

# Encouragement for Thinking Critically

**Sonia Olivares<sup>1</sup>, Carlos Saiz<sup>1</sup> & Silvia F. Rivas<sup>1</sup>**

---

<sup>1</sup>Departamento de Psicología Básica, Psicobiología y Metodología de las  
Ciencias del Comportamiento,  
Universidad de Salamanca, Salamanca.

---

**Spain**

*Correspondence: Sonia Olivares Moral.* Facultad de Psicología, Avda. de la Merced 109-131, 37005. Salamanca, España. E-mail: [soniaolivares@usal.es](mailto:soniaolivares@usal.es)

---

© Education & Psychology I+D+i and Editorial EOS (Spain)

## Abstract

**Introduction.** Here we report the results obtained in an innovative teaching experience that encourages the development of Critical Thinking skills through motivational intervention. Understanding Critical Thinking as a theory of action, “*we think to solve problems*”, and accompanying this concept with a program aimed at teaching/learning Critical Thinking and with active methodologies such as *Problem-Based Learning*” (PBL), we developed a parallel program designed to foster motivation for the development of these skills. This motivational instruction is based on a theoretical option that understands motivation as the result of two variables: *Expectancy/Value*. These two concepts enable an intervention in motivation towards more efficient Critical Thinking.

**Method.** 89 Spanish university students of both sexes were enrolled in the study, with ages between 20 and 30 years, who were assessed by means of the PENCRIASAL and the AGQ at both the start and the end of the intervention, together with continuous assessment. During the intervention, all the students received instruction in Critical Thinking. However, only half of the sample also participated in the motivation program.

**Results.** The results show that instruction in Critical Thinking skills through ARDESOS was successful. Moreover, the results obtained concerning motivation pointed to a maintenance of the scores in the group subjected to the motivation program.

**Discussion.** The results of the present study show that to a large extent intervention in motivation functions well. Nevertheless, it is necessary to increase such improvements. Thus, we describe a tool for studying the motivational factors of Critical Thinking, which could be especially useful from the perspective of instruction and pedagogical research.

**Keywords:** Critical thinking, motivation, instruction, assessment.

*Received: 03/30/13*

*Initial acceptance: 04/18/13*

*Final acceptance: 07/19/13*

# Motivar para Pensar Críticamente

## Resumen

**Introducción.** En este artículo presentamos los resultados ofrecidos a partir de una experiencia innovadora docente que fomenta el desarrollo de las habilidades de pensamiento crítico, a través de una intervención de naturaleza motivacional. Entendiendo el pensamiento crítico como una teoría de la acción, "pensamos para resolver problemas", y acompañando a esta concepción de un programa de enseñar/aprender a pensar y de metodologías activas como el aprendizaje basado en problemas (ABP), desarrollamos un programa paralelo que persigue fomentar la motivación para el desarrollo de dichas habilidades. Esta instrucción motivacional se sustenta en una opción teórica que entiende la motivación como el resultado de dos variables Expectativa/Valor. Estos dos conceptos posibilitan una intervención motivación en pensamiento crítico más eficaz.

**Método.** En este estudio participaron 89 universitarios españoles, con edades comprendidas entre los 20 y 30 años y de ambos sexos, quienes fueron evaluados mediante el PENCRISAL y el CMA tanto al inicio como al final de la intervención, junto con una evaluación continua. Durante dicha intervención, la totalidad de los alumnos recibieron una instrucción en pensamiento crítico. Sin embargo, sólo la mitad de la muestra participó además en un programa motivacional.

**Resultados.** Los resultados revelan que la instrucción en las habilidades de pensamiento crítico, a través de ARDESOS, ha sido exitosa. Además, los resultados obtenidos en motivación, han producido un mantenimiento de las puntuaciones en el grupo que disfrutó del programa motivacional.

**Discusión.** Los resultados muestran que la intervención motivacional ha funcionado en buena medida. Sin embargo, es necesario incrementar estas mejoras. De esta manera, se aporta así una herramienta para el estudio de los factores motivacionales del pensamiento crítico, el cual puede ser especialmente útil en la perspectiva de la instrucción y la intervención pedagógica.

**Palabras Clave:** pensamiento crítico; motivación; instrucción; evaluación.

*Recepción: 30/03/13    Aceptación inicial: 18/04/13    Aceptación inicial: 19/07/13*

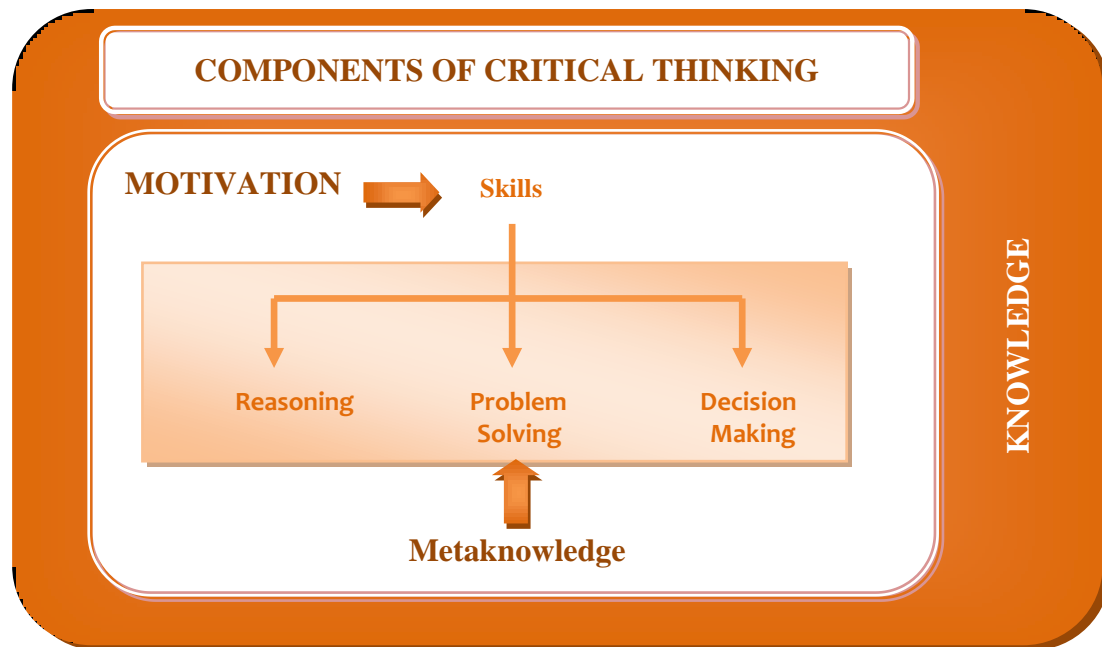
## Introduction

It is well known that to learn it is necessary to be able to and to be prepared to do so. The theory is attractive, but reality is very different. It is also known that during the different educational stages an important challenge is to encourage the development of a situation in which students *want* to learn; i.e. they must be motivated. This challenge is by no means an easy task. In the case addressed here, the university sphere, this is even more important. We could ask ourselves which actions we should implement to improve motivation in our students or how we would establish the conditions necessary for encouraging motivation in our students when they are learning about something or how we could set up the best conditions to boost such motivation. In this sense, the ideal situation would be for the core of the educational system to promote exploration and discovery and cognitive challenge; that education contexts should provide novelty and new complexities, desirable challenges, hoped-for goals and personalized feedback. All this aims at fostering intrinsic motivation. However, the truth is that in most cases this paradigm is simply utopian.

