

## Thinking Styles, Metacognitive Strategies and their Relation to Academic Achievement in Mathematics of 5th Grade Secondary School Students in a National School of La Molina, Lima, Peru

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### Abstract

*The present research aims to analyze the relationship of learning styles and metacognitive strategies with the academic performance of 5th year high school students of educational institutions in the district of La Molina. A non-experimental, descriptive correlational, cross-sectional design was used, a sample of 341 schoolchildren was evaluated, and the Stenberg-Wagner thought styles questionnaires and O'Neil & Abedi's Inventory of Cognitive Goal Strategies were used, translated by Martínez (2001). The results show that styles of thinking are directly related to meta-cognitive strategies and academic performance. The style of thought most used by the sample of study is the legislative style, taking into account the variables gender and age and the most used metacognitive meta strategy is the self-knowledge, so much by gender and age.*

**Keywords:** *Thinking Styles, Metacognition, Academic Performance, School Students.*

### INTRODUCTION

The research presented on thinking styles, metacognitive strategies and their relationship with academic performance in the subject of mathematics of fifth year secondary school students in the district of La Molina, Lima, aims to investigate the extent to which thinking styles are related to metacognition and academic performance.

The present research has the fundamental purpose of improving the teaching-learning process of students, analyzing how thinking styles are related to metacognition and academic performance, in order to stimulate thinking styles and pedagogical activities that allow quantitative and qualitative improvement in the performance of secondary school students.

The first part of this research presents the introduction of the research, the research problem and problem statement, the formulation of the problem, the justification and then the international and national background of the study variables and the research objectives. In addition, the theoretical and conceptual framework of both variables is developed. In the second part, the methodological framework is shown, which details the methodology used during the research; the hypotheses, variables, type of research, research method, characteristics of the population and sample.

Finally, the results obtained are shown, indicating the fulfillment of the objectives, followed by a discussion of the results, conclusions and suggestions.

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## **STUDY BACKGROUND**

The levels of thinking stand out: At the above average level, the hierarchical style predominates with 21%, at the medium-high level, the monarchical style predominates with 20%, and at the high level, the executive style prevails with 16% (Chinchay and Gil, 2014).

There is a predominance of creative, social and conservative styles, which are characterized by generating and following their own rules, dealing with unstructured problems, maximizing change and a high degree of self-esteem and autonomy in decision-making. Regarding thinking styles, no significant differences were found in relation to gender. Significant differences were only found in the creative style according to age, with higher scores related to older age (Panziera, 2014).

### **Problem Formulation**

How are thinking styles, metacognitive strategies and academic performance of 5th year secondary school students at secondary schools in the district of La Molina related?

### **Importance of the Research**

First, it describes thinking styles and metacognitive strategies, elements that are important in the learning process and in facing the different demands of reality.

It provides theoretical elements for the elaboration of different strategies that influence metacognition and thinking styles and thus improve students' learning conditions.

It tries to find differences in thinking styles and the use of metacognitive strategies according to different variables such as gender and type of performance, which is a sample of how both intervening variables influence the use of thinking styles and metacognitive strategies.

Establishes the relationship between certain factors of thinking styles and certain dimensions of metacognitive strategies, especially in self-monitoring and task self-regulation of these strategies.

### **General Objective**

To determine the relationship between thinking styles, metacognitive strategies and academic performance in the mathematics course of students in the 5th year of secondary education in secondary schools in the district of La Molina.

### **General Hypothesis**

There is a significant relationship between thinking styles, meta-cognitive strategies and academic performance in the mathematics course of students in the 5th year of secondary education in the district of La Molina.

## **METHOD**

The approach of this research is quantitative, since it describes the sociodemographic variables, thinking styles, metacognitive strategies and relates them to academic performance, all by means of descriptive and inferential statistical calculations of differences and significant correlations.

This is a descriptive-correlational research. On the one hand, the descriptive nature of the study is due to the fact that it seeks to describe learning styles, metacognitive strategies and academic performance according to different variables in the students of the study sample. On the other hand, it is also correlational, since another purpose of the research is to determine whether there is a relationship between learning styles, metacognitive strategies and academic performance, which assumes that academic performance varies according to learning styles and metacognitive strategies (Kerlinger y Lee, 2002).

The non-experimental, correlational-cross-sectional research design is used for this study. According to Hernández et al. (2014), "It is a study conducted without the deliberate manipulation of variables and in which only the phenomena are observed in their natural environment and then analyzed" (p. 149).

It is cross-sectional because "the data are collected at a single moment, in a single time. Its purpose is to describe variables and analyze their incidence and interrelationship at a given time" (Hernández et al. 2014, p. 154)

The population consisted of students in the mathematics course of the 5th year of secondary education of the secondary educational institutions I.E. Experimental La Molina, which had 150 students, I.E. Unión Latinoamericana, 159 students, I.E. Aurelio Miró Quesada Sosa, 192 students, for a total of 501 students, and the sample consisted of 341 students.

The questionnaire was applied individually or collectively and is designed to be administered to groups of adolescents and adults due to the type of statements it contains. The application of the instrument lasted approximately 30 minutes. The statements are scored in a Likert-type system with 7 points ranging from Not at all (0) to Completely (0) (7).

## RESULTS AND DISCUSSION

### Description of the Study Variables

Description of the characteristics of the sample

Table 27 Sociodemographic characteristics of the study sample

Age in ranges	Frequency	Percentage
15-16	208	61.0
17-18	133	39.0
Total	341	100.0
	Frequency	Percentage
Female	204	59.8
Male	137	40.2
Total	341	100.0

