


Cognitive and Self-regulation Strategies, Academic Engagement and Academic Achievement in Higher Education Students. The Mediating Role of Reading Comprehension

Estrategias cognitivas y de autorregulación, engagement académico y rendimiento académico en estudiantes del nivel superior. El rol mediador de la comprensión lectora


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Summary

This study was aimed at analyzing the relationship between cognitive and self-regulation strategies, academic engagement, and academic achievement (AA) of higher education students by analyzing the mediating role of reading comprehension. Different works to assess the constructs were applied to 209 students ($M_{age} = 21.71$; $SD = 4.36$). The GPA obtained by students was used to measure academic achievement. Significant associations were found between cognitive and self-regulation strategies, academic engagement, reading comprehension, and academic achievement of students. In addition, a correlation between cognitive and self-regulation strategies and student academic engagement was found. Finally, Structural equation analysis (SEM) showed that cognitive and self-regulatory strategies and academic engagement have direct effects on Academic Achievement. In addition, an indirect effect of cognitive and self-regulatory strategies on AA was observed through reading comprehension. The study implications are discussed in terms of the importance of promoting the recognition and implementation of cognitive and metacognitive strategies and student engagement to improve their academic achievement in higher education.

Keywords: Cognitive strategies, Self-regulation, Academic engagement, Reading comprehension, Academic achievement.

Resumen

El objetivo del presente estudio fue examinar la relación entre las estrategias cognitivas y de autorregulación, el engagement académico y el rendimiento académico (RA) en estudiantes del nivel superior, analizando el rol mediador de la comprensión lectora. Se administraron diferentes tareas para evaluar los constructos a 209 estudiantes ($M_{edad} = 21.71$; $DE = 4.36$). Para valorar el rendimiento académico se empleó el promedio académico de los estudiantes. Se hallaron asociaciones significativas entre las estrategias cognitivas y de autorregulación, el engagement académico, la comprensión lectora y el rendimiento académico de los estudiantes. Además, se observó una correlación entre las estrategias cognitivas y de autorregulación y el engagement académico del estudiante. Finalmente, el análisis de ecuaciones estructurales (SEM) mostró que las estrategias cognitivas y de autorregulación y el engagement académico tienen efectos directos en el RA. Además, se observó un efecto indirecto de las estrategias cognitivas y de autorregulación en el RA a través de la comprensión lectora. Se discuten las implicaciones del estudio en función de la relevancia de promover el reconocimiento e implementación de las propias estrategias cognitivas y metacognitivas y el engagement del estudiante, para favorecer su desempeño académico en el nivel superior.

Palabras claves: Estrategias cognitivas; Autorregulación; Engagement académico; Comprensión del texto; Rendimiento académico.

INTRODUCTION

In recent years, due to constant social changes, several challenges for higher education have arisen linked to the technological revolution and its impact on student information processing styles and epistemic modes (Castañeda et al., 2016). Recently, among the educational challenges demanded by the current pandemic, the implementation of various distance education modalities (e.g., e-learning and blended learning or hybrid modality) was highlighted, demanding greater autonomy and self-regulation by the student. Therefore, one of the main objectives of university education should be to promote learning to learn (Nejabati, 2015; Wingate, 2007) and train autonomous and active individuals characterized by possessing problem-solving and emotional regulation skills to adapt flexibly and creatively to new situations (Castañeda et al., 2016) to favor their success and continuation within the educational system.

Self-regulation is broadly defined as goal-directed behavior, usually within a minimal time perspective (Hofmann et al., 2012). According to Zimmerman (2000), self-regulation is activating and controlling thoughts, behaviors, and emotions to achieve personal goals. In addition to being a fundamental construct for health and adaptive development (McClelland & Cameron, 2011; Morrison et al., 2010), its central role in children's academic achievement (Becker et al., 2014; McClelland & Cameron, 2011; Morrison et al., 2010), adolescents (Gaxiola et al., 2013) and university students (Alegre, 2014; Elvira-Valdés & Pujol, 2012) has been demonstrated. Students with high self-regulation skills use a wide range of skills effectively that include effectively setting goals, implementing learning strategies, monitoring and evaluating the progress of the pursued goals, asking for help when needed, applying effort and persistence to learn, and setting new goals when the previous ones are achieved (Zimmerman & Schunk, 2008). While these metacognitive strategies are the deliberate or unconscious actions students use to plan, monitor and regulate their achievement, cognitive strategies are the actions that help the student to complete academic work (Botsas & Padelidu, 2003) as they encode, store, and retrieve information (Valle et al., 2009). Both cognitive and metacognitive strategies are related to academic achievement (Ernst et al., 2022; Valle et al., 2009) and text comprehension (McKeachie et al., 1986). In summary, employing self-regulated learning strategies, students can assume responsibility for their current learning and become lifelong learners (Weinstein et al., 2011). Therefore, studying this variable in relation to academic success has motivated a significant body of research in recent years.