In the considerable number of reviews conducted to date, many, highly varied programs have emerged that attempt to nurture the motivation of our students with a view to improving their academic yields. Many such initiatives are excessively general and broad, offering widely varying interpretations for instructors as to how best to implement such interventions and work the construct with their students. Naturally, there are indeed clues as to how to improve motivation but in the long-run they are difficult to apply. Furthermore, these programs mainly focus on obligatory education, leaving the university population aside.

With the above overall context in mind, this severe problem within the field of enquiry that we have been addressing from some years now -Critical Thinking skills- is further exacerbated. For us, Critical Thinking is a *theory of action*: it is reasoning and deciding about how to solve problems, thereby obtaining considerable benefits such as a desirable knowledge of reality, or greater wisdom. Thus, thinking critically is not merely advancing further into the terrain of good judgment and good argumentation; it must also help us to solve problems or reach our goals, thereby turning argumentation from an end in itself into a means (Saiz & Rivas, 2011). Most theoreticians in the field (APA, 1990; Ennis, 1996; Facione, 2011; Halpern, 1998, 2003; Paul & Elder, 2001) consider that in order to engage in this type of thinking effi-

ciently, as well as this set of skills it is necessary to add the involvement of other types of component, such as metaknowledge and motivation. We illustrate this in the following figure:



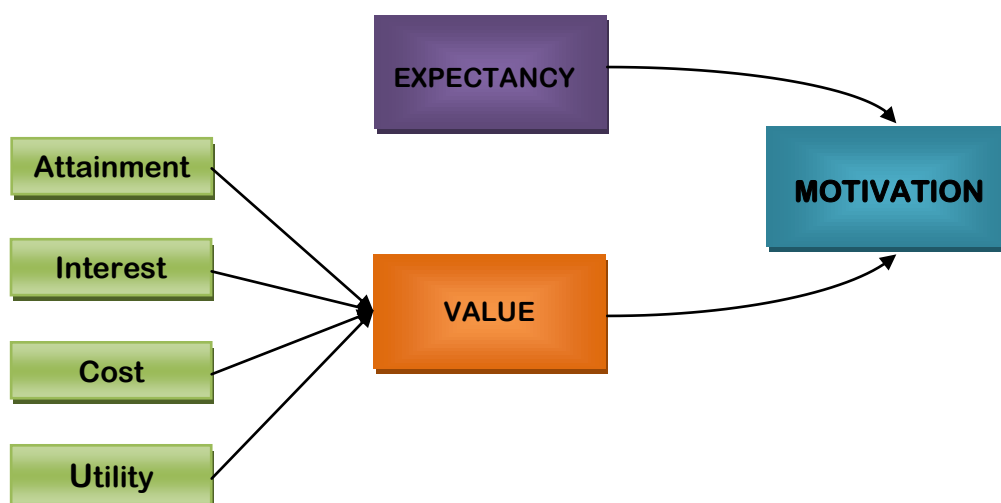
*Figure 1. Components of Critical Thinking (Saiz & Rivas, 2011).*

As may be seen, the fundamental core of the components of Critical Thinking are reasoning skills, problem solving and decision making. However, merely to be in possession of these does not in itself lead to an “efficient” performance; instead, it is necessary for two other constructs to enter the equation. To be able to set this type of thinking in motion, we need to “want” it to happen; we need to “desire” to think critically. And it is here that motivation makes its entrance. Both components, the cognitive one (that is, skills) and the motivational or dispositional one are inescapable since if a person knows which skills she/he must deploy in a given situation, but is not motivated to do so or to employ them, then that person will not be a good critical thinker. Likewise, having the disposition is also insufficient since if a person is disposed and motivated to think critically, but does not know how to, he or she will not be able to do so either. Both components, skills and dispositions, constitute the essence of the present study.

In turn we need metaknowledge to direct, organize and plan our skills in a profitable way once they have begun to be deployed. As may be seen, this is an important factor to be

taken into account. However, here we shall leave this to one side since it being addressed in a work currently under way.

Regarding the skills of Critical Thinking, it is accepted that these represent the cognitive components: knowing what to do and how to do it. In the case of teaching and the development of these skills, an instruction program called ARDESOS has been developed (see Saiz & Rivas, 2011), which we shall address below. In contrast, regarding the dispositional component there is no such conceptual clarity. In this context, our option is to consider motivation from the perspective of the *Expectancy and Value* model proposed by Eccles et al. (1983, 1987, 1993; Eccles & Wigfield, 2002; Wigfield, 1994; Wigfield & Eccles, 1992, 2000), since it offers great advantages such as a theoretical soundness based on much research work and the possibility of easily operativizing its variables when implementing interventions. These models derive from a general cognitive perspective and reflect the metaphor that a person is the maker of active and rational decisions, which matches our thesis about Critical Thinking perfectly. It should be noted that those authors conceived a motivation applied to choice and performance within a specific domain (mathematics). Despite this, and with respect to what we are interested in here, we see Expectancy/Value as a specific way of performing an activity. Motivation would focus on Critical Thinking, defined in operative terms, for the purposes of measuring it, as a mode of thinking characterized by its rigor.



**Figure 2.** The Eccles and Wigfield motivation model (simplified)

As seen in the figure, the *Expectancy* component refers to students' beliefs about their chances of success in a task (in this case, thinking critically in a given situation). This includes judgments about self-efficacy and control (Pintrich, 1989) and confidence in cognitive skills themselves for an academic task to be performed in the future. The second component of the model is *Value*. This refers to the worth assigned to a task, in this case to the value of the act of thinking critically for the person. This construct in turn comprises four factors: perceptions about how important it is for a person to perform a task well (*attainment*); the intrinsic interest of the task (*interest*); the cost involved (*cost*), and the usefulness or instrumentality that can be derived from it for future tasks (*utility*) (Eccles et al., 1983; Wigfield & Eccles, 1992).

In our study, we worked these variables jointly in order to improve Critical Thinking skills but we placed special emphasis on the *utility* factor, owing to its transcendence and the lack of data from research in the field. It is crucial for students to know what is actually demanded of them in the tasks they are set in order to maintain their enthusiasm and interest, for them to know the aim or purpose of performing each of the academic tasks they are challenged with, and for them to feel that Critical Thinking meets some particular need (information, going deeper into the problem, relating, integrating etc.). What happens is that if students are not aware of the aim of a task and are unable to relate that aim to understanding what the task demands and to their own needs, they will find it very difficult to carry out an in-depth study and then transfer the knowledge gained to real life circumstances. If this is not the case, since they are unable to relate the task to its underlying goals, they will tend to adopt a merely superficial focus upon attempting it (Rinaudo, Barrera & Donolo, 2006). We are convinced that if instructors can provide students with a clear indication of what objectives they are expected to meet and that if students are made to see the processes they are using or might use to achieve such aims, they will start to self-regulate their cognitive resources. To accomplish this, we incorporated this factor in our intervention, posing the question of whether there is something more important than critical reflection and showing its benefits with results. That is, a person is interested in and makes an effort to learn contents that he/she will later put into practice and that will be useful in his/her life. In this way, the learning achieved is much deeper and more significant.