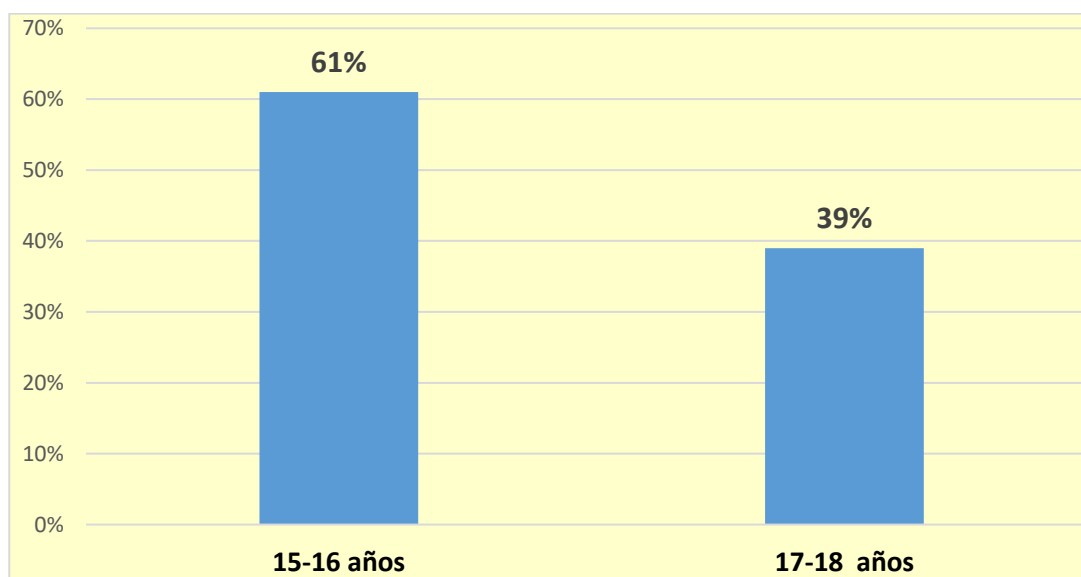
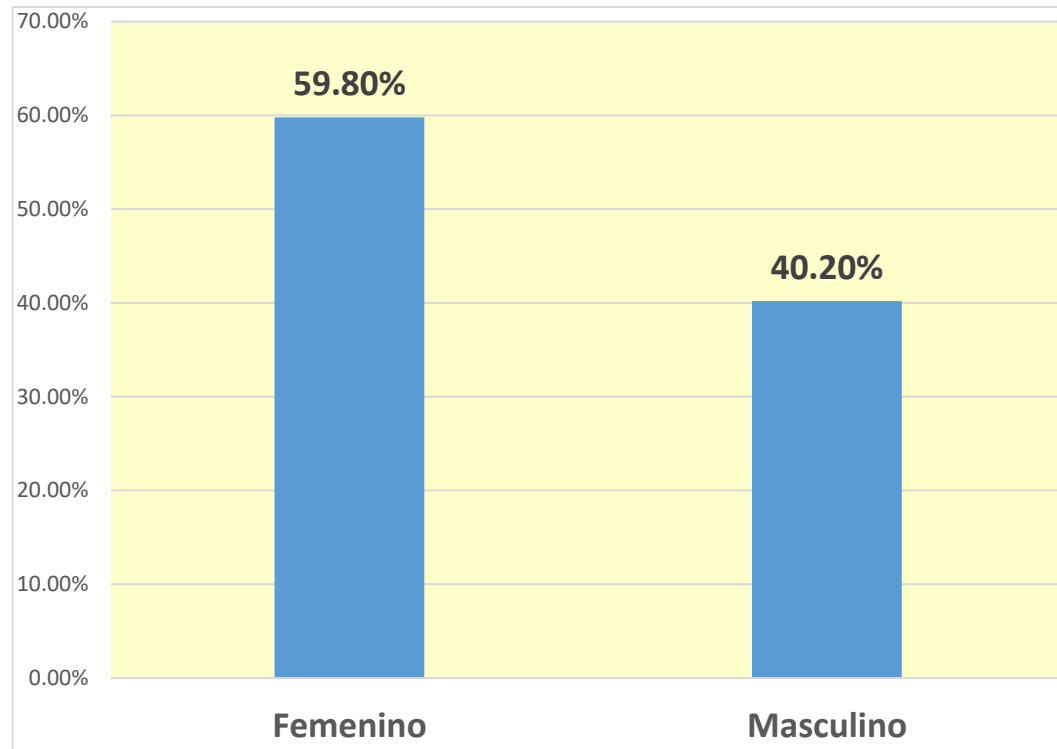


Figure 1. Percentage of ages in the study sample.

Table 27 and Figure 1 show that the sample taking into account age, the highest percentage is in the range of 15 to 16 years old (61.0%), in second place the age range is 17 to 18 years old (39.0%).

In Table 27 and Figure 2, the analysis of the sample by gender, it can be seen that the highest percentage is for *female* (59.8%) and the highest percentage is for *male* (59.8%) 40.2%.



**Figure 2.** Percentage of gender of the study sample

### Thinking styles most commonly used by the study sample

**Table 28** Description of thinking styles (n: 341)

Styles	Minimum	Maximum	Medium	Standard Dev.
	12	35	26.06	5.034
Legislative style	9	35	24.44	4.743
Anarchic style	7	35	24.32	5.196
Internal style	9	34	24.28	4.963
External style	5	35	24.15	4.709
Hierarchical style	5	35	24.01	5.335
Judicial style	5	35	23.94	4.863
Executive style	5	34	23.43	4.675

Monarchical style	5	34	23.23	4.609
Local style	7	34	22.33	5.084
Conservative style	8	33	22.23	4.963
Oligarchic style	9	33	21.75	5.073
Internal style	9	35	21.35	4.328

Table 28 shows that the most predominant thinking styles in the study sample are the legislative style ( $\bar{x}$  :26.06), the anarchic style ( $\bar{x}$  :24.44), and the internal style ( $\bar{x}$  :24.32). It can also be seen that the thinking style used on average is the executive style ( $\bar{x}$  :23.94). The styles with the lowest employment in the sample studied are: global style ( $\bar{x}$  :21.35), internal ( $\bar{x}$  :21.75), oligarchic ( $\bar{x}$  :22.23),

Thinking styles most employed by the study sample according to gender.