Another main variable for learning and academic success that has received increasing interest in recent years is academic engagement, defined as a student's active participation and engagement or involvement in academic work and activities (Alrashidi et al., 2016; Lei et al., 2018). It is considered a multidimensional construct that includes three dimensions: cognitive engagement, emotional engagement, and behavioral engagement (Boekaerts, 2016; Fredricks et al., 2004), which are selectively related to academic achievement (Lei et al., 2018). Indeed, several studies conducted in different countries with students at different educational levels (e.g., Estévez et al., 2021; Gunuc, 2014) have demonstrated its main role in academic achievement with differences according to culture and gender (Lei et al., 2018). Therefore, it is considered a key construct to promote student learning, interest, and academic achievement (Medrano et al., 2015). Considering the overlap between cognitive engagement and the self-regulated learning construct (i.e., SRL), recent integrative models emphasize the importance of their joint study to reach a holistic understanding of the learning process and how to improve it (Li & Lajoie, 2021).

Finally, reading skills, such as text comprehension, have also been shown to be a significant predictor of academic achievement, both in primary (Bastug, 2014) and high school students (Pinto et al., 2016; Peralbo et al., 2009), as well as in higher level students (Difabio, 2008; Oliveira & Dos Santos, 2006). Reading comprehension is considered a complex cognitive work that highly demands self-regulation and executive processes such as working memory, inhibition (Arán-Filippetti & López, 2016), and cognitive flexibility (Arán-Filippetti & Krumm, 2020). Although it is strongly related to higher-order cognitive processes, it has been shown to contribute independently to academic achievement (García-Madruga et al., 2014). For this reason, it is one of the most relevant psychological tools for the teaching-learning process (Gutiérrez-Braojos & Salmerón, 2012) as it represents a means for the construction of meaning and acquisition of new knowledge (Moje et al., 2011; Pretorius, 2002) in academic domains such as mathematics and language (García-Madruga et al., 2014).

The Study

Although previous studies have examined the role of cognitive and self-regulation strategies, academic engagement, and reading comprehension in academic achievement of university students, to our knowledge, no research has analyzed the combined effect of the constructs on academic achievement considering the mediating role of reading comprehension. This analysis is relevant considering, on the one hand, that cognitive and self-regulation strategies are related to reading comprehension (Arias-Gundín et al., 2012; Gutiérrez-Braojos & Salmerón, 2012; Nejabati, 2015) and, on the other hand, that both self-regulation and reading skills have direct effects on academic achievement. Moreover, due to the overlap between the self-regulation, cognitive strategies, and engagement constructs (Li & Lajoie, 2021), it is of great relevance to examine their combined effect in analyzing the factors that influence academic achievement. However, to date, no research has examined the combined effect of self-regulation and engagement on academic achievement of university students by analyzing the role of mediating variables. Based on the above, this study is aimed at examining the relationship between these variables to delve into the determinant mechanisms of academic achievement of university students, and the mediating role of reading comprehension in the relationship between self-regulation, academic engagement, and academic achievement of students. It is hypothesized that cognitive and self-regulation strategies, academic engagement, and reading comprehension are related to academic achievement of university students. In addition, it is hypothesized that cognitive and self-regulation strategies have direct effects on academic achievement and indirect effects through reading comprehension. The study hypotheses were tested using structural equation techniques (SEM).

METHOD

Type of Study

This is a descriptive, correlational, cross-sectional, and empirical study (Hernández-Sampieri & Mendoza, 2020).