In light of the above theoretical position, our working hypothesis was that we would see an improvement in Critical Thinking skills in students after the intervention, with better performance in the group that received instruction in motivation. Likewise, we foresaw an increase in motivation scores after the intervention.

## Method

### *Participants*

Owing to the complexity of Critical Thinking skills, the program was directed towards populations that had at least an intermediate intellectual level. Accordingly, we employed a sample of 90 students from the fourth year of the Psychology Degree of the University of Salamanca (Spain). These students were following a course entitled “The Psychology of Thinking”. There was one drop-out owing to a lack of information and incomplete tests. Thus, the final sample comprised 89 participants, of which 91% (81) were women and 9% (8) were men. The mean age of the participants was 21.72 years, with a standard deviation of 1.846 years.

### *Instruments*

*PENCRISAL Critical Thinking Test.* In order to measure the magnitude of the effect and hence determine in which of the two groups the greatest improvement in Critical Thinking skills had occurred, we applied the PENCRISAL test developed by Saiz and Rivas (Rivas & Saiz, 2012; Saiz & Rivas, 2008). This test comprises 35 production-problem situations, with an open answer format, structured around 5 factors: Practical Reasoning, Deduction, Induction, Decision Making, and Problem Solving (Cronbach  $\alpha$ =.632; test-retest:  $r$ =.786, Rivas & Saiz, 2010). Each of the factors harbors the most representative structures, thus being able capture the skills of Critical Thinking and the most relevant forms of reflection and resolution of our daily functioning.

To apply the test we decided to use a computerized format, given collectively, mainly because of the considerable advantages that can be derived from this as regards correction and the actual implementation of the test. For correction, standardized criteria are available; these assign between 0-2 points, depending on the quality of the answer offered by the participants. Regarding performance, since the test is a power test, it can be done in several sessions to reduce possible effects of fatigue and hence there was no time-limit. Nevertheless, the means



estimated duration of the test was 60-90 min. For more detailed information, readers are referred to Saiz and Rivas (2008b) and Rivas and Saiz (2012).

*AGQ, Academic Goal Questionnaire.* With a view to determining in which of the two groups the greatest improvement in academic motivation occurred, we applied the AGQ (Hayamizu & Weiner, 1991). A more detailed description regarding the translation can be found in Núñez and González-Pienda (1994).

This questionnaire measures which type of motivational trends or factors students have when directing their efforts to academic performance. The test comprises 20 items with a Likert-type format of 5 values, where the task simply consists of indicating to what extent each of the reasons or motives provided on the scales affects the disposition of the participant when studying.

These 20 items are distributed around 3 motivational factors: Learning Goals (factor I); Performance Goals (factor II) and Social Reinforcement Goals (factor III) (Cronbach  $\alpha=.915$ ). It should be noted that these types of academic goal are not mutually exclusive and only express dispositions, such that students can pursue more than one of them. Again, to administer the test we chose a computerized version together with collective application in different classrooms of the Psychology School owing to the above-mentioned advantages.

### *Design*

In order to analyze the efficiency of the intervention, we used a quasi-experimental design, with pre- and post-treatment measurements, an intervention group, and an equivalent quasi-control group. We performed an intentional or convenience sampling, where half of the sample was selected as the experimental group and the other half as the quasi-control group. Thus, both groups received the instruction equally in Critical Thinking skills through the ARDESOS program, but only the experimental group also obtained instruction in motivation.

### *The Intervention Program*

The working method used here for the intervention (explained below) covers the two aspects that are crucial for improving Critical Thinking commented above: the cognitive components (skills) and the motivational components (dispositions). Since they are both intimately linked -that is, neither the cognitive skills nor the dispositions alone is sufficient to

enable a person to think critically, the intervention incorporated, on one hand the consolidated active learning methodology called ARDESOS for the acquisition of *Critical Thinking skills* (Saiz & Rivas, 2011) and, on the other, an action program aimed at the supervision and control of the students' motivation, precisely the aim of the study.

### *The ARDESOS Program*

To detect this improvement in the intellectual skills that underpin Critical Thinking, we used the ARDESOS program (for further information, see Saiz & Rivas, 2011). This program is based on the direct teaching of skills by an expert instructor, where the intervention focuses mainly on feedback about the learning process carried out rather than on the actual learning of pure contents. The teaching-learning strategy was Problem-Based Learning (PBL), using everyday problems. This methodology fosters metacognitive processes and allows students to gain practice with real-life situations, where they must seek and investigate their own answers and solutions before following the instruction in the classroom. This offers decisive advantages for the success of the program. The aim in the sessions was for the students to solve problematic situations actively, after which they were provided with a detailed analysis and their work was assessed. This was followed by a discussion in class headed by the instructor, examining all the difficulties and doubts that may have arisen and a clarification of these problems. Accordingly, the assessment was continuous.

For the work of the five content blocks -deductive reasoning, inductive reasoning, practical reasoning, decision making and problem solving- 20-30 hours of face-to-face time were available, divided in 15-20 weekly sessions of 90 min and a maximum time of 60 h, including the students' own work.

Regarding the large-group classes (50-60 students) all the concepts of the material were worked, always starting out from activities carried out previously by the students and by means of procedures of reflection and discussion by the instructor, together with the PBL strategy, for the acquisition of the competencies in Critical Thinking. The small-group classes were organized in seminars with a maximum of 15 students and then in subgroups with three students in each, such that they were engaged in cooperative learning and work. In these classes, students reported the work they had been doing along the week and further time was allowed, under the continuous guidance of the instructor, for discussing and debating all the aspects that had emerged.

### *The Motivation Program*

To implement this intervention in motivation, on one hand we established a tutorial program and, on the other, we performed a follow-up across the small group classes on the interventions and the degree of involvement of the different students in these.

Before beginning the explanation, we wish to emphasize that the whole program was offered to the students as a set of aides for them to perform their tasks. Thus, this support worked on the motivation of the students through actions seeking the usefulness of the contents to be learned, and hence also facilitate the transfer of the knowledge gained to real-life situations in an integrated way. Accordingly, the idea was to provide an accompaniment to the students along the instruction period, which would provide support for the difficulties that might emerge and practical use of the skills of Critical Thinking in an integrated way.

For a better reading and follow-up of this tutorial program, below we offer a scheme of the different parts involved in the intervention:

- 1) Starting-block group tutorials
- 2) Record of behavior in the small-group classes and entries in a logbook        ad-  
dressing concerns arising in practicals.
- 3) Follow-up tutorials or work group tutorials
- 4) Closing-block group tutorials.