**Table 29** Descriptive statistics of thinking styles according to gender (n: 341).

Gender		Minimum	Maximum	Medium	Standard Dev.
<b>Female</b> (n: 204)	<b>Thinking styles</b>				
	Legislative style	14	35	25,84	5,033
	Executive style	5	35	24,14	4,840
	Judicial style	6	35	24,29	5,171
	Monarchical style	6	34	23,29	4,560
	Hierarchical style	9	35	24,43	4,682
	Oligarchic style	8	32	22,09	4,928
	Anarchic style	10	35	24,58	4,837
	Global style	11	32	21,08	4,242
	Local style	13	34	23,17	4,485
	Internal style	11	33	21,14	4,894
	External style	13	34	25,14	4,717
	Internal style	11	34	24,56	4,970
	Conservative style	7	34	22,34	5,102
<b>Male</b> (n: 137)	<b>Thinking styles</b>				
	Legislative style	12	35	26,39	5,036
	Executive style	6	32	23,64	4,899

	Judicial style	5	34	23,58	5,562
	Monarchic style	11	34	23,64	4,852
	Estilo jerárquico	5	34	23,74	4,735
	Estilo oligárquico	10	33	22,44	5,026
	Anarchic style	9	34	24,23	4,609
	Global style	9	35	21,75	4,439
	Local style	6	33	23,33	4,802
	Internal style	9	32	22,66	5,215
	External style	9	34	23,01	5,061
	Internal style	7	35	23,96	5,514
	Conservative style	10	34	22,32	5,076

Table 29 shows that, in both male and female students, the legislative style predominates as the style most used by the students in this study for problem solving, with a certain difference in favor of males. The least predominant thinking style is the global style, with very little difference between the two sexes. As second and third options, the thinking styles vary according to gender. In the case of schoolgirls, the external style is predominant ( $\bar{x}$  :25.14) and the anarchic style ( $\bar{x}$  :25.14). In the case of schoolchildren, the anarchic style is predominant ( $\bar{x}$  :24.23) and the executive ( $\bar{x}$  :23.64). The styles of thinking least used in the case of schoolgirls are: internal ( $\bar{x}$  :21.08), global ( $\bar{x}$  :21.14) and the oligarchic ( $\bar{x}$  :22.09); in the case of schoolchildren are: global ( $\bar{x}$  :21.75) , conservative, ( $\bar{x}$  :22.32) and the oligarchic ( $\bar{x}$  :22.44)

**Most commonly adopted thinking styles by the study sample according to age**

**Table 30** Descriptive statistics of thinking styles according to age (n: 341)

Age in ranges		Minimum	Maximum	Medium	Standard dev.
15-16 years (n: 208)	Legislative style	12	35	26,44	4,865
	Executive style	6	33	24,03	4,741
	Judicial style	5	35	24,39	5,393
	Monarchical style	11	34	23,62	4,472
	Hierarchical style	5	34	24,63	4,408
	Oligarchic style	10	33	22,48	4,770
	Anarchic style	9	35	24,45	4,562
	Global style	11	35	21,48	4,241
	Local style	6	34	23,24	4,567

	Internal style	11	32	21,74	4,734
	External style	9	34	24,23	5,065
	Internal style	7	35	24,72	5,224
	Conservative style	7	34	22,39	4,981
	Age in ranks	1	1	1,00	,000
17-18 years (n: 133)	Legislative style	12	35	25,47	5,251
	Executive style	5	35	23,80	5,063
	Judicial style	6	34	23,41	5,205
	Monarchical style	6	34	23,14	4,980
	Hierarchical style	9	35	23,41	5,072
	Oligarchic style	8	33	21,84	5,245
	Anarchic style	10	34	24,42	5,031
	Global style	9	32	21,15	4,470
	Local style	13	33	23,23	4,690
	Internal style	9	33	21,77	5,581
	External style	11	34	24,38	4,816
	Internal-b style	11	35	23,70	5,108
	Conservative style	10	34	22,24	5,259

Table 30 shows the thinking styles most and least adopted by the schoolchildren in the study sample according to age. In this sense, it is observed that in the age range of 15 to 16 years of age, the styles of greatest use are: legislative ( $\bar{x}$  :26.44), internal ( $\bar{x}$  :24.72) and hierarchical ( $\bar{x}$  :24.63). The least employed thinking styles according to this age range are: global ( $\bar{x}$  :21.48), internal ( $\bar{x}$  :21.74) and conservative ( $\bar{x}$  :22.39). In the 17 to 18 year-old age range, the most commonly used styles are: legislative ( $\bar{x}$  :25.47), anarchic ( $\bar{x}$  :24.42) and external style ( $\bar{x}$  :24.38). The least employed thinking styles according to this age range are: global ( $\bar{x}$  :21.15), internal ( $\bar{x}$  :21.77) and oligarchic ( $\bar{x}$  :21.84).

### Most frequently employed cognitive strategies in the study sample

Table 31 Description of cognitive strategies (n: 341)

strategies	Minimum	Maximum	Medium	Standard dev.
Self-knowledge	24	60	45.52	6.626
Self-regulation	7	20	15.34	2.311
Self-assessment	7	20	14.45	2.528

Table 31 shows that the predominant meta-cognitive strategy is the one that privileges self-awareness skills ( $\bar{x}$  :45.52), followed by the predominance of self-regulatory skills ( $\bar{x}$  :15.34) and self-evaluation ( $\bar{x}$  :14.45)

**Table 32** Description of the cognitive strategies according to gender (n: 341).

Gender		Minimum	Maximum	Medium	Standard dev.
<b>Female</b> (n: 204)	<b>Gender</b>				
	Self-awareness	30	60	46.10	6.295
	Self-regulation	9	20	15.49	2.267
	Self-evaluation	8	20	14.61	2.472
<b>Male</b> (n:137)	<b>Gender</b>				
	Self-awareness	24	60	44.66	7.025
	Self-regulation	7	20	15.12	2.368
	Self-evaluation	7	20	14.21	2.599

Table 32 shows that, in both male and female students, the meta-cognitive skills of self-knowledge predominate, with a certain difference in favor of female students (women: ( $\bar{x}$  :46.10) and men ( $\bar{x}$  :44.66). The least predominant strategy is self-assessment with very little difference between the two sexes (women: ( $\bar{x}$  :46.61) and men ( $\bar{x}$  :44.21).

