

Differences in Learning Strategies Based On Academic Performance in Several Years in the Same Compulsory Secondary Education Centre

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Abstract.

Numerous researchers show multiple benefits of learning strategies to achieve higher performance on Compulsory Secondary Education students. This paper aims to study the relationship between learning strategies and their impact on academic performance in 2016 and in 2019. Design corresponds to a descriptive, correlational and inferential cross-sectional study on two subsamples in the same Compulsory Secondary Education school with quantitative methodology. Motivated Learning Strategies Questionnaire (MSLQ) was administered to 221 students in 2016 and three years later, in 2019, to 358 students. Descriptive and correlational results are similar on both dates. There are significant differences in Effort, Time and Place Management, Help Seeking, Organization, Elaboration and Critical Thinking, with worse results for the lowest level of performance in 2016 and in 2019. The 2019 subsample is slightly better than 2016 in all the variables analysed except in Elaboration and Critical thinking that there are not statistically significant differences. This indicates the superiority of the most strategic students on academic performance conclusively, but the slight increase in performance in the 2019 subsample is not accompanied by an improvement in metacognitive strategies. The profile of the best high school student responds to the use of cognitive, metacognitive and resource management strategies. This work suggests the need to consider the variables studied when guiding families and students to improve their learning processes and academic performance. Finally, some conclusions are drawn from this study that we believe should be taken into account in future related studies.

Keywords: cognitive strategies, compulsory secondary education, learning processes, metacognitive strategies, resource management strategies.

1. Introduction

A set of cognitive, metacognitive, emotional and social factors participate in the self-regulation of learning. Many authors consider it key to obtaining positive academic results. Acquiring self-regulation strategies maintains adequate motivation in the learning process and facilitates the progressive independence of the student. Through personal commitment to goals, the student manages to maintain and direct attention and effort during the process. (Fernández et al., 2012; Pintrich, 1995). It is necessary to take into account a multiplicity of interconnected factors to analyse self-regulation of learning (Bronfenbrenner, 1979). Winne and Baker (2013) have defined self-regulated learning as a behavioural expression of

motivation with metacognitive guide by the student. When students are well self-regulated: 1st) reflect on their learning, 2nd) establish appropriate goals, 3rd) plan their strategies, 4th) readjust their actions and 5th) maintain their motivation and study habits during the process. In this way, students are considered to be more likely to achieve academic success than those who do not self-regulate (Dent & Koenka, 2016).

Learning strategies are part of self-regulated learning. Includes cognitive, metacognitive, and resource management behaviours, methods, techniques, and tactics that students use to perform a given task (Pintrich, 2000). Learning strategies facilitate acquisition, understanding and subsequent transfer of knowledge and skills to new situations (Weinstein et al., 2000). In this work, we will address cognitive, metacognitive and resource management strategies as relevant cognitive tools for learning of compulsory secondary education students (Cerezo et al., 2019). Cognitive strategies such as repetition, elaboration, organization and critical thinking, seek the integration of the new material with the prior knowledge of the student. They are used to encode, understand and remember information. With repetition strategy, students try to remember important information and keep it active in immediate memory. The elaboration strategy allows integrating the new information with the previous one. Organization strategy aims to structure information through the analysis, selection and construction of connections and hierarchies to integrate the new information into a coherent and meaningful whole. The critical or analytical thinking strategy is the process in which knowledge, opinions and statements are organized, analysed and evaluated to adopt the most reasonable and justified position on an issue. Metacognitive strategies are defined as the control and regulation skills of planning, monitoring and evaluating cognition before and during the performance of learning activities. Resource management strategies are used to manage temporal, circumstantial, material aspects, help seeking and collaboration, as well as the personal effort necessary to carry out the task.

Research on self-regulated learning has focused on the frequency of use of learning strategies, prior knowledge, and student performance. Currently, it is considered that in addition to the frequency and previous knowledge, the depth of the strategies and their joint or multiple use must be taken into account (Parkinson & Dinsmore, 2018; Suárez & Suárez, 2019). In this sense, the researchers differentiate two levels in the use of strategies, one more superficial and the other deeper. The use of strategies with a superficial cognitive approach is carried out in situations where the objective is the reproduction of content, facts or isolated data sets. For example, this occurs in the mechanical substitutions of mathematical formulas collected in memory. From this approach, the understanding of the learning content is very low or null. Instead, the use of strategies with a deeper cognitive approach is carried out in situations where the main objective is to understand the learning content for its application in problem solving. In this sense, Deekens et al. (2018) consider it appropriate to include in the research measures of the depth of the strategies used by the students and the frequency of their supervision. The results of the research by Ben-Eliyahu (2017) show us how students with a high level of cognitive regulation differ in their expectations, goal orientations, values and self-regulation of their emotions and behaviours, from those of a medium or low level. And students, who monitor their strategies more frequently, obtain better academic evaluations than those who monitor their strategies less frequently. Furthermore, according to Coertjens (2018), the correlation between the depth of information processing and metacognitive supervision occurs regardless of the learning approach, both those focused on self-regulation and those focused on learning and / or performance. Self-regulated learning, by itself, does not involve deeper information processing (Winne, 2018).