### *Starting-block group tutorials*

This type of tutorial was always implemented at the beginning of the content blocks and these tutorials were held with groups of 15 students. Since there were three groups of 15 students each, and bearing in mind that we were working five content blocks, throughout the study the motivation instructor performed 15 starting-out tutorials. The aim underlying these tutorials was to offer an introduction of the contents in a way applied to different contexts, without addressing any of the theoretical aspects of the content and following a previously established guide in order to develop a systematic intervention among the different groups. Each session lasted 20-30 min and was always held before the corresponding block began in the large-group classes under a time schedule established within the regular classes of the subject.

The general scheme of action is detailed below:

1. *Making contact* with the students at the start of each of the content blocks. When it was the first group tutorial of the intervention, an explanation of the dynamics to be followed with the motivation program was offered to the students so that they could have a global orientation of the process to be followed.
2. *Exploration of the previous knowledge* of the students with respect to the corresponding block (what do you do when...? How do you cope with a situation in which...? How would like to have acted when...?) and the provision of suitable feedback.
3. *Synthesis* of the comments and their *re-focusing towards utility* through the goals and sub-goals of the work.
4. *Clarifications and recommendations* regarding the importance of adaptability and flexibility of standards for action.
5. *A clarifying and reminder summary* of the tasks to be developed by the students in each block.  
*Closing* of the group tutorial.

With this series of actions, the aim was to facilitate initiation in the content block for later large-class groups. Thus, we provided the students with a first contact with the essential skills of Critical Thinking with a view to promoting learning with significance as regards its utility and the putting into practice of the contents to be developed in later classes.

*Record of behavior in small-group classes and logbook of reflections derived from the practical work.*

Once we had performed the starting group tutorial, the following step in the intervention involved making a record of the types of behaviour in the small-group classes. Each group of 15 students received one practical class per week, which lasted 90 min and was aimed at discussing and debating the tasks performed by the work group.

In each of these classes, the motivation instructor was a simple observer and merely recorded the comments made by the students, involving aspects such as: degree of participation in the practical work; whether or not spontaneous interventions were made, the number of these, the type and number of questions asked of the instructor (conceptual questions or questions about situational models), and whether the students asked for help from their peers and what type of help this was. All this information served as feedback for adjusting the interventions in the follow-up tutorials and allowed us to check whether there were any changes in the intervention of the students in the practical work or not.

At the end of the practical sessions, the students were asked to reply individually to the question about the utility of the skills worked during the session (*What utility does all we have seen today in this small-group class have for you in your daily life?*) in their “reflections log-book” about the practicals. These involved short comments in which the students described the personal use they made in their daily lives of the Critical Thinking skills they were working, after which this information was debated in the follow-up tutorials, both with the motivation instructor and with the rest of the students’ peers. Thus, it was possible to exchange impressions, learn new skills, engage in self-regulated behaviour, etc. Likewise the students were requested to add other annotations to their log book that they considered to be relevant for development in the follow-up tutorials, such that each student had to elaborate a logbook so that, as the blocks were closed, the trajectory followed by each of them could be tracked and the students could become aware of the steps followed and focus on the achievements attained.

#### *Follow-up Tutorials or Work-Group Tutorials*

This type of tutorial was carried out on each subgroup formed by three students who performed the tasks weekly along the subject. They were performed during the week available between the small group class and the following one, such that along the semester a total of 12 follow-up tutorials for each of the 15 work groups were carried out. The approximate duration of each was 10-15 min.

In these mini-group sessions, our aim was to monitor and follow up the performance of the group of students with respect to the applications they made of the skills of Critical Thinking in their daily lives and the difficulties they found in applying the process. All this was to foster their motivation.

These tutorials were carried out according to pre-established protocols in order to facilitate a systematic intervention in the different student groups.

At the same time, all the data were collected in a record. The work schedule was as follows:

- 1. A brief introduction to the session*
- 2. An exploration of effort vs. motivation.* In each tutorial the aim was to check how the process of elaboration and presentation of the week’s work had been done; how the stu-

dents had overcome their difficulties, and the evaluation of the amount of effort they had invested in all this, with a view to monitoring the performance of the working group and working the process of activating skills. Additionally, we had information provided by the behaviour record in the small-group classes that served, as reported above, as a readjustment and feedback for the intervention during the session. In parallel, with the students we worked the motivational aspects individually and differentially, seeking to promote the use of those skills. At this point it is crucial to recall that each individual is singular and particular and that not all motivational interventions work in the same way in those involved. Thus, we provided personal accompaniment throughout the intervention, attempting to regulate and control the beliefs of our students about the personal agency, of their emotion, and of their goals towards the mastery and usefulness of Critical Thinking skills. In these sessions it is essential to create an environment that will be sensitive to our students; one that would provide confidence, challenge and support. To accomplish this, we used different strategies according to the demands and circumstances in which our students found themselves in each session. In general the most commonly used strategies would include the provision of reiterated feedback; empathy regarding the difficulties encountered in performing the tasks, an explanation of the background knowledge before the start of the subject; an explanation of the disposition to learn the contents of a subject; promoting reflection and continuous participation in the development of the blocks; promoting the observation and analysis of behaviors with respect to the use of the skills of Critical Thinking by oneself and by others; an explanation of the working methodology whenever a student expressed doubts and became disorientation; emotional support and then promotion of the perception of self-efficacy and self-control; interpretations of practical cases and daily examples of the application of Critical Thinking skills and proposals for the resolution of situations, and emphasis on the integration of skills for use in daily contexts.

3. *Question about utility.* The students were asked to comment on the annotations they had made in their logbooks about the practical work done along the week. As each student commented on the utility he or she had derived from the contents explored, debate and reflection emerged among the peers forming the work group. All contributions were reinforced positively and, in turn, different daily examples were proposed and analyzed; these were based on what had been commented previously by the student. Thus, the aim was the transference of the skills learned to contexts closest to our students' daily lives.

4. *Utility goals.* We worked the approach subgoals for the setting up and use of the skills of Critical Thinking in daily life. The idea was for the students to perform a process of goal consolidation coupled with their idiosyncrasies in order to reach a good mastery of Criti-

cal Thinking skills. To facilitate this, the students were given a “weekly task”. Such tasks depended on the rhythm of the particular work group and the aim was to promote metacognitive efforts with respect to how the students learned, how they applied and how they could improve their competency, as well as facilitating the transfer to daily contexts. The focus we gave these tasks for the achievement of the subgoals towards utility was as follows:

- 1) Recognition and identification of the use and practice-reflection about the skills of Critical Thinking within its closest contexts, both academic and outside the academic sphere (communications media, academic texts, news, debates, friends, family relations, etc).
  - 2) Recognition-reflection about the use and practice of Critical Thinking skills in oneself.
  - 3) Identification and assessment of the practice of Critical Thinking skills in the context.
  - 4) Identification and assessment of the practice of Critical Thinking skills in oneself.
- V. An improvement in the implementation and performance of the use of Critical Thinking skills in others and in oneself.

