategy					
<i>Pre SRL macro-strategy</i>	1	370	29.40	.000	.074
<i>Condition (CG-EG)</i>	1	370	12.64	.000	.033
Use of SRL strategies in texts					
<i>Pre SRL texts</i>	1	370	61.96	.000	.144
<i>Condition (CG-EG)</i>	1	370	7.26	.007	.019
Surface approach to learning					
<i>Pre surface approach</i>	1	370	32.34	.000	.080
<i>Condition (CG-EG)</i>	1	370	214.22	.000	.367
Deep approach to learning					
<i>Pre deep approach</i>	1	370	64.05	.000	.148
<i>Condition (CG-EG)</i>	1	370	34.04	.000	.084
Academic performance					
<i>Pre academic performance</i>	1	228	21.45	.000	.086
<i>Condition (CG-EG)</i>	1	228	59.72	.000	.208

When rating the efficacy of the program to modify variables indirectly influenced by the intervention, we can conclude that the results are highly satisfactory. The change promoted in the *middle* and *distal* variables is especially remarkable owing to as the approaching to learning as academic achievement are variables hard to change (Struyven et al., 2006; Rosário et al., 2005, 2007) and not directly trained during the program. We underline having achieved a decrease in the students' surface approach to learning and, especially, having managed to increase their deep approach. Previous studies had found data on this direction but not statistically significant results (Maguire, Evans, & Dyas, 2001; Rosário et al., 2007, 2010). Therefore, the results obtained are excellent news with a view to continuing to develop the intervention and considering the relevance of the close relation between surface and deep approaching and low and high levels of self-regulation respectively (Heikkilä & Lonka, 2006).

In addition, the improvement showed on academic performance after the intervention is satisfactory. It can be referred several studies that support the impact of strategies instruction on the achievement of the students (Rosário et al., 2010; Tuckman, 2003a; Valle et al., 2008; Zimmerman, 2000) however there are others that haven't achieved this aim (Rosário et al., 2010). On the present work, the training increased students' academic performance, and this seems to indicate a transfer of the effect of the program onto one aspect that is particularly resistant to change. These results are especially relevant because the students will use all the trained competences if they observe that their use allows them to learn more and better, and, particularly, if the result obtained in academic performance is favorable compared to any other work method.

Despite the fact that there are increasingly more studies of SRL in its applied facet, the scarcity of assessments of the intervention programs is surprising. It's necessary to introduce new ways of assess the SRL. Qualitative and micro analytic methodologies are an emergent alternative to the classical self-reports; to introduce repeated measures that allow assessing the effects of the interventions along its implementation is another future prospect. Therefore, this work does not end here; it is essential to continue to investigate and to shed some light on this topic.

Finally, the impact of the virtual format of the intervention must be mentioned. User's are highly satisfied with the use of a CBLE as platform of the program and this could be contributing to the effectiveness of the training. The students describe the virtual quality of the experience as a «*comfortable and very practical method, as well as fun*» which allows them «*to perform more independently, because they are available (...) at any time of the day*». At the same time, the forums are the most value by the students: «*I learned a lot by reading my classmates' answers; you realize so many other things...*», «*it has motivated me a lot*», «*sharing experiences with others is a fantastic way of learning*». These learners' reflections encourage improving the virtual characteristics of the training in order to introduce more and better tools that continue helping student learn to learn.

Acknowledgements

Este artículo ha sido realizado gracias a la financiación de los proyectos I+D con referencias SEJ2006-08814 y MICINN-10-EDU2010-16231.