Participants

This study used a sample of 209 students aged between 18 and 30 ($M = 21.71$; $SD = 4.36$) of both sexes (71.3% female) from various higher education programs (i.e., psychology, law, dentistry, engineering, nursing, accounting) residing in the provinces of Entre Ríos and Misiones, Argentina. To estimate the sample size, the structural equation modeling (SEM) criteria (Ventura-León et al., 2020) employed in previous studies (e.g., Chavez & Vallejos-Flores, 2021) were used, entering the values in Soper's (2020) sample size calculator. Based on a probability of 0.05, an anticipated effect size of 0.30, and statistical power of 0.95, the minimum recommended sample size was 184 cases. The inclusion criterion was that the students had not been diagnosed with psychiatric or neurological disorders. The educational level of their mothers and fathers was categorized on a scale of 1 to 5 as follows: 1 = Primary, 2 = High school, 3 = Education higher than high school but lower than university, 4 = University, 5 = Graduate. Regarding the educational level of their mothers, 28.4% reported primary education, 24.5% high school, 10.6% tertiary education, 29.8% university education, and 6.7% graduate education. Regarding the educational level of their fathers, 31.3% reported primary education, 29.8% high school, 12.5% tertiary education, 19.2% university education, and 7.2% graduate education. Thirty-four percent of the participants reported working and studying concurrently, and 66% reported studying only. Regarding extracurricular activities, 42.1% reported doing one to three activities while 13.4% reported doing more than three activities.

Instruments

Study and Self-Regulation Strategies Inventory (Castañeda et al., 2016).

It consists of 52 items to assess *cognitive strategies* by the following subscales: a) information acquisition styles, b) information retrieval styles, and c) information processing styles, and self-regulation strategies by three dimensions: a) of the student (i.e., efficacy, internal contingency, perceived autonomy, and orientation to external approval), b) of the learning work (i.e., work orientation and goal orientation), and c) of the materials (i.e., evaluation and regulation). Reliability for the different subscales is adequate, with alpha coefficient values ranging from .82 to .87. In the study sample, the alpha coefficient of the total scale was .93.

Utrecht Work Engagement Scale (UWES-S) (Schaufeli et al., 2002).

The student version of the UWES scale was used (Schaufeli et al., 2002). It consists of 17 items to assess three dimensions: Vigor, Dedication, and Absorption, and are answered on a Likert-type scale ranging from 0 to 6. In Argentina, this instrument was validated in its 17-item version reporting appropriate psychometric properties with alpha values between .74 and .89 (Mesurado et al., 2016). In the study sample, the internal consistency of the total scale was adequate ($\alpha = .89$).

Text Comprehension Test (Castañeda et al., 2016).

It includes a text entitled "The two kings and the two labyrinths" by Borges (1946) and a comprehension test to evaluate two contexts of retrieval of what is understood: recognition and recall. The items of this test represent three dimensions: a) temporal-causal relations; b) inductive, deductive, and analogical reasoning strategies; and c) integration of knowledge schemes.

Reliability by coefficient alpha is .78 (Castañeda et al., 2016). In the study sample, the alpha coefficient was .83.

Academic Achievement.

The total grade average for the degree program extracted from the academic system of each educational institution in a range of 0 to 10 was used. In this data range, a grade of 6 or higher is considered a passing grade, with 10 being the highest grade.

Procedure

The directors of the institutions were contacted to request authorization to conduct the study. Once the directors authorized it, the informed consent form was given to the students, and the participants who signed it were evaluated. The consent form clarified that the student participation was voluntary and that any information that could identify the participant would be handled confidentially. This project does not violate any ethical, legal, or judicial provisions outlined in national and international bioethical regulations. The study was conducted under strict ethical criteria that ensured respect for the participants' values, rights, safety, and integrity.

Data Analysis

Pearson's r correlation was used to analyze the relationship between the variables using Windows version 20.0 of the SPSS statistical package. Structural equation techniques (SEM) were used to test an integrative model, employing the *AMOS Graphics 16.0* program (Arbuckle, 2007). The level of goodness of fit of the models was assessed using the χ^2 test and the following indices: *GFI* (*Goodness of Fit Index*) and *CFI* (*Comparative Fit Index*). The CFI and GFI values can range from 0 to 1, with values above .90 indicating an acceptable fit (Hu & Bentler, 1995, 1999). In addition, the adjusted Root Mean Error (RMSEA) index was calculated to determine the degree of error of the models. This index is acceptable when its values are less than .08.