5. *Closing of the tutorial(s)*. In this we offered a short synthesis with a concise explanation of the utilities of the skills commented by the students, placing emphasis on the importance of making an effort to detect them and applying those skills in daily situations. Finally, we proposed the following goal to be reached and encouraged the students to put into practice the skills of the block in hand.

#### *Closing-block group tutorials*

These tutorials took place once the block of contents in question had been closed. Likewise, groups of 15 students were formed, such that five closing block group therapies were performed for the same group together with a total of 15 closing-block group tutorials to be developed by the instructor in motivation, each of them lasting 20-30 min. The aim pursued in these tutorials was to elaborate a synthesis of all the “practical” contents offered by the different groups of students, debated across the sessions. Each closing-block was performed following pre-established protocols, first to facilitate a systematic intervention in the different groups of students and, second, to obtain a compilation of all relevant aspects debated in the sessions, so that at the end of each corresponding block all the groups would have the same information from both the starting-block group tutorials and from the follow-up tutorials.

Additionally, the general scheme of action in the closing block tutorials was as follows:

1) *A brief introduction*, in which the development of the block and the difficulties arising were explored.

2) *Recapitulation* with respect to the utilities worked concerning Critical Thinking skills seen in the block in question. *Reflection and self-assessment* of the trajectory performed and the goals achieved.

3) *Synthesis* of the information pursued and the provision of *feedback* corresponding to the interventions of the students.

4) *Integration* of the utilities of the working-block with respect to the rest of the skills seen in the previous blocks.

5) *Promotion of self-reflection and transference* of the skills to daily life situations.

### *Procedure*

Application of this teaching initiative was carried out along a semester in the classrooms of the School of psychology of the University of Salamanca. One week before beginning the instruction we applied both the PENCRISAL and the AGQ tests in all students. We proceeded likewise one week after the end of the intervention in order to collect the second measurement of the variables. The time elapsed between the pre-treatment and the post-treatment measurements was 4 months. The intervention was carried out by two observers.

### *Data analysis*

To check the degree of fit to the normal Gaussian model we performed an exploratory and descriptive study of all the measurement variables using the usual tools, box diagrams and tests of goodness of fit of the Kolmogorov-Smirnov test. Once this had been checked, ANOVA was implemented to explore the effect of the initiative and thus determine whether there were significant differences between the pre- and post-intervention situations. Data treatment was accomplished using the SPSS package (version 18.0).



## Results

We first performed a descriptive analysis of the properties of our sample according to the pre- and post-measurement times, both at global level (total sample) and by intervention groups. We then implemented Student's t test and ANOVA.

Regarding the descriptive analysis of all the variables in the different conditions of the study, we observed that some of them were not distributed according to the normal curve because they showed distributions with markedly negative and leptokurtic asymmetry indices and kurtosis.

**Table 1. Comparison of the pre-test measurements in total Critical Thinking and motivation and their corresponding factors as a function of the intervention groups**

Variables	n	Mean	Standard Deviation	Difference between means	Student's t test			
					t value	g.l.	p-sig. (bilateral)	
Total Critical Thinking	g.e.	44	25.32	6.15	1.10	.774	87	.441 <sup>NS</sup>
	g.c.	45	24.22					
Practical Reasoning	g.e.	44	5.43	2.13	.47	.960	87	.340 <sup>NS</sup>
	g.c.	45	4.96					
Deductive Reasoning	g.e.	44	3.57	2.23	.01	.028	87	.977 <sup>NS</sup>
	g.c.	45	3.56					
Inductive Reasoning	g.e.	44	4.16	1.75	.29	.802	87	.425 <sup>NS</sup>
	g.c.	45	3.87					
Decision Making	g.e.	44	5.18	1.96	-.15	-.362	87	.718 <sup>NS</sup>
	g.c.	45	5.33					
Problem Solving	g.e.	44	7.07	2.89	.40	.706	87	.482 <sup>NS</sup>
	g.c.	45	6.67					
Total Motivation	g.e.	44	65.66	6.00	-1.01	-.829	87	.409 <sup>NS</sup>
	g.c.	45	66.67					
Learning Goals	g.e.	44	29.93	4.08	-1.45	-1.832	87	.070 <sup>NS</sup>
	g.c.	45	31.38					
Achievement Goals	g.e.	44	26.00	3.58	.38	.518	87	.606 <sup>NS</sup>
	g.c.	45	25.62					
Social reinforcement Goals	g.e.	44	9.73	3.22	.21	.092	87	.927 <sup>NS</sup>
	g.c.	45	9.67					

NS= correlation not significant ( $p > .05$ ) \*Significant at the .05 level \*\* Highly significant at the .01 level

Then, we implemented ANOVA, in which we compared the pre-post measurements and the groups with one another in all the measurements analyzed. We also calculated the effect of the change in each case. First, we conducted an analysis of the assumption of normality and homogeneity of variances in the sample. The Kolmogorov-Smirnov test revealed that the sample in the pre-measurement period maintained a normal distribution with  $p < .05$  in

all the study variables, with the exception of the inductive reasoning factors ( $p < .00$ ) and social reinforcement goals ( $p < .01$ ), where there was a slight deviation from the normal curve. However, we did not attribute much importance to this since the  $p$  value, although at  $< .05$ , was still  $\geq .01$ ). However, in the post- condition we found that as well as inductive reasoning and the social reinforcement goals the learning goals factor and achievement goals did not meet the principle of normality either, with  $p < .05$  ( $p_{IRpost} = .04$ ;  $p_{LGpost} = .00$ ;  $p_{AGpost} = .00$ ;  $p_{SRGpost} = .00$ ). The other variables, did meet it. Regarding the principle of homogeneity, the Levene contrast revealed that this condition was met in all the variables studied.

The ANOVA results showed that regarding the total Critical Thinking variable, with respect to the pre-post measurements, there were significant differences, with  $p < .05$  ( $F_{CT}(1, 82) = 78.27$ ,  $p = .00$ ), where the post- condition revealed greater performance ( $M_{pre} = 24.77$ ;  $M_{post} = 33.72$ ). As also occurred at the intergroup level  $p < .05$  ( $F_{CT}(1, 82) = 4.25$ ,  $p = .04$ ), the experimental group had a significantly higher mean ( $M_{eg} = 30.38$ ) than the control group ( $M_{cg} = 28.11$ ). However, regarding the intersection between the group and the tie of application there were no significant differences  $p > .05$  ( $F_{CT}(1, 82) = 1.35$ ,  $p = .24$ ) (see table 2).

