

Influence of Learning Strategies on Performance in 2016 and 2019 on High School Students

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Abstract

Numerous researchers show the multiple benefits of learning strategies to achieve higher performance. The objective of this work is to study learning strategies and their impact on academic performance in students of compulsory secondary education in 2016 and 2019. In 2016, the Motivated Learning Strategies Questionnaire (MSLQ) was administered to 221 students and three years then, in 2019, to 358 students from the same compulsory secondary school. The results show significant differences in the management of effort, time, place and seeking help, as well as in the cognitive strategies of organization, elaboration and critical thinking, with worse results for the lowest level of performance in 2016 and 2019. This indicates the superiority in the academic results of the most strategic students in a conclusive way, since the results are similar on both dates. The profile of the high school student with the best performance responds to the use of cognitive strategies and resource management. 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 school, learning processes, resource management strategies

1. Introduction

Self-regulation of learning is a construct in which a set of cognitive, metacognitive, emotional and social factors participate. Many authors consider it key to obtaining positive academic results, as well as for the adequate motivation and progressive independence of the student. Through personal commitment to the objective or goal, the student manages to maintain and direct their attention and effort during the process (Fernández et al., 2012; Pintrich, 1995). Therefore, in the self-regulation of learning it is necessary to take into account a multiplicity of interconnected factors (Bronfenbrenner, 1979). Winne and Baker (2013) have defined self-regulated learning as a behavioural expression of motivation, metacognitively guided by the student. Well self-regulated students: 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, they 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 and encompass the cognitive, metacognitive, and resource management behaviours, methods, techniques, and tactics that students use to perform a given task. Learning strategies facilitate the 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 the learning of compulsory secondary education students (Cerezo et al., 2019). Cognitive strategies such as repetition, elaboration, organization and use of critical thinking, seek the integration of the new material with previous knowledge since they are used to encode, understand and remember information. With the 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 from the students. The organizational 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 by which the way in which knowledge, opinions and statements are organized is 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, the search for help 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 and students' prior knowledge. Currently, it is considered that in addition to the frequency and prior 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 strategies, one more superficial and the other deeper. The use of strategies with a superficial cognitive approach is carried out in situations where the main objective is the reproduction of learning contents, facts or isolated data sets, as 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 to a greater extent 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 the learning strategies and academic performance of the sample in 2016 and 2019; 2nd) to study the relationship between the different types of variables previously indicated, 3rd) to check if there are significant differences depending on the performance of Secondary Education students, 4th) to analyse the evolution of the sample.

2. Method

2.1 Participants

The sample of this study is made up of 221 (2016) and 358 (2019) students from a public secondary school in Seville (Spain). This centre is located in a peripheral area of the city. The location is characterized by being inserted between military houses, 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 1st level, the number of students in the sample is similar in 2016 and 2019. On the contrary, at 2nd, 3rd and 4th level, the number students in the sample are higher in 2019 than in 2016.

Table 1: Distribution of the sample of students by grade and gender

Course	1° ESO		2° ESO		3° ESO		4° ESO		Total	
	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

The tutors, during normal class hours, have been in charge of distributing and collecting the questionnaires used to students from 1st to 4th grade of Compulsory Secondary Education, following common instructions in all groups. The students have taken around 40 minutes to fill in 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 up to date on the different topics"), elaboration and critical thinking (e.g., "Whenever possible, I try to relate the ideas of some topics with those of others"), seek help (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 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 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 are performed with Spearman's rho test. And the difference of means is 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, so that tercile 1 is the group formed by students with the lowest level of performance, tercile 2 is the performance group intermediate and tercile 3 is the highest performing group. We have used Cohen's d to assess the magnitude of the differences found, considering that an effect $d = .20$ is small, $d = .50$ is moderate, and $d = .80$ is large (Cohen, 1988).

