SELF-REGULATED LEARNING, SELF-EFFICACY BELIEFS AND PERFORMANCE DURING THE LATE CHILDHOOD

[*Aprendizaje autorregulado, creencias de autoeficacia y desempeño en la segunda infancia*]

by/por

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Abstract

This article analyzes relations between self-regulated learning, self-efficacy beliefs and performance on tasks of solving arithmetic problems. The investigation has been developed with 268 students with six years old and enrolled in the first year of primary education in Spain. The results obtained by the application of binary logistic regression models indicate that self-regulated learning and its interaction with self-efficacy beliefs predict performance. Finally, the application of cluster analysis shows four profiles of students, called: i) positive adjusted; ii) negative unadjusted I; iii) negative unadjusted II y; iv) negative adjusted.

Keywords

Self-regulation learning; self-efficacy beliefs; performance; childhood; solving arithmetic problems

Resumen

Este artículo analiza relaciones entre el aprendizaje autorregulado, las creencias de autoeficacia y el desempeño en tareas de resolución de problemas aritméticos. El estudio se ha llevado a cabo con 268 escolares de seis años de edad y matriculados en el primer año de educación primaria en España. Los resultados obtenidos mediante modelos de regresión logística binaria indican que el aprendizaje autorregulado y su interacción con las creencias de autoeficacia predicen el desempeño. Por último, la aplicación de un análisis Cluster muestra cuatro perfiles de escolares, denominados: i) ajustado positivo; ii) desajustado negativo I; iii) desajustado negativo II y; iv) ajustado negativo.

Descriptores

Aprendizaje autorregulado; creencias de autoeficacia; desempeño; infancia; resolución de problemas.

This article presents and discusses the results of the relationship between self-regulated learning, self-efficacy beliefs, and school performance in students six to seven years of age (late childhood). Empirical work, studying the processes of self-regulation in this student age group is insufficient and within the topic, few analyse the relationship between self-regulated learning, self-efficacy beliefs and performance.

However, the study of these processes at this point of development, when students are in a transitional phase between the second and third stage of childhood (between eight years old and adolescence), it is relevant to develop a body of theoretical knowledge that can

guide teachers in facilitating self-regulated learning with their students.

Self-regulated learning in late childhood

The studies of Flavell and colleagues on metamemory (Kreutzer, Leonard and Flavell, 1975) and memory strategies (Flavell, Beach and Chinsky 1966, Keeney, Cannizo and Flavell 1967) conclude that before children are able to use developed memory strategies, two kinds of problems are present: mediation deficit and production deficit.

Mediation deficit, refers to the limitations of students to recover information when using induced memory strategies. Production deficit, refers to the limitations of the students to self-develop a strategy, not because they lack the ability to do so, but rather for other reasons (Flavell, 1977 states): (i) a lack of experimentation and control over such strategies; (ii) incapacity to grasp the demands of an assignment; (iii) inability to select, spontaneously, the appropriate strategies for a certain task; and (iv) an ignorance of the value of a strategy to facilitate the completion of an assignment. As noted by Keeney, Canizzo, and Flavell (1967), the most common problem in late childhood, prior to being able to use developed memory strategies, is a production deficit.

Based on imprecise translations of many of Flavell's studies, subsequent empirical studies (eg. Veenman and Spaans, 2005; Veenman, Van Hout-Wolters and Afflerbach, 2006). have been directed at students at this stage and have begun with the belief that metacognitive and self-regulative abilities do not start until the onset of early adolescence. Although Flavell and colleagues conclude that this capacity does not display itself until approximately the age of eight, these authors indicate the importance of studying this stage of childhood due to it being a transitional period, during which children show a production deficit. The explanation of this deficit, noted by Flavell (1977) and previously commented on, point to a shortage of experience for the de-velopment of these capabilities, and as such are not exclusively an endogenous, developmental incapacity.

Recent studies (e.g. Annervirta and Vauras, 2006; Perels, Merget-Kullman, Wende, Schmitz and Buchbinder, 2009; Salmeron, Gutierrez-Braojos and Salmeron, 2009; Whitebread, Bingham, Grau, Pasternak and Sangster, 2007) conclude that in early childhood, the students show themselves capable of improving their self-regulating, cognitive abilities, prior to early adolescence, as long as a specific context for the experimentation of these abilities is provided.