**Table 2. Summary of the significance of the effects of both factors on the total Critical Thinking variable**

Variable	Means & SD		FACTOR	gl	MC	F	p	Power	Eta2 partial
Total Critical Thinking	Applic. pre. 24.77 (s.d. 6.66)	Applic. post. 33.72 (s.d. 7.58)	Applic. Pre/Post	1 y 82	3569.745	78.278	.000**	-	.474
	G.E. 30.38 (s.d. 5.26)	G.C. 28.11 (s.d. 5.14)	Group Exp/Cont	1 y 82	230.337	4.254	.042*	-	.047
	G.E. pre. 25.31 (s.d. 6.15)	G.E. post. 35.45 (s.d. 8.00)	Group/Applicac.	1 y 82	61.880	1.357	.247 <sup>NS</sup>	.210	.015
	G.C. pre. 24.22 (s.d. 7.15)	G.C. post. 32.00 (s.d. 6.71)							

NS= correlation not significant ( $p > .05$ ) \*Significant at the .05 level \*\* Highly significant at the .01 level

Regarding the results obtained for the five factors of Critical Thinking according to the pre-post times of measurement, it was seen that there were significant differences in all the factors ( $F_{PR}(1, 82) = 54.69$ ,  $p < .01$ ;  $F_{DR}(1, 82) = 53.37$ ,  $p < .01$ ;  $F_{IR}(1, 82) = 60.78$ ,  $p < .01$ ;  $F_{DM}(1, 82) = 37.75$ ,  $p < .01$ ) except in problem solving ( $F_{PS}(1, 82) = .20$ ,  $p = .64$ ). As expected, the scores obtained at pre- were lower than those recorded after the intervention. In the comparison among groups, we observed statistically significant differences, in consonance

with the intervention only in the practical reasoning factor ( $F_{PR}(1, 82) = 6.43, p < .01$ ) with respect to the other factors ( $F_{DR}(1, 82) = 1.19, p = .27$ ;  $F_{IR}(1, 82) = 2.35, p = .12$ ;  $F_{DM}(1, 82) = .11, p = .73$ ;  $F_{PS}(1, 82) = .862, p = .35$ ). With respect to the interaction of the two levels, neither were there any significant differences in any of the five factors ( $F_{PR}(1, 82) = 1.82, p = .18$ ;  $F_{DR}(1, 82) = 1.45, p = .23$ ;  $F_{IR}(1, 82) = .21, p = .64$ ;  $F_{DM}(1, 82) = .87, p = .35$ ;  $F_{PS}(1, 82) = .00, p = .95$ ). It was seen that although the measurements increased as a result of the intervention, the difference among the groups was not significant; both improved their performance equally (see table 3).

**Table 3. Summary of the significance of the effects of both factors on the practical, deductive and inductive reasoning, decision making and problem solving variables**

Variable	Means & SD		FACTOR	gl	MC	F	p	Power	Eta2 partial
Practical Reasoning	Applic. pre. 5.19 (s.d. 2.34)	Applic. post. 7.74 (s.d. 2.53)	Applic. Pre/Post	1 y 82	290.644	54.695	.000**	-	.386
	G.E. 6.94 (s.d. 1.66)	G.C. 6.00 (s.d. 1.83)	Group Exp/Cont	1 y 82	39.582	6.434	.013*	-	.069
	G.E. pre. 5.43 (s.d. 2.13)	G.E. post. 8.45 (s.d. 2.20)	Group/Applicac.	1 y 82	9.700	1.825	.180 <sup>NS</sup>	.267	.021
	G.C. pre. 4.96 (s.d. 2.52)	G.C. post. 7.04 (s.d. 2.66)							
Deductive Reasoning	Applic. pre. 3.56 (s.d. 2.08)	Applic. post. 5.82 (s.d. 2.34)	Applic. Pre/Post	1 y 82	227.788	53.372	.000**	-	.380
	G.E. 4.88 (s.d. 1.75)	G.C. 4.50 (s.d. 1.57)	Group Exp/Cont	1 y 82	6.642	1.192	.278 <sup>NS</sup>	.191	.014
	G.E. pre. 3.57 (s.d. 2.23)	G.E. post. 6.20 (s.d. 2.31)	Group/Applicac.	1 y 82	6.215	1.456	.231 <sup>NS</sup>	.222	.016
	G.C. pre. 3.56 (s.d. 1.96)	G.C. post. 5.44 (s.d. 2.34)							
Inductive Reasoning	Applic. pre. 4.01 (s.d. 1.75)	Applic. post. 6.09 (s.d. 1.88)	Applic. Pre/Post	1 y 82	192.510	60.785	.000**	-	.411
	G.E. 5.26 (s.d. 1.31)	G.C. 4.84 (s.d. 1.25)	Group Exp/Cont	1 y 82	7.734	2.350	.129 <sup>NS</sup>	.329	.026
	G.E. pre. 4.16 (s.d. 1.75)	G.E. post. 6.36 (s.d. 1.90)	Group/Applicac.	1 y 82	.690	.218	.642 <sup>NS</sup>	.075	.002
	G.C. pre. 3.87 (s.d. 1.68)	G.C. post. 5.82 (s.d. 1.83)							
Decision Making	Applic. pre. 5.25 (s.d. 1.96)	Applic. post. 7.01 (s.d. 2.21)	Applic. Pre/Post	1 y 82	137.170	37.752	.000**	-	.303
	G.E. 6.19 (s.d. 1.61)	G.C. 6.07 (s.d. 1.59)	Group Exp/Cont	1 y 82	.593	.115	.736 <sup>NS</sup>	.063	.001
	G.E. pre. 5.18 (s.d. 1.96)	G.E. post. 7.20 (s.d. 2.34)	Group/Applicac.	1 y 82	3.170	.872	.353 <sup>NS</sup>	.152	.010
	G.C. pre. 5.33 (s.d. 1.97)	G.C. post. 6.82 (s.d. 2.08)							

Problem Solving	Applic. pre. 6.86 (s.d. 2.67)	Applic. post. 7.04 (s.d. 2.66)	Applic. Pre/Post	1 y 82	1.434	.209	.649 <sup>NS</sup>	.074	.002
	G.E. 7.14 (s.d. 1.97)	G.C. 6.76 (s.d. 1.89)	Group Exp/Cont	1 y 82	6.461	.862	.356 <sup>NS</sup>	.151	.010
	G.E. pre. 7.07 (s.d. 2.89)	G.E. post. 7.23 (s.d. 2.86)	Group/Applicac.	1 y 82	.019	.003	.959 <sup>NS</sup>	.050	.000
	G.C. pre. 6.67 (s.d. 2.45)	G.C. post. 6.87 (s.d. 2.48)							

NS= correlation not significant ( $p > .05$ ) \*Significant at the .05 level \*\* Highly significant at the .01 level

Regarding the total motivation variable, the data show that in the intra-group factor there were significant differences  $p < .05$  ( $F_{TM} (1, 82) = 5.99, p < .01$ ). These differences were seen in the means, but, in this case, in the sense opposite that expected since the scores decreased in the post-measurement period ( $M_{TMpre} = 66.16; M_{TMpost} = 64.09$ ). Significant differences were also seen with respect to the relationship between the intervention groups and the time of pre-post application ( $F_{TM} (1, 82) = 6.95, p < .01$ ), where we observed that the experimental group maintained their scores on both measurements ( $M_{EGpre} = 65.66; M_{EGpost} = 65.82$ ), whereas in the control group we observed a significant decrease in the scores, in disagreement with the intervention ( $M_{CGpre} = 66.67; M_{CGpost} = 62.38$ ). However, at inter-group level, no significant differences were found ( $F_{TM} (1, 82) = .94, p = .33$ ) (see table 4).