References

- Allgood, W.P., Risko, V.J., Álvarez, M.C., & Fairbanks, M.M. (2000). Factors that influence study. In R.F. Flippo & D.C. Caverly (Eds.), *Handbook of college reading and study strategy research* (pp. 201-219). NJ: Lea.
- Azevedo, R. (2005a). Computer environments as metacognitive tools for enhancing learning. *Educational Psychologist*, 40(4), 193-197.
- Azevedo, R. (2005b). Using hypermedia as a metacognitive tool for enhancing student learning? The role of self-regulated learning. *Educational Psychologist*, 40(4), 199-209.
- Azevedo, R., Cromley, J.G., & Seibert, D. (2004). Does adaptive scaffolding facilitate students' ability to regulate their learning with hypermedia? *Contemporary Educational Psychology* 29, 344-370.
- Azevedo, R., Cromley, J., Fielding, I., Winters, F. I., Moos, D.C., & Greene, J.A. (2005). Adaptive human scaffolding facilitates adolescents' self-regulated learning with hypermedia. *Instructional Science*, 33, 381-412.
- Bandura, A. (2001). Social cognitive theory: An genetic perspective. *American Review of Psychology*, 52, 1-26.
- Biggs, J., Kember, D., & Leung, D.Y.P. (2001). The revised two-factor study process questionnaire: R-SPQ-2F. *British Journal of Educational Psychology*, 71, 133-149.
- Boekaerts, M., & Corno, L. (2005). Self-regulation in the classroom: A perspective on assessment and intervention. *Applied Psychology: An International Review*, 54, 199-231.
- Brandl, K. (2005). Are you ready to «Moodle»? *Language Learning & Technology*, 9(2), 16-23.
- Brophy, J. (2004). *Motivating students to learn*. Mahwah, New Jersey: LEA, Pub.
- Cardelle-Elawar, M., & Sanz de Acedo, M.L. (2010). Looking at teacher identity self-regulation. *Psicothema*, 22(2), 293-298.
- Cerezo, R., Núñez, J.C., Rosário, P., Valle, A., Rodríguez, S., & Bernardo, A. (2010). New media for the promotion of self-regulated learning in higher education. *Psicothema*, 23(2), 306-315.
- Cerezo, R., Nuñez, J.C., Rosário, P., González-Pianda, J., Álvarez, D., González-Castro, P., et al. (2009, July). *Adaptación de un programa de promoción de estrategias de autorregulación del aprendizaje a las TIC's*. Paper presented at the VII Jornadas de Redes de Investigación en Docencia Universitaria, Alicante, Spain.
- Cheung, C.K., & Kwok, S.T. (1998). Activities and academic achievement among college students. *The Journal of Genetic Psychology*, 159(2), 147-162.
- De la Fuente, J., Pichardo, M.C., Justicia, F., & Berbén, A. (2008). Learning approaches, self-regulation and achievement in three European universities. *Psicothema*, 20, 705-711.
- Elliot, A.J. (2008). *Handbook of approach and avoidance motivation*. Mahwah, NJ: Lawrence Erlbaum Associates
- González, J., & Wagenaar, R. (2003). *Tuning educational structures in Europe*. Informe final - Proyecto Piloto, Fase Uno. Bilbao: Universidad de Deusto.
- Graesser, A.C., McNamara, D.S., & VanLehn, K. (2005). Scaffolding deep comprehension strategies through Point&Query, AutoTutor and iSTART. *Educational Psychologist*, 40(4), 225-234.
- Heikkilä, A., & Lonka, K. (2006). Studying in higher education: Students' approaches to learning, self-regulation and cognitive strategies. *Studies in Higher Education*, 31(1), 99-117.
- Kok, A. (2008). An online social constructivist tool: A secondary school experience in the developing world. *Turkish Online Journal of Distance Education-TOJDE*, 9(3), 87-98.
- Maguire, S., Evans, S.E., & Dyas, L. (2001). Approaches to learning: A study of first-year geography undergraduates. *Journal of Geography in Higher Education*, 25(1), 95-107.