RESULTS

Descriptive Statistics

Table 1 shows the descriptive statistics of the variables analyzed.

Relationship between the strategies used, engagement, reading comprehension, and academic achievement

A significant correlation between cognitive study strategies, self-regulation strategies, and academic achievement of students was observed. Specifically, the higher the scores for cognitive acquisition and retrieval strategies and self-regulation related aspects (person, work, materials), the higher the student grade average ($r = .27$ to $r = .45$). The relationship between academic engagement and self-regulation strategies ($r = .28$ to $r = .43$) and between academic engagement and cognitive strategies ($r = .28$ to $r = .38$) was also significant. Finally, correlations between

academic engagement and academic achievement ($r = .19$ to $r = .30$) and between reading comprehension and student grade average ($r = .21$ to $r = .35$) were found (see Table 2).

Table 1.
Descriptive statistics of the study variables

	M (DE)	Asymmetry	Internal consistency
Cognitive and self-regulation strategies			.93
Acquisition	23.72 (3.29)	-0.38	
Retrieval	23.98 (3.09)	0.12	
Processing	21.79 (3.03)	0.04	
Materials	12.17 (1.86)	-0.18	
Person	44.49 (6.48)	-0.89	
Work	22.76 (3.28)	-0.31	
Reading comprehension			.83
Temporal-causal (TC) relations	4.15 (1.60)	-0.06	
Reasoning strategies	4.38 (1.41)	-0.76	
Integration of schemes	3.64 (1.41)	-0.49	
Engagement			.89
Vigor	20.14 (5.81)	-0.08	
Dedication	24.21 (4.59)	-1.25	
Absorption	20.50 (5.91)	-0.24	
Academic achievement	7.97 (0.93)	-0.23	

Source. Elaborated by the author.

Table 2.
Relationship between the study constructs and academic achievement.

	1	2	3	4	5	6	7	8	9	10	11	12	13	
COGNITIVE STRATEGIES	1. Acquisition	-												
	2. Retrieval	.66**	-											
	3. Processing	.62**	.55**	-										
	4. Materials	.59**	.53**	.56**	-									
SELF-REGULATION	5. Person	.59**	.59**	.50**	.55**	-								
	6. Work	.68**	.60**	.63**	.65**	.66**	-							
READING COMPREHENSION	7. TC relations	.29**	.18*	.09	.08	.19**	.13	-						
	8. Reasoning	.25**	.09	.07	.04	.14*	.10	.67**	-					
	9. Integration of schemes	.30**	.19**	.14*	.11	.22**	.18*	.61**	.59**	-				
ENGAGEMENT	10. Vigor	.38**	.37**	.30**	.41**	.43**	.40**	.08	.09	.09	-			
	11. Dedication	.28**	.32**	.33**	.28**	.31**	.30**	.11	.01	.07	.50**	-		
	12. Absorption	.31**	.35**	.28**	.36**	.35**	.37**	.01	.04	.10	.73**	.49**	-	
ACHIEVEMENT (AA)	13. Average	.31**	.31**	.13	.27**	.45**	.29**	.31**	.21**	.35**	.30**	.19**	.25**	1

Source. Elaborated by the author.

Structural Equation Modeling (SEM)

An integrative model was tested to examine the direct effects of self-regulation and cognitive strategies (CS), engagement, and reading comprehension (RC) on academic achievement, also considering the indirect effects of cognitive and self-regulation strategies and engagement on AA through RC. Likewise, the direct effects of the parents' educational level and the students' age on AA were also included. The model showed an adequate fit to the empirical data ($\chi^2 = 149.391$, $gl = 85$) as the fit indices found were above .90 (GFI = .92; CFI = .95) and RMSEA of .060. The results indicate that self-regulation and cognitive strategies (.20), engagement (.19), and RC (.30) have direct effects on academic achievement. In addition, the strategies employed have indirect effects on academic achievement through RC. It is also observed that the strategies employed are related to academic engagement ($r = .56$). The age (.02) and educational level (-.01) of the parents were not significant predictors of AA (see Figure 1).