Table 33

**Description of cognitive strategies according to age (n: 341)**

Age in ranges		Minimum	Maximum	Medium	Standard dev.
<b>15-16</b> (n:208)	Self-awareness	24	60	45,95	6,556
	Self-regulation	7	20	15,30	2,286
	Self-assessment	7	20	14,47	2,595
	Self-knowledge	24	60	44,85	6,703
<b>17-18</b> (n:133)	Self-regulation	10	20	15,41	2,358
	Self-evaluation	8	20	14,42	2,428

Table 33 shows that both 15- to 16-year-old students and 17- to 18-year-old students predominate in the meta-



cognitive skills of self-knowledge, with a slight difference in favor of 15- to 16-year-old students. The least used strategies according to age are self-regulation and self-evaluation. Self-regulation is slightly higher in 17- to 18-year-old students, and self-evaluation is slightly higher in 15- to 16-year-old students.

### Description of Academic Performance Levels

Table 34 Levels of academic achievement in the schoolchildren of the study sample (n: 341)

Academic performance levels	Frequency	Percentage
Low Academic Performance	5	1.5
Medium Academic Performance	184	54.0
High Academic Performance	152	44.6
Total	341	100.0

Table 34 shows that the study sample shows a predominance of medium (54.0%) and high (44.5%) academic performance levels, with only 1.5% having low academic performance.

### Hypothesis Testing

Before testing the hypotheses proposed in the present study, the normal or non-normal distribution of the data of the sample studied was evaluated.

Table 35 Normality test of the study variables

One-sample Kolmogorov-Smirnov Test			
Styles	Normal parameters <sup>a,b</sup>		Asymptotic sig. (bilateral)
	Mean	Standard Dev.	
Self-knowledge	45.52	6.626	.028 <sup>c</sup>
Self-regulation	45.34	2.311	.000 <sup>c</sup>
Self-assessment	44.45	2.528	.000 <sup>c</sup>
General meta-cognition	75.31	10.186	.002 <sup>c</sup>
Legislative style	26.06	5.034	.000 <sup>c</sup>
Executive style	23.94	4.863	.001 <sup>c</sup>
Judicial style	24.01	5.335	.003 <sup>c</sup>
Monarchical style	23.43	4.675	.001 <sup>c</sup>
Hierarchical style	24.15	4.709	.000 <sup>c</sup>
Oligarchic style	22.23	4.963	.004 <sup>c</sup>
Anarchic style	24.44	4.743	.000 <sup>c</sup>
Global style	21.35	4.328	.002 <sup>c</sup>

Local style	23.23	4.609	.000 <sup>c</sup>
Internal style	21.75	5.073	.003 <sup>c</sup>
External style	24.28	4.963	.000 <sup>c</sup>
Internal-b style	24.32	5.196	.001 <sup>c</sup>
Conservative style	22.33	5.084	.001 <sup>c</sup>
Age in ranges	1.39	488	.000 <sup>c</sup>
Gender	1.40	491	.000 <sup>c</sup>
a. The test distribution is normal, b. It is calculated from data; c. Lilliefors significance correction.			

According to Table 35, the study variables show a distribution that does not conform to normality, so it is advisable to use non-parametric statistics such as the Mann Whitney U, an index with which the hypotheses of this research related to the hypotheses of significant differences and relationships will be contrasted. In the case of the correlation index, Spearman's r is used.

### **Establishment Of Differences in Thinking Styles According To Gender, Age And Academic Performance**

**Table 36**Differences in thinking styles according to gender (n: 341)

Styles	Mann-Whitney U	Z	Sig. asymptotic (bilateral)
	12,893.500	-1.213	.225
Legislative style	13,372.500	-.675	.499
Executive style	13,095.000	-.987	.324
Judicial style	13,087.500	-.996	.319
Monarchical style	12,794.500	-1.325	.185
Hierarchical style	13,330.000	-.723	.470
Oligarchic style	13,509.000	-.522	.602
Anarchic style	12,883.000	-1.226	.220
Global style	13,383.500	-.663	.507
Local style	11,393.000	-2.897	.004 *
Internal style	10,580.500	-3.810	.000 *
External style	13,277.500	-.782	.434

Internal style	13,916.000	-.065	948
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Table 36 shows the differences in thinking styles considering gender. In this sense, it is found that there are significant differences in the external and internal styles. In the rest of the thinking styles, no significant differences are found between one gender and the other, so the alternative hypothesis is partially accepted and the null hypothesis, which states that there are significant differences in the thinking styles taking into account gender as an intervening variable, is rejected.

**Table 37** Differences in thinking styles according to age ranges (n: 341)

Styles	15-16 years			17 – 18 years		
	Mann-Whitney U	Z	Sig. asymptotic (bilateral)	Mann-Whitney U	Z	Sig. asymptotic (bilateral)
Legislative style	4,862.500	-.554	579	1,856.000	-1.450	147
Executive style	4,600.000	-1.179	239	2,069.000	-.482	630
Judicial style	4,544.000	-1.311	190	2,100.000	-.341	733
Monarchical style	4,711.500	-.914	361	2,044.000	-.596	551
Hierarchical style	4,550.500	-1.297	195	2,111.000	-.291	771
Oligarchic style	4,955.000	-.334	738	1,839.500	-1.525	127
Anarchic style	4,535.000	-1.334	182	2,031.000	-.655	513
Global style	5,071.000	-.058	953	1,743.500	-1.964	050*
Local style	4,914.500	-.431	667	1,849.000	-1.484	138
Internal style	4,214.000	-2.097	036	1,734.500	-2.002	045*
External style	3,504.500	-3.785	000*	1,872.000	-1.378	168
Internal-b style	4,542.000	-1.316	188*	2,029.500	-.662	508
Conservative style	4,966.000	-.308	758	2,120.500	-.248	804

\* Significant  $p < ,05$

Table 37 shows the differences in thinking styles taking into account age. In this sense, in the age range of 15 and 16 years of age, significant differences are found in the external and internal style. In the age range of 17 and 18 years of age, significant differences are found in the internal style; in the rest of the thinking styles, no significant differences are found between one age range and the other, so the alternative hypothesis is partially accepted, and the null hypothesis is rejected.