- Moskowitz, G.B., & Grant, H. (2009). *The psychology of goals*. New York: Guilford Press.
- Nota, L., Soresi, S., & Zimmerman, B.J. (2004). Self-regulation and academic achievement and resilience: A longitudinal study. *International Journal of Educational Research*, 41(3), 198-251.
- Núñez, J.C., Solano, P., González-Pienda, J.A., & Rosário, P. (2006). Self-regulation processes measurement through self-report methodology. *Psicothema*, 18, 353-358.
- Núñez, J.C., Valle, A., Cabanach, R.G., González-Pienda, J.A., Rodríguez, S., Rodríguez, N., et al. (2009). Perfiles motivacionales en estudiantes universitarios. *Revista de Psicología y Educación*, 1(4), 15-30.
- Perry, N.E., Hutchinson, L., & Thauberger, C. (2008). Talking about teaching self-regulated learning: Scaffolding student teachers' development and use of practices that promote self-regulated learning. *International Journal of Educational Research*, 47, 97-108.
- Pike, G.R., & Kuh, G.D. (2005). A typology of student engagement for american colleges and universities. *Research in Higher Education*, 46(2), 185-209.
- Plant, E.A., Ericsson, K.A., Hill, L., & Asberg, K. (2005). Why study time does not predict grade point average across college students: Implications of deliberate practice for academic performance. *Contemporary Educational Psychology*, 30, 96-116.
- Quintana, C., Zhang, M., & Krajcik, J. (2005). Scaffolded software environments for supporting metacognitive aspects of online inquiry. *Educational Psychologist*, 40, 235-244.
- Riggs, E.G., & Gholar, C.R. (2009). *Strategies that promote student engagement. Unleashing the Desire to Learn*. SAGE Publications.
- Rosário, P., Núñez, J.C., & González-Pienda, J.A. (2006). *Cartas do Gervásio ao seu umbigo*. Coimbra: Almedina.
- Rosário, P., Mourão, R., Núñez, J.C., González-Pienda, J.A., & Solano, P. (2006). School-family: Is a reciprocal and positive relationship possible? *Papeles del Psicólogo*, 27(3), 174-182.
- Rosário, P., Núñez, J.C., González-Pienda, J.A., Almeida, L., Soares, S., & Rubio, M. (2005). The academic learning viewed from the perspective of John Biggs' «3P model». *Psicothema*, 17(1), 20-30.
- Rosário, P., Mourão, R., Núñez, J.C., Pienda, J., Solano, P., & Valle, A. (2007). Evaluating the efficacy of a program to enhance college students' self-regulation learning processes and learning strategies. *Psicothema*, 19(3), 422-427.
- Rosário, P., Núñez, J.C., González-Pienda, J.A., Valle, A., Trigo, L., & Guimarães, C. (2010). Enhancing self-regulation and approaches to learning in first-year college students: A narrative-based program assessed in the Iberian Peninsula. *European Journal of Psychology of Education*, 25, 411-428.
- Rosário, P., González-Pienda, J., Cerezo, R., Pinto, R., Ferreira, P., Lourenço, A., et al. (2010). Efficacy of the program «Testas's (mis)adventures» to promote the deep approach to learning. *Psicothema*, 22(4), 828-834.
- Schunk, D.H., & Zimmerman, B.J. (2008). *Motivation and self-regulated learning: Theory, research and applications*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Struyven, K., Dochy, F., Janssens, S., & Gielen, S. (2006). On the dynamics of students' approaches to learning: The effects of the teaching/learning environment. *Learning and Instruction*, 16, 279-294.
- Tuckman, B.W. (2003). The effect of learning and motivation strategies training on college students' achievement. *Journal of College Student Development*, 44(3), 430-437.
- Zimmerman, B.J. (2000). Attaining self-regulated learning: A social-cognitive perspective. In M. Boekaerts, P.R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13-39). San Diego, CA: Academic Press.
- Zimmerman, B.J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, 41(2), 64-70.
- Zimmerman, B.J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments and future prospects. *American Educational Research Journal*, 45, 166-183.