Researchers show how students who use task-appropriate learning strategies achieve better academic performance (Alexander, 2018; Barca-Enríquez et al., 2015). According to Dinsmore (2017), research carried out between 2011 and 2016 on strategic learning agrees that there is a lack of empirical development on the nature of knowledge processing, depth and the conditional use of strategies that explain performance. In addition, the frequency of use of strategies, personal characteristics and environmental factors also influence their effectiveness (Torrano et al., 2017). In this sense, low-performing students use low-level strategies and low results remain despite increased time spent on homework. Therefore, what achieves the best results is not only related to the amount of time invested but also to its use from a strategic point of view (Difrancesca et al., 2016). Depending on the effort and the frequency of the follow-up strategies, the association between the dedication of time to the accomplishment of the task and the results can be a characteristic of favourable behaviour. But if little effort is exerted, the time spent is associated with a low motivation (Flunger et al., 2017).

Based on the theory presented and the works cited, we set the following specific objectives: 1st) to describe learning strategies and academic performance of the sample in 2016 and in 2019; 2nd) to study the relationship between the different types of variables previously indicated in 2016 and in 2019, 3rd) to check if there are significant differences depending on the performance of Secondary Education students in 2016 and in 2019, 4th) to analyse the evolution of the variables in 2016 and in 2019.

2. Method

2.1 Participants

The sample of this study is made up of two different moments: 221 students in 2016 and 358 students in 2019 from the same public centre of Compulsory Secondary Education in Seville (Spain). This centre is located in a peripheral area of the city. The location is characterized by being a military residential area, in addition to its proximity to residential developments on the outskirts of the city. The families that reside in this wide area have, in general terms, a medium socioeconomic level and in some cases high, with the exception of families from peripheral localities, which cover all types of levels. The type of sampling used has been for accessibility. The distribution of the sample by grade and sex is shown below in Table 1. At the 1st course, the number of students in the sample is similar in 2016 and in 2019. At the 2nd, 3rd and 4th course, the number of students in the sample is higher in 2019 than in 2016.

Table 1

Distribution of the sample of students by grade and gender

Course	1 ^o		2 ^o		3 ^o		4 ^o		Total	
Year	2016	2019	2016	2019	2016	2019	2016	2019	2016	2019
Man	51	48	33	65	14	33	18	45	116	191
Woman	28	33	47	52	14	41	16	41	105	167
Total	79	81	80	117	28	74	34	86	221	358

Source: own elaboration

2.2 Process

Tutor, during normal class hours, have been in charge of distributing and collecting the questionnaires used to students from 1st to 4th course of Compulsory Secondary Education, following common instructions in all groups. The students have taken around 40 minutes to fill it and have been informed that they must answer according to their opinions, as there are no right or wrong answers. It has been explained that participation is voluntary and that all data collected will be used solely for research purposes, guaranteeing the confidentiality of all participants.

2.3 Variables and instruments

To collect the information on the strategic variables, we used the Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich et al. (1993). It is a self-report instrument designed to evaluate the use of different learning strategies, with a Likert-type scale with 7 scoring levels, the lowest level (Never) corresponding to 1 and the highest level (Always) to 7. The 4 factors analysed were: Time, Place and Effort management (e.g., "I try to keep my study and work at date on the different topics"), Elaboration and Critical thinking (e.g., "Whenever possible, I try to relate the ideas of some topics with the others one"), Help seeking (e.g., "When I do not understand some content of a topic, I ask another colleague for help") and Organization (e.g., "When I study, I do a first quick reading of books or notes and I try to find the most important ideas").

To collect performance information, students are asked for their usual grades in Math subjects; Spanish Language and Literature; and English, since these subjects are representative of the areas of science, letters and languages respectively and are studied by all students during Compulsory Secondary Education. From this information the "Average performance" will be calculated with the arithmetic mean of the three subjects.

2.4 Data analysis

We study the characteristics of the sample using the Kolmogorov-Smirnov test with Bonferroni correction, and we verify how the quantitative variables studied do not meet the requirements to apply the parametric statistical analysis tests, therefore, we will use non-parametric tests.

For descriptive analyses we have obtained the most common statistics such as the mean and standard deviation. Correlational analyses were performed with Spearman's rho test. And the difference of means was analysed with the Mann Whitney U test and the Kruskal-Wallis H test as appropriate.