Self-regulated learning, self-efficacy beliefs and school performance.

Since dialectical constructivism, (Moshman, 1982), the focus of self-regulated learning claims that students are active in their learning processeses. Through experience, they construct meaning, objectives, self-efficacy beliefs, and learning strategies. Beginning with the interaction between contextual and mental models (Pintrich, 2004: 388). Thus, the effective use of self-regulating strategies in certain areas would depend on the quantity and quality of the interaction, between the person and the subject. According to Zimmerman (2008: 166), self-regulating learning is defined as "those self-governing processes and self-beliefs that facilitate the student's transformation of mental abilities into school-performance abilities."

For De la Fuente and Justicia (2007: 539), self-regulation in learning are comprised of different sub-processes:

i) Strategic knowledge, implying success for the person who is learning, provided that they possess an adequate level of knowledge and self-knowledge to be fluent in the task (before, during, and after executing it).

ii) To possess a repertoire of cognitive strategies that enable them to acquire, codify, process, personalise, memorise,

recover and apply their knowledge.

iii) Processes of a motivational nature such as learning goals, effort, beliefs of self-efficacy, responsibility.

These self-regulation processes depend on each level of fluency and the difficulty of the activity. Pozo (2006:85) notes "the skill is not related to providing knowledge or generalised capabilities, but rather seeks to provide knowledge and specific strategies for fluency". For example, the strategies that are appropriate for literacy tests differ from those required for solving mathematical problems.

In arithmetic problem solving, Salmerón, Gutierrez-Braojos, and Salmerón (2009) assert that in order to be considered strategists capable of accurately using cognitive and self-regulative strategies, students need to have developed abilities with certain levels of performance in order to:

i) Activate previous knowledge for the correct understanding of the question;

ii) Prepare a plan of action that responds to the question and establish hypotheses on the level of consistency of these plans for the perceived problem.

iii) Represent the problem and the plan of action in order to answer the question;

iv) Execute the planning process coherently;

v) Self-regulate the execution;

vi) Make correct deductions from the information provided;

vii) Be capable of applying what is learnt to solve similar problems;

viii) Be conscious of the skill involved in each of the aforementioned steps, as well as the skill involved in adapting their execution to the demands of the problem.

However, this self-regulated learning refers not only to the process of logic, but also to the emotional and motivational learning (Gargallo, Suarez-Rodríguez and Pérez-Pérez, 2009; Ugartetxea, 2001). One of the most relevant elements for the students to initiate and maintain their efforts in learning are their beliefs in self-efficacy (Bandura, Caprara, Barbaranelli, Gerbino, and Pastorelli, 2003; Blanco, 2010). These are defined as the beliefs that people have, in this case the students, concerning their capacity to execute the required actions and achieve defined results for a task (Bandura, 1999).

The relevance of these beliefs reside in the direct influence that the students exert over their capacity for self-regulation, cognivity, effectiveness, interest , and decision making (Bandura et. al., 2003).

The works of Zimmerman and colleagues (Zimmerman, Bandura, and Martinez-Pons, 1992; Zimmerman, Kitsantas, and Campillo, 2005) note that the student's self-efficacy beliefs concerning the capacity to self-regulate learning, predicts the self-efficacy beliefs in performance within a specific learning area. In turn, the last belief predicts the grades obtained by the students (Kim and Lorsbach, 2005; Usher and Pajares, 2008; Wood, Atkins, and Tabernero, 200; Zimmerman, Kitsantas, and Campillo, 2005).

According to Zimmerman (1999) the properties that make up the beliefs in self-efficacy are:

i) Self-efficacy involves judgments about the student's own capabilities to perform tasks and not their personal, physical or psychological qualities. It is an integral part of self-concept, although not synonymnous.

ii) Self-efficacy beliefs are multidimensional and are linked to a specific areas.

iii) The level of self-efficacy perception depends on the context.

iv) The measurement of self-efficacy depends more on the measurement of the execution fluency criteria rather than the regulation criteria. The perception of the capacity to face a task is more suitable when it is based on an earlier experience obtained from similar tasks, as opposed to when at-

tained through comparison with the execution of others.

v) Determining the level of self-efficacy is an internal process prior to the beginning the activity. Therefore, students need to be conscious of the characteristics of the task at hand in order to judge its self-efficacy.