**Table 38** Differences in thinking styles according to academic performance (n: 341)

Styles	Mann-Whitney U	Z	Sig. asymptotic (bilateral)
Legislative style	123,500	-2,793	,005 *
Executive style	37,000	-3,513	,000 *

Judicial style	53,500	-3,377	,001 *
Monarchical style	88,000	-3,090	,002 *
Hierarchical style	91,000	-3,068	,002 *
Oligarchic style	226,000	-1,943	,052
Anarchic style	28,000	-3,588	,000 *
Global style	30,500	-3,569	,000 *
Local style	61,000	-3,316	,001 *
Internal style	73,000	-3,213	,001 *
External style	161,000	-2,483	,013 *
Internal-b style	81,000	-3,146	,002 *
Conservative style	128,000	-2,757	,006

\* Significant  $p < ,05$

Table 38 shows the differences in thinking styles taking into account academic performance. In this sense, significant differences are found in all the thinking styles, except in the oligarchic and conservative styles, so the alternative hypothesis is accepted, and the null hypothesis is rejected.

### **Establishment Of Differences in Meta-Cognitive Strategies According to Gender, Age And Academic Performance.**

**Table 39** Differences in meta-cognition strategies according to gender (n: 341)

		t	gl	Sig. (bilateral)	Difference in averages	95% Confidence interval for the difference		5% confidence interval for the difference
						Inferior	Superior	
<b>Female</b>	Self-awareness	104,594	203	,000	46,098	45,23	46,97	
	Self-regulation	97,577	203	,000	15,485	15,17	15,80	
	Self-assessment	84,433	203	,000	14,613	14,27	14,95	
<b>Male</b>	Self-knowledge	74,410	136	,000	44,657	43,47	45,84	
	Self-regulation	74,743	136	,000	15,124	14,72	15,52	
	Self-assessment	63,996	136	,000	14,212	13,77	14,65	

One sample test, Significant  $p < ,05$

Table 39 shows the differences in the meta-cognitive strategies taking gender into account. In this sense, it is found that in these strategies there are significant differences in all the meta-cognitive strategies ( $< ,05$ ), so the

alternative hypothesis is accepted, and the null hypothesis is rejected. The alternative hypothesis states that there are differences in the metacognitive strategies taking into account gender.

**Table 40** Differences in meta-cognition strategies according to age ranges (n: 341)

		t	gl	Sig. bilateral	Difference of averages	95% Confidence interval for the difference	
						Inferior	Superior
15-16 years	Self-awareness	101,081	207	,000	45,947	45,05	46,84
	Self-regulation	96,524	207	,000	15,298	14,99	15,61
	Self-assessment	80,430	207	,000	14,471	14,12	14,83
17-18 years	Self-knowledge	77,163	132	,000	44,850	43,70	46,00
	Self-regulation	75,341	132	,000	15,406	15,00	15,81
	Self-assessment	68,486	132	,000	14,421	14,00	14,84

One sample test, Significant  $p < ,05$

Table 40 shows the differences in the meta-cognitive strategies considering the age range. In this sense, it is found that in these strategies there are significant differences in all the meta-cognitive strategies according to the age range ( $< ,05$ ), so the alternative hypothesis is accepted, and the null hypothesis is rejected. The alternative hypothesis states that there are differences in the metacognitive strategies taking into account the age range.

**Table 41** Differences in meta-cognition strategies according to academic performance levels (n: 341)

		t	gl	Sig. (bilateral)	Difference of averages	95% Confidence interval for the difference	
						Inferior	Superior
Low Academic Performance	Self-awareness	20,555	4	,000	26,000	22,49	29,51
	Self-regulation	12,728	4	,000	9,000	7,04	10,96
	Self-assessment	8,913	4	,001	9,600	6,61	12,59
	Age in ranges	6,000	4	,004	1,200	,64	1,76
Average Academic Performance	Self-knowledge	131,510	183	,000	41,505	40,88	42,13
	Self-regulation	109,887	183	,000	14,234	13,98	14,49
	Self-assessment	86,557	183	,000	13,332	13,03	13,64
	Age in ranges	38,822	183	,000	1,413	1,34	1,48
High Academic Performance	Self-knowledge	169,850	151	,000	51,020	50,43	51,61
	Self-regulation	120,464	151	,000	16,888	16,61	17,17

	Self-assessment	94,675	151	,000	15,967	15,63	16,30
	Age in ranges	34,860	151	,000	1,368	1,29	1,45

Table 41 shows the differences in the meta-cognitive strategies according to the levels of academic performance. According to the results found, it is found that in these strategies there are significant differences in all the meta-cognitive strategies according to academic performance ( $<, 05$ ), so the alternative hypothesis is accepted, and the null hypothesis is rejected. The alternative hypothesis states that there are differences in the metacognitive strategies taking into account the levels of academic performance.

### Relationship Between Thinking Styles and Meta-Cognitive Strategies

**Table 42** *Correlation between thinking styles and meta-cognitive strategies.*

Thinking styles	General meta-cognition		
	Correlation coefficient	sig. (bilateral)	N
Legislative style	.88**	.000	41
Executive style	.79**	.000	41
Judicial style	.618**	.000	41
Monarchical style	.413**	.000	41
Hierarchical style	.306**	.000	41
Oligarchic style	.223**	.000	41
Anarchic style	.327**	.000	41
Global style	.407**	.000	41
Local style	.308**	.000	41
Internal style	.280**	.000	41
External style	.466**	.000	41
Internal-b style	.302**	.000	41
Conservative style	.359**	.000	41
General meta-cognition	.000	.000	41

\*. The correlation is significant at the 0.01 level (bilateral).

Table 42 shows that thinking styles correlate directly and significantly with meta-cognitive strategies; this correlation ranges from low to high ( $r: 223 - r: 618$ ), so the alternative hypothesis is accepted, and the null hypothesis is rejected.

### Relationship Between Thinking Styles and Academic Performance

**Table 43** *Level of correlation between thinking styles and academic performance. (n: 341)*

Thinking Styles	Academic performance		
	Correlation coefficient	Sig. (bilateral)	N
Legislative style	.416**	.000	341
Executive style	.436**	.000	341
Judicial style	.552**	.000	341
Monarchical style	.356**	.000	341
Hierarchical style	.534**	.000	341
Oligarchic style	.166**	.002	341
Anarchic style	.437**	.000	341
Global style	.322**	.000	341
Local style	.422**	.000	341
Internal style	.210**	.000	341
External style	.417**	.000	341
Internal-b style	.426**	.000	341
Conservative style	.309**	.000	341
Academic performance	1.000	.000	341
** . The correlation is significant at the 0.01 (bilateral).			