To make the comparison according to academic performance, 3 level groups were established based on the terciles of said variable. Tercile 1 is the group formed by students with the lowest level of performance (0-4.9), tercile 2 is the performance group intermediate (5.0-6.9) and tercile 3 is the highest performing group (7.0-10). We have used Cohen's d to assess the magnitude of the differences found, considering that an effect $d = 0.20$ is small, $d = 0.50$ is moderate, and $d = 0.80$ is large (Cohen, 1988).

To check the evolution of the variables, a mean difference analysis was carried out between 2016 subsample and 2019 subsample.

3. Results

3.1. Descriptive and correlational study

Table 2 shows the main descriptive statistics (means and standard deviations) and the correlations between the 5 variables analysed: Time, Place and Effort management (1), Elaboration and Critical thinking (2), Help seeking (3), Organization (4) and Performance (5). The results obtained in 2016 and in 2019 are similar to each other. This indicates coherence and consistency of the study. The means of the 4 learning strategies obtained by the sample in 2019 are slightly higher than those obtained in 2016. It is observed that the most used learning strategy is Time, Place and Effort management, followed by Help seeking, Organization and, finally, Elaboration and Critical thinking in 2016 and in 2019.

Students, in the 2016 sample, obtain an average of 6.13 in academic performance; and in 2019 it rises to 6.57, improving by almost half point of difference. Regarding the correlations, all the strategies are positively and significantly correlated with each other. It is worth highlighting the positive, moderate and significant correlation of Time, Place and Effort Management and Help Seeking (.39 in 2016 and .48 in 2019). Also, the correlation between Time, Place and Effort management strategy with Performance stands out (.53 in 2016 and .45 in 2019).

Table 2

Descriptive and correlational statistics

Variable	Time, Place and Effort management (1)		Elaboration and Critical thinking (2)		Help seeking (3)		Organization (4)		Performance (5)	
	2016	2019	2016	2019	2016	2019	2016	2019	2016	2019
Year	2016	2019	2016	2019	2016	2019	2016	2019	2016	2019
α	.81	.82	.81	.73	.73	.75	.68	.81		
M	4.95	5.31	4.28	4.40	4.68	5.51	4.52	4.86	6.13	6.57
SD	1.08	1.28	1.05	1.14	1.25	1.31	1.42	1.60	1.81	1.52
(2)	.32**	.40**								
(3)	.39**	.48**	.32**	.24**						
(4)	.38**	.36**	.39**	.30**	.32**	.34**				
(5)	.53**	.45**	.26**	.20**	.38**	.21**	.18**	.12*		

Note. * $p < .05$, ** $p < .01$

3.2 Analysis of differences of means in learning strategies as a function of performance

Regarding the three groups of performance levels created, we found statistically significant differences in the 4 strategies analysed: Time, Place and Effort management; Elaboration and Critical thinking; Help seeking and Organization that are benefit the group with the highest performance (T3) compared to the average level (T2) and the lowest performance level (T1) as we can see in Table 3. It is observed that the group with the lowest performance (T1) is the one that obtains significantly lower scores in these variables, with an effect size between moderate and large in 2016 and in 2019.

Table 3

Inferential analysis of learning strategies

V	H		p		Tercile	U		p		Cohen's d	
	2016	2019	2016	2019		2016	2019	2016	2019	2016	2019
V1	53.227	77.666	.000	.000	T1<T2	1146.500	2333.000	.007	.000	0.48	0.53
					T1<T3	713.000	1015.500	.000	.000	1.45	1.56
					T2<T3	1640.500	5728.500	.000	.000	0.85	0.83
V2	13.340	18.058	.001	.000	T1<T2	980.500	3341.000	.004	.962	0.53	0.00
					T1<T3	1389.000	2478.000	.000	.002	0.63	0.51
					T2<T3	2765.500	7194.500	.668	.000	0.08	0.47
V3	25.879	16.263	.000	.000	T1<T2	1021.500	3412.000	.001	.308	0.56	0.17
					T1<T3	1146.500	2609.500	.000	.001	0.99	0.57
					T2<T3	2664.000	8244.000	.075	.001	0.35	0.41
V4	9.239	7.849	.010	.020	T1<T2	1341.000	3488.500	.072	.259	0.36	0.14
					T1<T3	1781.000	2927.500	.002	.006	0.58	0.40
					T2<T3	2798.500	9555.500	.247	.070	0.20	0.23

V1= Time, Place and Effort management; V2= Elaboration and Critical thinking; V3= Help seeking; V4= Organization.