However, according to Bandura (1999) self-efficacy beliefs are formulated before and after a specific task. For example, if a student is faced with a type of task with high self-efficacy beliefs, they will produce more if their self-efficacy beliefs are low. Similarly, to finish a task, based on their perception of success or failure on performance, they will confirm an increase or decrease in their self-efficacy beliefs in facing that task (Ilgen and David, 2000).

As Zimmerman and Schunk (2008) have demonstrated, a reciprocal relationship exists between the capacity of self-regulation and the self-efficacy beliefs. As students increase their self-regulation capacity, they increase their self-efficacy beliefs, and vice versa: these self-efficacy beliefs allow the student to face new, self-regulated learning.

It seems logical that when students have not reached an appropriate metacognitive level of development, an inconsistent relationship becomes evident between self-efficacy beliefs for learning and performance. Thus, although the students in their early childhood are capable of expressing whether they have correctly or incorrectly completed a task, the perception of their competency and expectations of success are disproportionate and overestimated. These begin to be consistent with their performance in early adolescence (Alonso Tapia, 2005, Eccles, Wigfield, Harold and Blumenfeld, 1993). In fact, the works of Schunk and colleagues (Schunk and Rice, 1987, Schunk, 1990) and the study by Zimmerman and Martinez-Pons (1990) indicate that the metacognitive and cognitive appropriation strategies appropriately favor self-efficacy beliefs. Therefore, the highest level of predic-

tive efficiency of self-efficacy beliefs should be observed when a consistent relationship is maintained though the metacognitive capacities of the student.

Objectives

This study has the following objectives:

(i) To determine the dependency relations between self-regulated learning, beliefs of self-efficacy, and performance in tasks that require the solving of arithmetic problems;

(ii) To verify whether self-regulated learning and beliefs of self-efficacy are predictive variables of scholarly performance;

(iii) To determine student profiles with respect to these variables.

Method

Participants

The study included a total of 268 six-year-old first-grade students (58.2 % girls and 41.8% boys) enrolled in their first year of primary school in the provinces of Cadiz and Granada (Spain).

The sampling was not random, selecting students that met the requirements of the research, ie. six years old with a relative competence in the understanding of short texts, in our case the wording of a question, and a certain grasp of solving arithmetic problems. However, neither the sociocultural context of the student nor the characteristics of the school were considered relevant.

For this reason, sampling was begun by contacting teachers willing to collaborate with the study. They were consulted about the competence level of their students in problem solving, with the aim of identifying students who would be considered capable of undertaking the tasks envisaged.

Measures

a) To evaluate the learning strategies, the Strategies of Contextualized Learning Scale ESEAC, (Bernad, 2000) was used (see Appendix I). This scale has been applied in various studies with satisfactory results in terms of reliability, internal validity, and external validity (Bernad, 1995; Teruel, 1997; Ascaso, 1998).

The ESEAC is a Likert-type scale that assesses the student's performance in different subjects (e.g. mathematics, reading, and writing). It uses three levels to evaluate strategic thought: "1= low"; "2= medium; "3= high"). In evaluates which of the variables is appropriate, Bernad (2000) provides instructions that, in a reactive manner, requests the student to describe a particular mode of strategic thought. According to the students' response and execution of the task, the evaluator places the student at one of the three levels.

For this study, the scale was not used in its entirety, as the following variables were excluded: a) analogical and verbal language, considered less appropriate for solving arithmetic problems; b) typical errors stemming from evaluators' problems in assessing the student on this variable; c) motivation-control of anxiety, which falls outside the scope of our study.

The ESEAC variables used in this study and their significance are:

- Comprehension and planning of the task: this refers to the students' mastery of the relevant declarative knowledge needed in order to understand and interpret the task, and putting the work into context. In addition, they review how to present the plan of action (procedural and conditional knowledge).
- Representation of iconic languages: representations that students execute from their knowledge using this code.
- Inferences: Deduce something or draw a conclusion from what they have available.
- Hypothesis Action: this refers to the degree of consistency, durability or any justified changes that the student executes between the plan of action and the implementation of this action.
- Typical Gaps: Distraction or silences more in character with the student rather than the subject matter of the test.
- Self-regulation of the execution: doubts that arise during the task and the capacity of the student to be aware of them and resolve them correctly.
- Metacognition: Student awareness of the level of mastery in the task and the moments that comprise the task.
- Transfer: This refers to the student's ability to generalize and transfer what has been learned.