**Table 4. Summary of the significance of the effects of both factors on the total motivation variable**

Variable	Means & SD		FACTOR	gl	MC	F	p	Power	Eta2 partial
Total Motivation	Applic. pre. 66.16 (s.d. 5.72)	Applic. post. 64.09 (s.d. 8,42)	Applic. Pre/Post	1 y 82	189.715	5.998	.016*	-	.065
	G.E. 65.73 (s.d. 6.28)	G.C. 64,52 (s.d. 5,54)	Group Exp/Cont	1 y 82	65.837	.940	.335 <sup>NS</sup>	.160	.011
	G.E. pre. 65.66 (s.d. 6.00)	G.E. post. 65,82 (s.d. 8,49)	Group/Applicac.	1 y 82	220.075	6.958	.010**	-	.074
	G.C. pre. 66.67 (s.d. 5.45)	G.C. post. 62,38 (s.d. 8,09)							

NS= correlation no significant ( $p > .05$ ) \*Significant at the .05 level \*\* Highly significant at the .01 level

With respect to the results obtained for the three motivation factors according to the pre-post measurements, it was found that there were no significant differences in any of the factors ( $F_{LG} (1, 82) = 1.46, p = .22; F_{AG} (1, 82) = 3.86, p < .05; F_{SRG} (1, 82) = 1.95, p = .16$ ). The

means of the scores show that there was a decrease in the learning goals and achievement goals factors, in disagreement with the intervention, and yet in the social reinforcement factor there was a slight, but not significant, increase in the scores, in agreement with the intervention. Likewise, there were no significant differences between the experimental and control groups ( $F_{LG}(1, 82) = .41, p = .52$ ;  $F_{AG}(1, 82) = .42, p = .51$ ;  $F_{SRG}(1, 82) = 1.04, p = .31$ ), where the performance means were similar among the groups. Neither were there significant differences in the relationship between the pre-post measurements and the intervention groups ( $F_{LG}(1, 82) = 2.21, p = .14$ ;  $F_{AG}(1, 82) = .07, p = .78$ ;  $F_{SRG}(1, 82) = 1.83, p = .17$ ) (see table 5).

**Table 5. Summary of the significance of the effects of both factors on the learning, achievement and social reinforcement goals variables**

Variable	Means & SD		FACTOR	gl	MC	F	p	Power	Eta2 partial
Learnings Goals	Applic. pre. 30.65 (s.d. 3.77)	Applic. post. 29.95 (s.d. 6.12)	Applic. Pre/Post	1 y 82	21.692	1.469	.229 <sup>NS</sup>	.224	.017
	G.E. 30.011 (s.d. 4.77)	G.C. 30.60 (s.d. 3.79)	Group Exp/Cont	1 y 82	15.417	.416	.521 <sup>NS</sup>	.098	.005
	G.E. pre. 29.93 (s.d. 4.08)	G.E. post. 30.09 (s.d. 6.60)	Group/Applicac.	1 y 82	32.704	2.215	.140 <sup>NS</sup>	.313	.025
	G.C. pre. 31.38 (s.d. 3.32)	G.C. post. 29.82 (s.d. 5.69)							
Achievement Goals	Applic. pre. 25.81 (s.d. 3.42)	Applic. post. 24.56 (s.d. 6.16)	Applic. Pre/Post	1 y 82	68.990	3.868	.052 <sup>NS</sup>	.494	.043
	G.E. 25.46 (s.d. 4.54)	G.C. 24.91 (s.d. 3.43)	Group Exp/Cont	1 y 82	13.695	.423	.517 <sup>NS</sup>	.099	.005
	G.E. pre. 26.00 (s.d. 3.58)	G.E. post. 24.93 (s.d. 6.75)	Group/Applicac.	1 y 82	1.394	.078	.780 <sup>NS</sup>	.059	.001
	G.C. pre. 25.62 (s.d. 3.29)	G.C. post. 24.20 (s.d. 5.58)							
Social Reinforcement Goals	Applic. pre. 9.69 (s.d. 3.09)	Applic. post. 10.44 (s.d. 5.47)	Applic. Pre/Post	1 y 82	25.011	1.950	.166 <sup>NS</sup>	.282	.022
	G.E. 10.46 (s.d. 4.05)	G.C. 9.67 (s.d. 3.19)	Group Exp/Cont	1 y 82	27.638	1.040	.311 <sup>NS</sup>	.172	.012
	G.E. pre. 9.73 (s.d. 3.22)	G.E. post. 11.20 (s.d. 6.10)	Group/Applicac.	1 y 82	23.551	1.836	.179 <sup>NS</sup>	.268	.021
	G.C. pre. 9.67 (s.d. 3.00)	G.C. post. 9.69 (s.d. 4.71)							

NS= correlation not significant ( $p > .05$ ) \*Significant at the .05 level \*\* Highly significant at the .01 level

## Discussion

The results of the present study show, although with some reserve, that the initiative used was successful. Regarding instruction in Critical Thinking skills, the results concerning efficiency were satisfactory. The dimensions of practical reasoning, deduction, induction and decision-making improved after the intervention, a substantial change occurring in both groups, although better performance was seen for the experimental group owing to the intervention focusing on motivation. As seen, the intervention in motivation channeled through utility helps students in their promotion towards greater transfer, which leads to greater integration of contents and hence better performance.

Nevertheless, we believe that an interpretation to the effect that no significant improvements occurred in the problem-solving factor rests on the fact that we were dealing with a temporally short block, which did not allow a significant interiorization of the procedures. At the same time, we believe that both decision making and problem solving were worked to a similar extent as regards general strategies. In fact, it is very difficult to separate these two strategies because a large part of the cases in which a problem is solved are done through choice. In the future, we hope to tackle the consideration of these two dimensions as a special case of each other. In any case, these results allow us to continue to work in the direction adopted with a view to improving our teaching and assessment work.

Thus, our hypotheses would be partially confirmed since, on one hand, an increase in performance was seen in the scores on Critical Thinking, thanks to the ARDESOS intervention and, on the other, the experimental group obtained a better performance than the control group on some of the variables studied. Additionally, it could be concluded that the intervention in motivation was efficient since it helped to improve performance, although not sufficiently so to produce significant differences in all of the variables studied, especially when dealing with results obtained from the intersection of the intra and inter-group levels.

However, regarding the scores obtained in motivation, we observed that at intra-group level there were significant differences, although in the sense opposite the hypothesis posited; that is, after the intervention the mean of the scores on motivation underwent a decrease of

two points instead of increasing. At the inter-group level, no significant differences were observed since both groups attained similar means. Nevertheless, at the intersection of the two levels there were significant differences, such that the experimental group maintained its mean in motivation along the intervention, while in the control group it decreased significantly, despite having scored higher (1 point) with respect to the experimental group in the pre-measurement of the intervention. However, this observation was not significant.