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, Elaboration and critical thinking, Help seeking, Organization and Performance. The results obtained in 2016 and 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 the management of time, place and effort, followed by seeking help, organization and, finally, the elaboration and critical thinking in 2016 and 2019.

Students, in the 2016 sample, obtain an average of 5.64 in academic performance; in 2019 it rises to 6.57, improving by almost one point of difference. Regarding the correlations, they also correlate all strategies positively and significantly with each other. It is worth highlighting the positive, moderate and significant correlation of all the strategic variables, highlighting the correlation with the management of time, place and effort and the search for help (.39 and .48 in respect of 2016 and 2019). In the same way they do it with the performance, highlighting the correlations with the time, place and effort management strategy (.46 and .45 in respect of 2016 and 2019).

Table 2: Descriptive and correlational statistics

Variable	(1) Time, place and effort management		(2) Elaboration and critical thinking		(3) Search for help		(4) Organization		(5) Performance	
	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	5.64	6.57
SD	1.08	1.28	1.05	1.14	1.25	1.31	1.42	1.60	2.07	1.52
(1)	1	1								
(2)	.32**	.40**	1	1						
(3)	.39**	.48**	.32**	.24**	1	1				
(4)	.38**	.36**	.39**	.30**	.32**	.34**	1	1		
(5)	.46**	.45**	.18**	.20**	.34**	.21**	.13	.12*	1	1

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 significant differences in the 4 strategies analysed: Time, place and effort management; Elaboration and critical thinking; seek help and organization that 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 2019 except in Elaboration and critical thinking, which only obtains significant data 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	44.408	77.666	.000	.000	T1<T2	1725.500	2333.000	.018	.000	.37	.53
					T1<T3	971.500	1015.500	.000	.000	1.23	1.56
					T2<T3	1328.500	5728.500	.000	.000	.76	.83
V2	5.525	18.058	.063	.000	T1<T2		3341.000				
					T1<T3		2478.000		.002		.51
					T2<T3		7194.500		.000		.47
V3	18.331	16.263	.000	.000	T1<T2	1712.000	3412.000	.018		.35	
					T1<T3	1529.500	2609.500	.000	.001	.76	.57
					T2<T3	1856.000	8244.000	.038	.001	.39	.41
V4	6.487	7.849	.039	.020	T1<T3	2063.500	297.500	.014	.006	.44	.40

V1= Time, place and effort management; V2= Elaboration and critical thinking; V3= Search for help; V4= Organization.

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 the management of time, place and effort, and the least used was that of elaboration and critical thinking in 2016 and 2019. The elaboration and critical thinking of Information is considered a more complex strategy that acquires a deeper knowledge. Therefore, the sample shows a level in the use of mainly superficial learning strategies (Deekens et al., 2018; Fiorella & Mayer, 2016). Students who use the strategy of time, place and effort more, as in the case of our sample, may need reinforcement in the planning and evaluation of the process, 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 one point higher than that obtained in 2016 ($M = 5.64$). 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). Furthermore, improvement in performance without an improvement in the use of learning 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 of time, place and effort 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 no evolution in the learning strategies used by the students in the sample from 2016 to 2019. On the other hand, with respect to the average performance, there is an improvement in one point of difference. This result, in which students increase their academic performance but not as a consequence of the increase in the use of learning strategies, indicates the need to reinforce learning from a strategic point of view and not only from the performance obtained (Martín-Lobo et al., 2018). In addition, statistically significant differences are found with respect to the learning strategies used when comparing the groups of performance levels to the detriment of the lowest level.

Numerous researchers show the broad relationship between students' prior knowledge, 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 since the results are similar in 2016 and 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 the 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 involve family academic support (Pérez-Bóveda and Yániz, 2015). Although taking into account the multiple nature of self-regulated learning theory, in interventions to improve student performance we must take into account all these factors.

To advance in 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. It necessary to carry out an intervention with a specific program to reinforce learning strategies in students and their parents and to check if there are differences in performance between the experimental and control groups. With special attention to the students with the lowest performance.

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