With respect to the beliefs on self-efficacy, the data collected on the theoretical framework of this study indicate that self-efficacy should be measured at two points —before and after the task (see Appendix I). However, in this study, we considered it appropriate to evaluate at three distinct points: i) before presenting the specific task and after advising the student that the task required the solution of an arithmetic problem; ii) during the task, after the specific problem is presented and has been read by the student; iii) after the task, taking a similar future task as a reference. In this study, we included an additional point of evaluation on self-efficacy beliefs with the aim of collecting more precise and reliable information about the six-year-old subjects. Also, we consider it possible to gain further and more relevant information by asking about self-efficacy beliefs at the three aforementioned points.

To measure self-efficacy beliefs, we chose three multiple-choice questions, with three response options: i) "I am well prepared and all the exercises I do are going to turn out well" corresponds to level "3"; ii) I am not well prepared and the work I am going to do will not be very good" corresponds to level "2"; iii) I am badly prepared and I am sure

that the work I am going to do is going to turn out badly" corresponds to level "1".

b) The performance and adaptation between the demands of the task and its execution has been evaluated by means of direct observation of the problem-solving process (see Appendix I). The values for measuring the performance are binary (1= correct; 0= incorrect) and they correspond to the correct or incorrect solution of the arithmetic problem. This requires the student to undertake the process correctly and in addition to use the appropriate calculations to solve the problem.

With reference to the educational appropriateness of this study, the test was validated by experts (10 elementary-school teachers) in the previous phase. All of the experts considered the task appropriate for the education level of the participants.

Respecto a la validez de la escala se llevo a cabo un análisis factorial (método de máxima verosimilitud y rotación oblimin directo), una vez se recogieron los datos (ver Tabla I). En la misma tabla se presentan la medida de adecuación muestral de Kaiser-Meyer-Olkin (KMO) y la prueba de Bartlett. Los datos obtenidos nos permiten afirmar que el análisis factorial resulta pertinente. Así, la aplicación del análisis factorial ofrece como resultado dos factores bien definidos. El factor I, "aprendizaje autorregulado" explica un 63.29% de la varianza y el factor II, "creencias de autoeficacia" un 25.14%. Y entre ambos explican el 88,24% de la varianza total.

With respect to the validity of the scale, a statistical analysis is undertaken (method of *maximum likelihood* and oblimin direct rotation), and the following data was collected.(see Table I). The same table presents the adaptation measurement shown by Kaiser-Meyer-Olkin (KMO) and Bartlett's test. The data compiled indicates that the numerical analysis was appropriate. The result of the statitical analysis provides two well-defined factors: Factor I, "self-regulated learning", which explained 63.29% of the variance; and Factor II, "beliefs of self-efficacy", which explained 25.14%. And both factors explain 88.24% of the total variance.

Table I. Factorial Analysis for the validation of the measurement scale (*n*= 268)		
Items	**F1**	**F2**
1. Understanding the problem	.95	
2. Representation of the problem	.87	
3. Inferences concerning the procedures needed to solve the problem	.93	
4. Hypothetical Action on the steps needed to answer the question	.97	
5. Typical gaps in solving the problem	.85	
6. Self-regulation during the solution of the problem	.89	
7. Consciousness and evaluation of the difficulties encountered while solving the problem	.95	
8. Transference	.94	
9. Self-efficacy before the test		.91
10. Self-efficacy during the test		.90
11. Self-efficacy after the test		.92
Cronbach's Alpha	.96	.93
Total of Cronbach's Alpha		.94
Total variance explained = 88.24% F1: Self-regulated learning; variance of the factor explained = 63.29% F2: Beliefs of self-efficacy; variance of the factor explained = 25.15% (KMO= .886) (Bartlett's χ^2 = 4765.56; *p*< .00)		

Consequently, with the aim of eliminating any threats to the validity of the measure used, the evaluators were instructed in its correct use. The five evaluators selected had a bachelor's degree in psychopedagogy, and four were teachers at educational centers whilst one was a doctoral student. They were trained by an expert for six sessions of approximately two hours each (see Table II). Also, to avoid distractions, the students were evaluated individually.