In light of the foregoing, our data seem to favor the hypothesis proposed. Although we expected a significant increase in the scores on motivation in the experimental group with respect to the control group, the results confirm the idea that even though that increase was not achieved there was at least a maintenance of those scores in the experimental group. By contrast, in the control group, which did not receive the program for motivational help, a decrease was seen in the mean scores at the end of the intervention. The explanation for this is clear, learning Critical Thinking skills is very costly and requires considerable investment in continued effort. The fact that this type of learning demands considerable willingness means that if along the instruction the disposition of the students to learn such skills does not receive feedback there exists the possibility that the scores in motivation will fall, as we see from the results, and with this performance in Critical Thinking. Accordingly, we believe that thanks to the intervention performed in the experimental group, motivation, although not increasing, was maintained along the intervention. As is evident from what has gone before, this challenge is difficult to meet. Thus, thanks to the intervention we were able to improve the performance in Critical Thinking of this group to a significantly greater extent than that of the control group. However, although the performance of this latter group was reduced in comparison with the experimental group, its performance did increase along the intervention, which we attribute mainly to the curricular context.

Finally, it may be deduced that motivation is a construct that modulates Critical Thinking but that, alone, it is unable to increase performance in Critical Thinking skills. As stated at the beginning of this contribution, with dispositions we would only obtain a minor increase in performance in these skills. Vice-versa, by only intervening in Critical Thinking we would be unable to attain such performance scores. Indeed, both factors –dispositions and skills- are necessary for the good use and practice of these skills and their transfer to daily life.

Up to here, we have explained what is in agreement with our prognoses. Now it is time to see what does not fit in with our approaches and what seems to be the fruit of the limitations of our procedure. First, the test chosen to measure the motivation construct was not the best option for picking up on the essence of what we were seeking from the intervention . Second, our method of instruction in motivation to a large extent worked, as may be seen from the results discussed above. However, as usually occurs with intervention processes there are always factors that cannot be adequately controlled in context of the whole learning situation, which –additionally- is in part governed institutionally. It is possible that if the limitations referred to, such as those mentioned in the problem-solving dimension, had been controlled we could have obtained some of the results that were not in fact achieved. It should be noted that the tutorial program depended on the good functioning of the instruction in Critical Thinking skills. Currently, we are considering these limitations and modifying the instruction. At the same time, we are revising all the guidelines followed in the procedure with a view to improving the whole motivation intervention. Thirdly, certain negative effects may have occurred in the group work, which could have led to the decrease in performance or effort and which that were not solved in the tutorials (Salomon & Globerson, 1989). Our method does not consider controlling these limitations in team work. Accordingly, the fact that some of the results were not obtained could have been due to a lack of control in the group work. Currently, as stated, we are studying how to incorporate controls to prevent such biases. One that has been tested in a study carried out previously is to use an anonymous system for the assessment of the efforts of the group members by each of its components This assessment weighs the grade of each member of the group on each task such that performance may improve or worsen as a function of the effort made in the group work. Apart from this, there are also other aspects that we are considering for future research.



## References

- APA, (1990). Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. Executive Summary "The Delphi Report". <http://www.insightassessment.com/dex.html>.
- Eccles, J., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L. & Midgley, C. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motivation* (pp. 75–146). San Francisco, CA: W. H. Freeman.
- Eccles, J. (1987). Gender roles and women's achievement-related decisions. *Psychology of Women, 11*, 135–172. DOI: 10.1111/j.1471-6402.1987.tb00781.x.
- Eccles, J. (1993). School and family effects on the ontogeny of children's interests, self-perceptions and activity choice. In J. Jacobs (Ed.), *Nebraska Symposium on Motivation, 1992: Developmental perspectives on motivation* (pp.145–208). Lincoln, NE: University of Nebraska Press.
- Eccles, J., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M. & Meece, J. L. (1983). Expectancies, values and academic behaviors. *Achievement and achievement motivation* (pp.75-146). San Francisco, CA: W.H. Freeman.
- Eccles, J. & Wigfield, A. (2002). Motivational beliefs, Values and Goals. In S.T. Fiske, D.L. Schacter y C. Sahn-Waxler (eds.), *Annual Review of Psychology* (pp.109-132). Palo Alto, CA: Annual Reviews.
- Ennis, R. H. (1996). *Critical Thinking*. Upper Saddle River, Nueva Jersey: Prentice-Hall.
- Facione, P. A. (2011). *Think critically*. New York: Prentice Hall.
- Halpern, D. F. (1998). Teaching critical thinking for transfer across domains - dispositions, skills, structure training, and metacognitive monitoring. *American Psychologist, 53* (4), 449-455. DOI: 10.1037/0003-066x.53.4.449.
- Halpern, D. F. (2003). *Thought and knowledge: An introduction to critical thinking* (Fourth edition). Hillsdale, NJ: Erlbaum.

- Paul, R. W. & Elder, L. (2001). *Critical thinking: Tools for taking charge of your learning and your life*. Upper Saddle River, NJ: Prentice Hall.
- Rinaudo, M. C., Barrera, M. L. y Donolo, D. S. (2006). Motivación para el aprendizaje en alumnos universitarios. *Revista Electrónica de Motivación y Emoción*, 22 (9), 84-93. <http://reme.uji.es/reme/numero22/indexsp.html>.
- Rivas, S. F. y Saiz, C. (2012). Validación y propiedades psicométricas de la prueba de pensamiento crítico PENCRISAL. *Revista Electrónica de Metodología Aplicada*, 17 (1), 18-34.
- Saiz, C. (2002). Solución de problemas. En C. Saiz (Ed.), *Pensamiento crítico: conceptos básicos y actividades prácticas* (p.183-211). Madrid: Pirámide.
- Saiz, C. y Nieto, A. M. (2002). Pensamiento crítico: capacidades y desarrollo. En C. Saiz (Ed.), *Pensamiento crítico: conceptos básicos y actividades prácticas* (p.15-19). Madrid: Pirámide.
- Saiz, C. y Rivas, S. F. (2008). Intervenir para transferir en pensamiento crítico. *Praxis*, 10 (13), 129-149.
- Saiz, C. y Rivas, S. F. (2008). Evaluación en pensamiento crítico: una propuesta para diferenciar formas de pensar. *Ergo, Nueva Época*, 22-23, 25-26.
- Saiz, C. & Rivas, S. F. (2011). Evaluation of the ARDESOS program: an initiative to improve critical thinking skills. *Journal of the Scholarship of Teaching and Learning*, 11 (2), 34-51.
- Salomon, G. & Globerson, T. (1989). When teams do not function the way ought to. *International Journal of Educational Research*, 13, 89-99. DOI: 10.1016/0883-0355(89)90018-9.
- Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational Psychology Review*, 6, 49-78. DOI:10.1007/BF02209024.
- Wigfield, A. & Eccles, J. (1992). The development of achievement task values: A theoretical analysis. *Developmental Review*, 12, 265-310. [http://dx.doi.org/10.1016/0273-2297\(92\)90011-P](http://dx.doi.org/10.1016/0273-2297(92)90011-P).

Wigfield, A. & Eccles, J. (2000). Expectancy-Value Theory of Achievement Motivation. *Contemporary educational psychology*, 25, 68-81. <http://dx.doi.org/10.1006/ceps.1999.1015>.

**[This page intentionally left blank]**