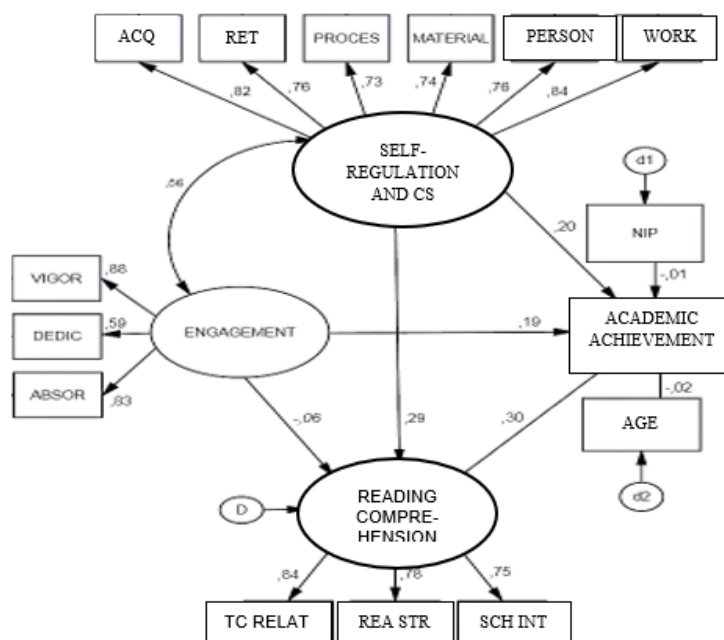


Figure 1.

Structural equation modeling of predictors of academic achievement.

Source. Elaborated by the author.

DISCUSSION

For optimal academic achievement in higher education, students must implement cognitive and self-regulation strategies and engage in their learning process autonomously and effectively. For this reason, constructs such as self-regulation and engagement have been placed the focus of attention to understand the factors that influence academic success and student retention in higher education. The aim of this study was twofold; on the one hand, to analyze the relationship between cognitive and self-regulation strategies, academic engagement, reading comprehension, and

academic achievement in university students and, on the other hand, to examine the mediating role of reading comprehension in the relationship between the constructs under analysis.

First, significant relationships between cognitive and self-regulation strategies and academic achievement of students were found. These results are consistent with preceding evidence that has shown that cognitive and self-regulatory strategies are related to student academic achievement (Alegre, 2014; Kohler, 2013; Martín et al., 2008) and that self-regulation strategies would be more determinant for academic achievement than cognitive strategies (Valle et al., 2009). Thus, students who monitor and regulate their learning process and effectively employ cognitive strategies would obtain the best academic results. Indeed, previous studies that examined the relationship between cognitive and metacognitive strategies and AA reported greater use of particular *cognitive* and *metacognitive strategies* in students with good AA (see Ernst et al., 2022). Likewise, consistent with what was reported in previous studies (Arias-Gundín et al., 2012; Gutiérrez-Braojos & Salmerón, 2012; Nejabati, 2015), we found that cognitive and self-regulation strategies are related to reading comprehension. Thus, knowledge of which cognitive strategies to employ and the efficient and adaptive use of metacognitive strategies (Arias-Gundín et al., 2012; Botsas & Padeliadu, 2003) would be essential to overall academic achievement and good reading performance, in particular. In contrast to students with reading difficulties, it was indicated that good comprehenders participate more actively in reading work and possess a greater repertoire of cognitive and metacognitive strategies to control, regulate and monitor their comprehension process (Botsas & Padeliadu, 2003).

Academic engagement was also positively related to student academic achievement. Using the UWES-S and UWES-S 9, recent studies have also shown that academic engagement is related to high school (Serrano et al., 2019) and university (Casuso-Holgado et al., 2013; Gómez et al., 2015) academic achievement of students, and, in line with our results, the vigor dimension is the most related (Casuso-Holgado et al., 2013). Both studies examining the role of engagement in academic achievement, considering engagement in its multidimensional character, i.e., behavioral, cognitive, and emotional (Gunuc, 2014; Lei et al., 2018), and through a composite measure (Northey et al., 2018), have demonstrated the positive relationship between the variables. Finn's (1989) participation-identification model of student engagement would explain this phenomenon (see Lei et al., 2018). According to this model, continued student engagement is related to better academic achievement, which in turn leads to greater recognition of the importance of school, generating positive feedback, i.e., students are motivated to dedicate themselves to study, improving their level of academic achievement and starts the cycle anew (Finn, 1989). This emphasizes the importance of deepening research on methods and strategies to apply to increase student engagement (Gunuc, 2014; Heng, 2014), such as here and now learning (Northey et al., 2018) or through university-based tutoring programs, such as the CURO program (e.g., Fechheimer et al., 2011).