Table II. Evaluators' Training Sessions	
Sessions	**Objectives of the sessions**
Session I	Introductory explanation of the study: objectives, tools, and variables
Session II	Detailed explanation of the tools: ESEAC
Session III	Practice I: Observation on how to apply the ESEAC and resolution of doubts concerning the application procedure
Session IV	Practice II: Application of the ESEAC with the supervision of an expert, and once applied, resolve any doubts that arose during the application process
Session V	Practice III: Application of the ESEAC without supervision and,once applied resolve any doubts that arose during the application process.
Session VI	Practice IV: Identical to practice "III"

Design

An explanatory design format has been followed to establish the relationships between the variables of the study.

Data Analysis

Below, the tests used for examining each objective :

(i) To determine the dependency relations between self-regulated learning, self-efficacy beliefs, and performance in tasks that require the solving of arithmetic problems, Kendall's Tau-b correlation test was used, since the ESEAC is a Likert-type scale.

(ii) To verify whether self-regulated learning and self-efficacy beliefs are predictive variables of student performance, we used the binary logistic regression, as performance is valued as a binary variable. For a crossed validation of the results, we divided the sample into two subsamples, one analysis sample and one validation sample.

(iii) To determine the students' profiles with respect to these variables, we applied the two-phased cluster analysis followed by a discriminant analysis to determine how many students were correctly classified.

For each of the tests (Kendall's Tau-b correlation test, binary logistic regression, Cluster analysis and discriminative analysis), the SPSS 18 program was used to analyse the data.

Results

i) The study of the dependency relations between the variables of the study: self-regulated learning, beliefs of self-efficacy, and performance.

The correlation analysis by means of Kendall's Tau-b shows a significant dependent relationship between performance and

self-regulated learning. However, no significant relationship was found between self-regulated learning and self-efficacy beliefs (see Table III). Neither was a significant relationship found between self-efficacy beliefs and performance. One reason for these results could be that self-efficacy beliefs alone are inadequate to determine performance. That is, a student with strong self-efficacy beliefs and weaker self-regulation abilities in a given task may not obtain the desired performance.

Table III. Dependency relations between self-regulated learning, performance, and self efficacy beliefs (n=268)			
Variables	**Self-regulated learning**	**Self-efficacy beliefs**	**Performance**
1. Self-regulated learning	-		
2. Self-efficacy beliefs	.117	-	
3. Performance	.686**	.111	-
*p < 0.05; ** p < 0.01			

Nevertheless, we believe that when a student is capable of self-regulation and presents strong self-efficacy beliefs, those beliefs should correlate with performance.

ii) Study of the explicative relationships of the performance variable with respect to self-regulated learning and self-efficacy beliefs.

The explicative relationships between the variables were studied with a binary logistic regression model, since the dependent variable (performance) is a dichotomic variable. The independent variables are self-regulated learning, self-efficacy beliefs , and a resulting variable of the interaction between the two that enables us to determine whether self-efficacy beliefs are predictive of performance when those beliefs and self-regulated learning have high scores.

The model the sample was validated by dividing it into two groups, each constituting 50% of the total sample (see Table IV, analysis sample I and validation sample II).

With respect to the determination of the model (see Table IV, Sample I), with the application of the *backward* method, two steps are shown, and both show an appropriate adjustment (Hosmer and Lemeshow test, $p=.901$, in step I and $p=.361$, in step II) since no significant differences were found between the frequency of the observed cases and the predicted cases. In step I, all of the variables considered in the study were included in the model, but self-efficacy beliefs did not prove relevant in predicting performance (see Table IV, Analysis sample, step I). In step II, this was eliminated, resulting in a model in which self-regulated learning and its interaction with self-efficacy beliefs were the only variables distinguished, since their *direct influence* is high and they come with associated statistical significance (see Table IV, Analysis sample, step II). Also, the Nagelkerke coefficient ($R^2= .810$) indicates that the predictive variables explain an important percentage of the variance.