Table 43 shows that thinking styles correlate directly with academic performance in a low and moderate way ( $r: .166 - r: .552$  and  $p < .000$ ). The oligarchic style correlates in a low way with a level of correlation ( $r: .002$ ), so the alternative hypothesis is accepted, and the null hypothesis is rejected.

	Academic performance		
	Correlation coefficient	Sig. (bilateral)	N
Self-awareness	.904**	.000	341
Self-regulation	.750**	.000	341
Self-evaluation	.681**	.000	341

\*\* . The correlation is significant at the 0,01 (bilateral).

Table 44 shows that meta-cognitive strategies are also moderately and highly correlated with academic performance levels ( $r: .681 - r: .904$  and  $p < .000$ ), so the alternative hypothesis is accepted, and the null hypothesis is rejected.

**Table 45** Correlation between metacognitive strategies and academic performance levels.

	Academic-Performance-Levels		
	Correlation coefficient	Sig. (bilateral)	N
Self-knowledge	.804**	.000	41
Self-regulation	.649**	.000	41
Self-assessment	.574**	.000	41

\*. The correlation is significant at the 0,01 (bilateral).

Table 45 shows that meta-cognitive strategies are also moderately and highly correlated with academic performance levels ( $r: .574 - r: .804$  and  $p < .000$ ), so the alternative hypothesis is accepted, and the null hypothesis is rejected.

**Table 46** Level of prediction of thinking styles on academic performance.

Summary of the Model				
Model	R	R square	R-squared corrected	Standard error of estimation
1	.600 <sup>a</sup>	.359	.334	1.558

a. Predictor variables: (Constant), Conservative style, Legislative style, Oligarchic style, External style, Internal style, Local style, Monarchic style, Global style, Internal-b style, Hierarchical style, Executive style, Anarchic style, Judicial style.

Table 46 shows that 60% of academic performance is explained by thinking styles.

**Table 47** Table 46 shows that 60% of academic performance is explained by thinking styles.

Model		Sum of squares	gl	Root mean square	F	Sig.
1	Regression	445,236	13	34,249	14,114	.000 <sup>b</sup>
	Residual	793,479	327	2,427		
	Total	1.238,716	340			

a. Dependent variable: academic performance

b. Predictor variables: (Constant), Conservative style, Legislative style, Oligarchic style, External style, Internal style, Local style, Monarchic style, Global style, Internal-b style, Hierarchical style, Executive style, Anarchic style, Judicial style.

Table 47 shows that the critical level  $p: 0.000$  confirms that there is a significant linear relationship. In this sense, it can be affirmed that at least one of the thinking styles significantly explains academic performance, the Judicial and hierarchical styles, which have shown the highest correlation with academic performance.



**Table 48**Level of prediction of meta-cognitive strategies on academic performance.

Model summary					
Model	R	R square	R-squared corrected	Standard error of estimation	Sig. change in F
1	.925 <sup>a</sup>	.855	.854	.729	.000
a. Predictor variables: (Constant), Self-assessment, Self-regulation, Self-knowledge.					

**Table 49**Predictive value of meta-cognitive strategies on academic performance.

Model		Sum of squares	df	Root mean square	F	Sig.
1	Regression	1.059,508	3	.593,169	664,137	.000 <sup>b</sup>
	Residual	179,207	337	.732		
	Total	1.238,716	340			
a. Dependent variable: ACADEMIC PERFORMANCE						
b. Predictor variables: (Constant), Self-assessment, Self-regulation, Self-knowledge.						

Table 49 shows that the critical level  $p: 0.000$  confirms that there is a significant linear relationship, so it can be argued that at least one of the meta-cognitive strategies significantly explains academic performance, with a significant correlation of the strategy self-knowledge.

## DISCUSSION OF RESULTS

The most predominant thinking styles in the study sample are the legislative style, the anarchic style and the internal style, which is consistent with the findings of several authors who have studied these styles in educational populations (Caycho, 2010; González-Pineda et al. 2004 and López and Martín, 2010), which according to Sternberg the populations studied would be characterized by a preference for creating formulas and planning solutions to problems rather than following established ones, questioning rules and assumptions rather than accepting them. Secondly, the executive style predominates, which is characterized by following rules or activities in which they are specified what they should do and how they should do it, as well as handling previously structured and posed problems.

The most predominant thinking styles according to gender is also the legislative style as the style most used by the students in this study for problem solving, with a certain difference in favor of boys. In second place, the anarchic style predominates in males, a behavior characterized by not being based on rules or order and tending to be distracted. In women, the second predominant style is the external style, which would indicate that there would be an important difference between men and women according to their coping and problem-solving styles.

The thinking styles most and least used by the schoolchildren in the study sample according to age, it is observed that in the age range of 15 to 16 years and 17 to 18 years of age is the legislative style, which shows that in this study sample predominates a style in which the schoolchildren face problems according to norms and criteria.

The predominant meta-cognitive strategies are those that privilege self-knowledge skills, followed by the predominance of self-regulation skills and self-evaluation, that is to say, the study sample would give priority to the description and analysis of the facts that occur in the problematic reality of learning. As for gender, the strategies that also predominate are those of self-knowledge, the same occurs with the strategy of self-knowledge according to age ranges, with a slight tendency to a greater tendency in favor of students from 15 to 16 years

old. It is important to take into account the evolutionary processes; in this sense, each stage of development has its own characteristics of affective, cognitive or physical development, so this condition would make schoolchildren organize their thoughts differently for the resolution of their tasks (Valadez, 2009). This author emphasizes that thinking styles are not static but are modified throughout life.

In terms of academic performance, the sample shows a predominance of high and medium values, totaling almost 100% of the cases.

### **Differences In Thinking Styles According to Gender and Academic Performance**

Differences were found in the thinking styles taking into account the gender variable, such differences occurring in the external and internal styles. In the rest of the thinking styles, no significant differences were found between one gender and the other. This would be showing evidence that the styles of learning and facing daily problems would have to do with the ability and aptitude that each person would have to perform these activities, which could be unique to each person and independent of sexual consideration.