Note. *p<.05, **p<.01

3.3 Analysis of differences of means between the variables of the sample in 2016 and in 2019

We found statistically significant differences in 3 strategies (Time, Place and Effort management, Help seeking and Organization) and in Performance in benefit of the 2019 subsample compared to 2016 subsample. The size of the effect is small in all the variables analysed except for Help seeking, which is moderate as we can see in Table 4.

Table 4

Inferential analysis between the 2016 and 2019 subsamples

V	U	p	Cohen's d
V1	28139.500	.000	0.31
V2	31874.000	.178	0.11
V3	21831.500	.000	0.65
V4	32446.000	.002	0.23
V5	32951.500	.005	0.26

V1= Time, Place and Effort management; V2= Elaboration and Critical thinking; V3= Help seeking; V4= Organization; V5= Performance.

Note. *p<.05, **p<.01

4. Conclusion

In the development of this work, we have addressed the four proposed objectives. Regarding our first objective, the learning strategy most used by students was Time, Place and Effort management, and the least used was Elaboration and Critical Thinking in 2016 and in 2019. Elaboration and Critical thinking of the information are considered more complex strategies that acquire a deeper knowledge. Therefore, the sample has a mainly superficial strategic level (Deekens et al., 2018; Fiorella & Mayer, 2016). Students who habitually use Time, Place and Effort Management strategy, as in the case of our sample, may need reinforcement in the planning and evaluation of the process, thus enhancing the metacognitive analysis of the tasks, reflection and strategic foresight. In this way, they can improve the learning cycle, since the strategies are proposed again for each new task (Zimmerman, 2000). Furthermore, this may mean that the students in the sample have trouble applying the knowledge in other situations.

The average performance obtained by the students in the sample in 2019 ($M = 6.57$) is almost half point higher than obtained in 2016 ($M = 6.13$). Taking into account that the management of learning strategies is not being adequate, at higher academic levels, the students in the sample may not reach the performance aspirations and cause feelings of disappointment, confusion or frustration since the effort made may not give the results expected (Castejón et al., 2016). In addition, the slight improvement in performance without an improvement in the use of metacognitive strategies may be indicating a decrease in academic motivation. These results are similar to those obtained by other researchers (Rodríguez et al., 2017).

In relation to our second objective, the relationship between the different types of variables studied has been confirmed by the multiple correlations found. The correlation obtained between the strategy Time, Place and Effort management with performance stands out. These results are in line with those obtained in previous research (Suárez & Suárez, 2019).

In relation to the third objective, the statistically significant differences found between the extreme performance groups point to the need to develop students strategically to achieve an optimal result. Furthermore, the size of the effect found has been moderate and large.

Regarding the fourth objective, there is a positive evolution in the learning strategies used by the students in the sample from 2016 to 2019 but not in Elaboration and Critical thinking. On the other hand, with respect to the average performance, there is an improvement in half point of difference between the subsample in benefit of 2019 students. This result, in which students increase their academic performance but not as a consequence of the increase the use of metacognitive strategies, indicates the need to reinforce learning from a strategic point of view and not only from the effort or the time spent (Martín-Lobo et al., 2018).

Numerous researchers show the broad relationship between students' prior knowledge and learning strategies as mediators of subsequent academic performance (Arens et al., 2019). In this sense, the lack of mastery of more complex learning strategies such as Elaboration and Critical thinking can hinder performance in later courses. The profile of the student in this research shows a deficit in complex strategies in 2016 and in 2019. According to Veas et al. (2019) the importance of metacognition during early adolescence is crucial. These authors suggest the participation of parents for the development of models that favour home study. For these reasons, we consider it necessary to promote specific strategic reinforcement programs that include family counselling. The support structure of parents during the student

process can be modified to enhance self-regulation of learning. These guidelines should provide information to parents about the difficulties of the process that allows minors to maintain adequate development of strategies and academic motivation. We must bear in mind that intrinsic motivation for learning is related to parents' belief in the effectiveness of their children, as well as to the nature of the task itself (Inglés et al., 2015; Rodríguez & Guzmán, 2018). With family orientation and training activities, the adaptation between the participation of parents and the regulation of the educational environment that most favours the academic development of students is sought. Most performance improvement interventions focus on one of the following aspects: acquiring self-regulated learning strategies that favour decision-making, changing personal motivational factors in relation to learning expectations and goals, developing positive attitudes towards the learning, learn from the school, teachers and other students, and develop involved family academic support (Pérez-Bóveda & Yániz, 2015). Taking into account the multiple nature of self-regulated learning theory, interventions to improve student performance can enhance some of these factors.

To advance the research on learning strategies in compulsory secondary education, we consider it necessary to include the influence of parental variables, as well as the consideration of motivational variables. Through specific programs to reinforce learning strategies in students and their parents, it is possible to verify the differences in performance between the experimental and control groups. With special attention to students with lower performance.

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