The results found in the validation sample are quite similar to the analysis sample (see Table IV, Sample II, with respect to sample I of Table IV). Thus, the model adjustment is good (Hosmer and Lemeshow test, $p=.756$, for step I and $p=.846$, for step II). Similarly, as in the analysis sample, self-efficacy beliefs proved irrelevant in predicting performance (see Table IV, Validation sample, step I). Consequently, in step II the only relevant variables were self-regulated

learning and its interaction with self-efficacy beliefs (see Table IV, Validation sample, step II). Likewise, a Nagelkerke coefficient was

close to one (R^2=.852), indicating that these predictive variables explain a high percentage of the variance.

Table IV. Logistic forward regression : Predictive performance variables				
Samples	Analysis sample I (n=134)		Validation sample II (n=134)	
Steps	Step I	Step II	Paso I Step I	Step II
Hosmer and Lemeshow test	$p = .901$	$p= .361$	$p = .756$	$p= .846$
Predictive Variables	$R^2= .822$	$R^2= .810$	$R^2= .855$	$R^2= .852$
Self-regulated learning	8.23* (.000)**	7.37* (.000)**	8.42* (.000)**	8.30* (.000)**
Self-efficacy beliefs	1.4* (.138)**	Not included	.91* (.437)**	Not Included
Interaction between variables	5.54* (.001)**	4.68* (.001)**	4.90* (.017)**	4.85* (.020)**
*b: direct influence; **p: probability level associated with the predictive variable				

In summary, for these participants, a high level of self-efficacy beliefs did not guarantee success in performing tasks requiring the solution of mathematical problems. The most relevant variables in predicting performance were self-regulated learning and its interaction with self-efficacy beliefs.

iii) Study of student profiles: two-phase cluster analysis

The results for the foregoing sections led us to test the presence of profiles in this sample of students. That is, self-efficacy beliefs were relevant in predicting performance only when they interact with self-regulated learning. Therefore, we felt that in this sample we should distinguish whether the student profiles were consistent or not between the scores of self-regulated learning, self-efficacy beliefs, and performance.

For this, a two-phase cluster analysis was applied due to the nature of the data (quantitative and dichotomic). The results in the first phase indicated four profiles of students (observe the associated values of "F", "p" and

eta squared (η^2) in Table V).

The first cluster, "Cluster I", made up of 73 students, presents high scores in self-regulated learning as well as in self-efficacy beliefs (see associated values Mean and S, Table V). This profile has been named "positive adjusted".

The second cluster, "Cluster II", with 37 students, shows high scores in self-efficacy beliefs and Mean scores in self-regulated learning (see associated values Mean and S, Table V). This profile has been named "negative unadjusted I".

The third cluster, "Cluster III", with 94 students, shows elevated scores in self-efficacy beliefs, but low scores in self-regulated learning and performance (see associated values Mean and S, Table V). This profile has been named "negative unadjusted II".

Clusters II and III receive the same name "unadjusted negative" since both present higher scores in self-efficacy beliefs than in self-regulated learning. The difference between the two is that the Mean score of Clus-

ter II in self-regulated learning is higher than in Cluster III. Despite the similarity between these profiles, we consider it appropriate to differentiate them. These profiles would each present a distinct relationship with performance and would present a different time course in future studies with respect to a longitudinal design.

Cluster IV, with 64 students, presents low scores in self-regulated learning and low scores in beliefs of self-efficacy (see associ-

ated values Mean and S, Table V). This profile has been named "negative adjusted".

With the cluster analysis, we found no profile with high scores in self-regulated learning or low scores in self-efficacy beliefs. This means that in the second childhood and in our sample, students with the above-mentioned profile were atypical cases.

Table V. Phase I of the cluster analysis (*n*=268)										
	Cluster 1 Positive adjusted (*n*=73)		Cluster 2 Negative unadjusted I (*n*=37)		Cluster 3 Negative unadjusted II (*n*=94)		Cluster 4 Negative adjusted (*n*=64)		Associated values		
	Mean	S	Mean	S	Mean	S	Mean	S	F	P	η²
Self-regulated Learning	2.61	.50	2.02	.12	1.23	.39	1.10	.15	540.68	.000	.860
Self-efficacy beliefs	2.63	.51	2.67	.43	2.51	.61	1.78	.45	118.74	.000	.574

The second phase of the cluster analysis classifies the conglomerates found in the first phase according to performance (see Table VI). The Cluster I profile, positive adjusted,

corresponds to the students who correctly solved the arithmetic problem, while the rest of the profiles correspond to the students who had difficulties solving the problem.