Sternberg (1999), guided by these principles, defines style, without differentiating by gender or age, as "a way of thinking, a preferred way of using the skills that the individual possesses" (in Valadez, 2008, p. 6), which could also have the effect of social influence, rather than gender. An important aspect of this finding is that the differences found are with all the meta-cognitive strategies, making possible the interpretation that the strategies would be part of larger constructs, but that all of them would come into play in the teaching and learning process.

Differences in thinking styles have been found taking into account age. In the age range of 15 and 16 years, significant differences were found in the external and internal styles. In the age range of 17 and 18 years of age, significant differences were found in the internal style; in the rest of the thinking styles, no significant differences were found between one age range and the other. Apparently, the thinking style that is very different would be the internal style in which both age ranges coincide. According to Sternberg, this style is seen in introverted people, who focus on tasks or work individually, even in solitude. This aspect could be due to a form of style, which has been seen to evolve with age, but it could also be due to a personality trait, which also evolves with age.

On the other hand, Sternberg (1988) affirms that they are propensities, and that it would be the way of facing the tasks and not the intensity in how they perform them. In addition, people, according to different conditions in learning tasks, do not always use the same styles, and even the subject would apply a certain style according to whether he feels comfortable in using it. This author also affirms that they can be modified throughout life and that they are variable, they have modifiability. However, the neuropsychology point of view would have proved that thinking styles, as other learning styles, there would be structures among them; one of them is the physiological basis of them, but there is also a social influence. The biological basis of the styles would not change, but the psychosocial domains of the thinking styles would change.

Significant differences were found in the thinking styles taking into account the levels of academic performance, except in the oligarchic and conservative style. This finding could be due to cognitive or intellectual differences or strategies that would be expressed in the performance levels of the students in the study sample. One of the aspects that have been reflected upon in relation to thinking styles and academic performance is the fact of the variability, adaptability, adaptation and socialization of styles in the face of different learning tasks. The different subjects of education would demand the use of one or another of the styles and the subject would apply it according to such needs and abilities.

### **Differences In Meta-Cognitive Strategies According to Gender and Academic Performance**

Significant differences have been found in meta-cognitive strategies taking into account the gender variable. Although in the present research these differences have been found, this fact may be due precisely to the way of using skills, cognition and their practice, it may be to what for decades was assumed that cognitive activity, skill and their practice were a single.

Significant differences were found in the meta-cognitive strategies taking into account the age range. In this sense, it is found that in these strategies there are significant differences in all the meta-cognitive strategies according to the age range (<, 05). Since meta-cognitive strategies have to do with the way the subject solves a situation, then, this strategy would be influenced by the age factor, which in turn would account for the evolution of cognitive structures factor.

Differences were found in the meta-cognitive strategies according to the levels of academic performance. According to the results found, it is found that in these strategies significant differences are found in all the meta-cognitive strategies according to academic performance (<, 05), so the alternative hypothesis is accepted, and the null hypothesis is rejected.

**Relationship Between Thinking Styles, Meta-Cognitive Strategies and Academic Performance**

Thinking styles correlate directly and significantly with meta-cognitive strategies; this correlation ranges from low to high (r: 223 - r: 618). This finding is understandable to the extent that for some authors metacognition would be part of the practice or learning style of the subjects; therefore, the subject would use both strategies and skills. This leads to think that meta-cognition is the mental basis of thinking styles and in turn their learning style. It would also occur that the subject would have differentiated forms of meta-cognition and thinking styles according to the needs, this would explain a result like the one found in which the relationship values are from low to medium-high, that is, there would not always be a high relationship between both variables.

Both variables would be related to each other in the different tasks, for example in the learning of any subject, particularly in those of basic and students of the last grade of secondary education, so the relationship between thinking styles and meta cognitive strategies would converge in the tasks of academic performance.

In the study sample there would not be a predominance of thinking styles such as oligarchic, so they do not correlate with academic performance. One of the characteristics of this sample is the fact that they are from schools characterized by a diverse order in all their activities and educational and organizational policies.

According to the results, the meta-cognitive strategies would be used much more by these students and would reveal their higher levels of correlation and that the levels of academic performance found would be explained in a percentage higher than 50% by the thinking styles, which meant that there would also be other conditions, such as the same meta-cognitive strategies.

On the other hand, taking into account the relationship between meta-cognitive strategies and academic performance, 85% of this was explained by the use of these strategies or at least one of them, especially those of self-knowledge. From the results found, it can be affirmed that all the strategies come together in the process of learning tasks. In the present investigation, in the thinking styles questionnaire, an item-test validity considered appropriate by Kline (1986) has been obtained, since the critical level of significance should not be less than 0.20 (p < .20). Of the 65 items, 64 of them obtain a higher level, but 1 does not, so it has not been considered in the total of the items, this item is number 7 for obtaining a very low correlation and significance (r: .078 and a p: 151). For the thinking styles inventory, the consistency values found and measured by Cronbach's alpha are sufficiently high to be able to affirm that the test is reliable for measuring thinking styles. In general, this inventory obtains an alpha of (α: .94) and consistency values high enough to be considered values above (α: .70) are reliability values. Items that can measure the thinking styles construct in the study sample (Nunnally and Berstein, 1995).

**Table 50** Consistency of the dimensions of thinking styles

thinking styles	Scale mean	Scale variance	Correlation element-to-total correlation corrected	Cronbach's alpha
Legislative style	279,48	1.902,250	,716	,927
Executive style	281,60	1.920,871	,698	,927

Judicial style	281,53	1.855,156	,780	,924
Monarchical style	282,10	1.938,857	,684	,928
Hierarchical style	281,38	1.902,507	,773	,925
Oligarchic style	283,30	1.967,364	,568	,932
Anarchic style	281,09	1.899,503	,774	,925
Global style	284,18	1.955,808	,699	,927
Local style	282,30	1.916,622	,754	,926
Internal style	283,78	1.949,159	,597	,931
External style	281,25	1.946,047	,620	,930
Internal-b style	281,21	1.895,314	,707	,927
Conservative style	283,20	1.925,832	,651	,929

Regarding construct validity through factor analysis of the metacognitive strategies test, it is shown that the values obtained are grouped in three dimensions with an acceptable level of variance saturation 46.064 (Appendix 10). These data agree exactly with the values obtained by Martínez (2005) in Spain, so it can be affirmed that the inventory appropriately measures the content of the metacognitive strategies, indicated by O'Neil & Abedi (1996).