Regarding the relationship between reading comprehension and academic achievement, our findings are consistent with those from previous studies that noted a positive relationship between the variables in students from various university degree programs and different countries (e.g., Difabio, 2008; Oliveira & Dos Santos, 2006). Considering that learning requires text reading and their comprehension, it is to be expected that high academic achievement demands efficient reading and reading-based meaning construction (Bastug, 2014). Therefore, teaching strategies to

improve student reading comprehension is essential to increase the chances of achieving academic success (Bharuthram, 2012).

Finally, when examining the relationship between the constructs using structural equation techniques (SEM), it was found that cognitive and self-regulation strategies, academic engagement, and reading comprehension predict student academic achievement and that reading comprehension mediates the relationship between the strategies used and academic achievement, but not between engagement and their achievement. Thus, using cognitive and metacognitive strategies would facilitate the reading comprehension process (Gutiérrez-Braojos & Salmerón, 2012), and both the efficient use of strategies and the level of reading comprehension would influence student academic achievement. Likewise, academic engagement would also be a fundamental predictor of student academic achievement, assessed by their grade average, but not of their reading proficiency, assessed by performance-based work. Furthermore, it is essential to highlight the highly significant relationship found between cognitive and self-regulation strategies and academic engagement. This would be consistent with theoretical proposals that postulate an overlap between the constructs (see Li & Lajoie, 2021, for an integrative model), emphasizing the importance of their combined study of the analysis of factors influencing academic achievement.

In summary, this study's findings indicate that cognitive and self-regulation strategies influence both student reading comprehension and their academic achievement, and the latter, in turn, is influenced by academic engagement. Thus, academic achievement at higher education would be conditioned by the efficient use of cognitive and self-regulation strategies, student engagement, and their reading comprehension level. Before discussing the study's implications, it is necessary to mention some limitations. First, the sample was purposive and was limited to Argentine higher education students. Therefore, the results cannot be generalized to students from other countries or cultural contexts. In addition, it is necessary to point out that this study is cross-sectional. For this reason, it was not possible to examine the trajectory of cognitive and self-regulation strategies, academic engagement, reading comprehension, and their effects on AA over time. Future research would benefit from deepening the findings obtained through a longitudinal study and addressing the analysis of the relationship between the constructs considering the context and other personal and environmental variables as predictors of academic achievement.

The results of this study have important educational implications on the design and implementation of strategies aimed at facilitating the teaching-learning process and favoring the transition from high school to university and student retention in higher education, especially considering that a significant number of students who complete high school are not sufficiently prepared to benefit from their studies (Weinstein et al., 2011). First, this study's findings regarding the central role of cognitive and self-regulation strategies in reading comprehension and academic achievement highlight the importance of promoting the effective use of these strategies to foster student success and continuity in higher education. Indeed, it was indicated that explicit instruction in the effective use of metacognitive strategies is of great relevance to improving reading skills in students with reading difficulties (Arias-Gundín et al., 2012). Second, taking into account that academic engagement was also related to student AA and that it was indicated that students with a high level of academic engagement are more likely to graduate (Svanum & Bigatti, 2009) while their less engaged peers would drop out of university earlier (Hughes & Pace, 2003),

it is of great relevance to developing programs to promote and favor student engagement, both in academic and extracurricular activities, especially in academically disadvantaged students (Heng, 2014).

In summary, this study's results indicate that engaged students who self-regulate their study by using cognitive strategies achieve better academically, facilitated, in part, by better reading comprehension. These results are relevant for identifying factors that influence academic achievement and designing strategies to favor student achievement in higher education. Future studies will benefit from going deeper into this topic to identify the factors (academic, personal, or social) that impact academic achievement as a complex multidimensional phenomenon to potentiate and promote mechanisms to improve the teaching-learning process and student retention in higher education.

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