Table VI. Second Phase of the Cluster analysis by phases (n=268)				
	Correct Resolution		Incorrect Resolution	
CLUSTERS	Frequency	Percentage	Frequency	Percentage
Cluster I (*n*= 73) positive-adjusted	73	100%	0	0%
Cluster II (*n*=37) negative-unadjusted	0%	0%	37	19%
Cluster III (*n*= 94) Negative-unadjusted	0%	0%	191	100%
Cluster IV (*n*=64) Positive-adjusted	0%	0%	64	32.8%

In addition, to validate these profiles, and given that the cluster analysis is sensitive to the order of the data, we have mixed up the database and reapplied an analysis with results identical to those reflected in Tables "V"

and "VI" (not shown due to their similarity). We also applied a discriminant analysis in order to determine how many students were correctly classified by means of the cluster analysis. The results indicate that 91.4% of the students were correctly classified (see

Table VII). Specifically, the results indicate that the following percentages of students were correctly classified according to their Cluster: 79.5% of the positive-adjusted profile or Cluster I, 91.9% of the negative-unadjusted I profile or Cluster II, 100% of the negative-unadjusted II profile or Cluster III, 94% of the negative-adjusted profile or Cluster IV.

Table VII. Discriminant Analysis with respect to the classification by cluster analysis						
		Predicted group of belonging				
	Two-phase clusters	Cluster I	Cluster II	Cluster III	Cluster IV	Total
Frequency	Cluster I	58	9	5	1	73
	Cluster II	2	0	1	34	64
	Cluster III	0	0	94	0	94
	Cluster IV	0	59	5	0	37
Percentage	Cluster I	79.5%	12.3%	6.8%	1.4%	100%
	Cluster II	5.4%	0%	2.7%	91.9%	100%
	Cluster III	0%	0%	100%	0%	100%
	Cluster IV	0%	92.2%	7.8%	0%	100%
91.4% of the originally grouped cases were correctly classified						

Conclusions

This study set out three objectives: (i) To determine whether a reciprocal relationship of dependency exists between self-regulated learning, self-efficacy beliefs, and performance; (ii) To detect predictive variables (self-regulated learning and self-efficacy beliefs) of performance; (iii) To determine student profiles with respect to these variables.

With respect to the first objective, in this sample of students, the reciprocal relationship of dependency between the capacity for self-regulation and self-efficacy beliefs was not found, as noted by Zimmerman and Schunk (2008). The results indicate that self-regulated learning correlates with performance, but the two do not correlate with the self-efficacy beliefs.

Also, we sought to identify which variable (self-regulated learning or self-efficacy beliefs) better predicted the performance in solving arithmetic problems. The results indicate that self-regulated learning and its interaction with self-efficacy beliefs predicted the performance. However, in contrast to the affirmation of Zimmerman and Schunk (2008), self-efficacy beliefs, by themselves, are not relevant in predicting this performance among students in their late childhood.

With respect to the third objective, the results indicate four student profiles. Only the students with a positive adjusted profile, those who had a high level both with regard to their capacity for self-regulating as well as to their self-efficacy beliefs, were classified within the group that performed well in solving arithmetic problems.

In Cluster II as well as Cluster III, both of which are termed "negative adjusted", the students registered a high level of self-efficacy beliefs but an inadequate level of self-regulated learning and performance. These students demonstrated that their perception of their capacity to solve arithmetic problems in a self-regulated and successful way is disproportionate and inflated, as noted by Alonsa Tapia (2005) and Eccles et al.

(1993). Although there was a disproportionate relation in both clusters according to the results, the outcome is clearer in Cluster III than in Cluster II.

Finally, in the Cluster called "negative adjusted", the students showed low scores in every variable of the study. Thus, these students have an accurate vision, although are negative, regarding their capacity to solve problems.

These results, in late childhood, lead us to ask new questions related to those student profiles that show difficulty with self-regulated learning: To what extent do the self-efficacy beliefs, whether low or high, facilitate or hamper the development of self-regulated learning during late childhood and the first cycle of primary education? And, to what extent do they make the progressive improvement of performance easier or more difficult in late childhood and the first cycle of primary education?