The reliability has been found through the Alpha coefficient, where the reliability estimates of internal consistency are presented through Cronbach's Alpha indexes. The results obtained show that the thinking styles questionnaire has a Cronbach's Alpha index of 0.913, which indicates that it has a high internal consistency, therefore it is concluded that this scale is reliable.

**Table 51** Consistency of thinking styles (5 groupings of styles)

Cronbach's alpha	N of elements
.913	5

The most predominant thinking styles in the study sample are the legislative style, the anarchic style and the internal style, which is consistent with the findings of several authors who have studied these styles in educational populations (Caycho, 2010; González-Pineda et al., 2004 and López and Martín, 2010), which according to Sternberg, the populations studied would be characterized by a preference for creating formulas and planning solutions to problems rather than following established ones, questioning rules and assumptions rather than accepting them. Secondly, the executive style predominates, characterized by following rules or activities in which they are specified what they should do and how they should do it, as well as handling previously structured and posed problems.

The predominant metacognitive strategies are the one that privileges self-knowledge skills, followed by the predominance of self-regulation skills and self-evaluation, that is, the study sample would give priority to the description and analysis of the facts that happen in the problematic reality of learning. As for gender, the strategy that also predominates are those of self-knowledge, the same occurs with the strategy of self-knowledge according to the age ranges, with a slight to a greater tendency in favor of students from 15 to 16 years of age. It is important to take into account the evolutionary processes; in this sense, each stage of development has its own characteristics of affective, cognitive or physical development, so this condition would make

schoolchildren organize their thoughts differently for the resolution of their tasks (Valadez, 2009). This author emphasizes that thinking styles are not static but are modified throughout life.

**Table 52 Sociodemographic characteristics of the study sample**

Age in ranges	Frequency	Percentage
15-16	208	61.0
17-18	133	39.0
Total	341	100.0
	Frequency	Percentage
Female	204	59.8
Male	137	40.2
Total	341	100.0

Thinking styles correlate directly and significantly with metacognitive strategies. This correlation ranges from low to high ( $r = .223$  -  $r = .618$ ). This finding is understandable insofar as for some authors metacognition would be part of the practice or learning style of the subjects; therefore, the subject would use both strategies and skills. This leads to think that metacognition is the mental basis of thinking styles and in turn their learning style. It would also occur that the subject would have differentiated forms of metacognition and thinking styles according to the needs, this would explain a result such as the one found in which the relationship values are from low to medium-high, that is, there would not always be a high relationship between both variables.

In the study sample, there would not be a predominance of thinking styles such as oligarchic, so they do not correlate with academic performance. One of the characteristics of this sample is the fact that they are from schools characterized by a diverse order in all their activities and educational and organizational policies. From the results found, it can be affirmed that all the strategies come together in the process of learning tasks

## CONCLUSIONS

The most predominant thinking styles in the study sample are the legislative style, the anarchic style and the internal style. It can also be seen that on average, the thinking style used is the executive style. The least used styles in the sample studied are the global, internal and oligarchic styles. According to gender, in both male and female schoolchildren, the legislative style predominates, with a certain difference in favor of males. The least predominant thinking style is the global style, with very little difference between both sexes. In the case of schoolgirls, the external style and the anarchic style predominate. In the case of schoolboys, the anarchic style and the executive style predominate. The least used thinking styles, in the case of schoolgirls, are internal, global and oligarchic; in the case of schoolboys: global, conservative and oligarchic.

The styles of thinking according to age, it is observed that in the age range of 15 to 16 years of age the styles of greatest use are legislative, internal and hierarchical. In the age range of 17 to 18 years old, the styles of greatest use are the legislative, the anarchic and the external style.

In the present research, it was found that the predominant metacognitive strategy is the one that privileges self-knowledge skills, followed by the predominance of self-regulation skills and self-evaluation. The metacognitive strategies in relation to gender were found to be predominantly self-knowledge metacognitive skills in both male and female schoolchildren. The strategies in relation to age, both in 15- to 16-year-old schoolchildren and in 17- to 18-year-old students, the meta-cognitive skills of self-knowledge predominate. Self-regulation is slightly higher in 17- to 18-year-old students, and self-evaluation is slightly higher in 15- to 16-year-old students.

The thinking styles taking into account gender, it has been found that there are significant differences in the external and internal styles. In the rest of the thinking styles, no significant differences were found between one gender and the other. Considering age, in the age range of 15 and 16 years of age, significant differences were found in the external and internal styles. In the age range of 17 and 18 years of age, significant differences are found in the internal style. Taking into account academic performance, significant differences were found in all thinking styles, except in the oligarchic and conservative style ( $< ,05$ ).

The metacognitive strategies taking into account gender, it has been found that there are significant differences in all metacognitive strategies ( $< ,05$ ). The metacognitive strategies taking into account the age range, it has been found that there are significant differences in all metacognitive strategies ( $< ,05$ ). The metacognitive strategies according to the levels of academic performance. It has been found that in these strategies there are significant differences in all metacognitive strategies ( $< ,05$ ),

Thinking styles correlate directly and significantly with metacognitive strategies. This correlation ranges from low to high ( $r: 223 - r: 618$ ). Thinking styles correlate directly with academic performance in a low to moderate way ( $r: ,166 - r: ,552$  and  $p < .000$ ). The oligarchic style correlates low with a level of correlation ( $r: .002$ ). At least, one of the thinking styles significantly explains academic performance. Metacognitive strategies correlate with academic performance levels moderately and highly ( $r: ,681 - r: ,904$  and  $p < .000$ ). At least one of the metacognitive strategies significantly explains academic performance.

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*Thinking Styles, Metacognitive Strategies and their Relation to Academic Achievement in Mathematics of 5th Grade Secondary School Students in a National School of La Molina, Lima, Peru*

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