In this sense, focusing on student profiles that show bad performance, we would consider interesting to use a longitudinal design to test future research in the progress of such profiles.

This research also shows limitations related to the sample selection, as the number of participants is not large, and also has not followed any probability sampling process that permits the generalisation of the results of this population of students. Therefore, in future studies it would be informative to employ rigorous sampling techniques that randomly select an appropriate number of students belonging to a more varied school context. In this way, these profiles could be verified with the goal of studying the educational development during late childhood.

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ANEX I

Questionnaire to evaluate self-regulated learning, self-efficacy beliefs and the performance in the solving of arithmetic problems
(Modified from the original quiz for this publication)

This questionnaire serves two purposes: a) You can know yourself better and b) Your teachers can know you much better. With these questions, we´ll be able to understand
- How you study
- How you can learn more and in a better manner
- Some of the difficulties you have with studying and learning math
- How we can help you become a more efficient and successful math student.

Thank you for your answers.

Name and Last Name: …………………………………………………………….……
Grade: ……………….
Class: ………………………………………………………………….
Semester: ……………………………………………………...………….
Year: ………………………...

You´re going to solve a problema like ones you would usually have in class.

Before starting to answer the questions, we´re interested in how you feel about this work. Please select amongst the following phrases which you feel expresses you the best as a student. In order to select one, circle with a pencil which option describes you best a); b); or c);

  a) I´m very well prepared and I´m giong to do well on all the exercises.
  b) I´m prepared very little and I´ll do average on the exercises.
  c) I´m poorly prepared and I´m sure that I´m going to do badly on the exercises.

Read this problem carefully and answer the questions that follow.

In the office supply store there are three workers. Between the three workers, 15 pencils in total are sold this month. Together, two of the workers sell 10 pencils this month. Do you know how many pencils each worker sells if all sell the same amount of pencils this month?

1.   Answer: This problem is about _____ and in order to solve it, I ought to be able to use things I´ve already studied in math class, such as _____
- Classify and select: Other things that you have also studied in math class that won´t help you solve this problem are:
-   ....
    ....
    ....

You´re going to create a plan to solve the problem. Follow the instructions below.

2.   Explain the problem in your own words.
    ....
    ....
    ....

3.   Draw a picture to explain the problem and help you solve it.

4.   Wait a moment, before you continue, we´re interested in how you feel about this work. Please select amongst the following phrases which you feel expresses you the best as a student. In order to select one, circle with a pencil which option describes you best a); b); or c);

     a) I´m very well prepared and I´m giong to do well on all the exercises.
     b) I´m prepared very little and I´ll do average on the exercises.
     c) I´m poorly prepared and I´m sure that I´m going to do badly on the exercises.

5.   Now it´s important to say what you ought to due to solve the problem.
    ....
    ....
    ....
Although another way to solve the problem would be ....
    ....

6.   Solve the problem (Do all your scratch work on this sheet. If you run out of space, ask your tester for more paper and don´t throw away anything, even if you make a mistake)

7. Revise the work you´ve done. Did you make a mistake? If so, write it down, later, write in which part of the activity you made a mistake and correct it. (If you run out of space, ask your tester for more paper and don´t throw away anything, even if you make a mistake.)
    ....
    ....
    ....

8.   Write the obtained results
    ....
    ....
    ....

9. Wait a moment. It´s important to indicate in which parts you had the most problems. That way, we´ll know what we need to improbé. Therefore, it´s important that you answer this question. What part did you think was the hardest?

    a) Understanding the problem.
    b) Remembering what I know that could help me solve the problem.
    c) Classifying and selecting the things I know that could help me and could not.
    d) Thinking of a plan to solve the problem.
    e) Solving the problem and the mathematical operations.
    f) Correcting my own work.

10. Create a problem similar to the one you solved and that you could solve if you created a plan to solve it.
....
....
....

11. . Create a different problem than the one you solved that would be more difficult.
....
....
....

12. We´ve already finished the quiz. Do you believe that the next time you do a similar activity, you´ll do it correctly?

    a) I´m sure I´ll do it well.
    b) I think I´ll do it well.
    c) I will do poorly.

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