



Effect of Cognitive Learning Strategy on Academic Stress of the University Students in COVID-19 Context

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ABSTRACT

Aims The conscious regulation of learning enables students to cope with academic, social and technological demands in times of COVID-19 pandemic in a positive or negative way. The aim was to explain the influence of cognitive learning strategy on academic stress in university students.

Instrument & Methods This quantitative research with basic type a hypothetico-deductive method was performed. The sample of two hundred students (one student calculated through probability sampling) who were administered instruments with content and construct validity, as well as reliability by Cronbach's Alpha of 0.99 for learning strategies and academic stress.

Findings The predominant cognitive strategy was information coding, considered risky because it produces high levels of stress, as well as idiosyncratic underlining, reviewing aloud and repeated review; while applications, metaphors, groupings and concept maps were considered protective, because they do not generate academic stress. Likewise, social interactions had a significant influence on the information processing support strategy.

Conclusion The information coding, epigraphy, applications, searching for encodings, and social interactions strategies have the highest effect on cognitive learning, information acquisition indicators, information coding, information retrieval, and processing support, respectively.

Keywords Covid-19; social interactions; Cognitive strategies; Academic stress

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Introduction

Due to the COVID-19 pandemic, a variety of situations have arisen in the teaching-learning of higher education, as both teachers and students face a new reality. After the health hazard, an opportunity for remote work is born that allows continuing with the work, this requires the inevitable presence of pedagogical aspects that make use of digital resources and tools [1]; problematic situations are identified in teachers without academic or pedagogical training in digital skills with ignorance of teaching methodologies that involve digital skills and abilities [2]. This causes empiricism, repetition of mistakes and loss of valuable information. On the other hand, students cannot initiate a process of discovery, acquisition of a specialized language and a method of work becoming frustrated; because of this, many are forced to drop out of their career [3]. There is no clarity in the evaluation criteria, it is based on subjectivities, there is little student participation and the virtual evaluation instruments do not allow evaluation in a fair and reliable way. It is known that many students enter university with deficiencies and in many cases, university education does not consolidate their professional competencies in the current educational context.

While it is true that the development of academic competencies does not only depend on the teacher, it is important to highlight that the student has the responsibility to exercise their autonomy in learning for the consolidation of their professional competencies [2-4]. The study also leads to knowing whether or not students are prepared to organize and manage their learning, if not they will be overcome by the academic, social and individual demands that the current context drives them to meet. The activities in which students consciously regulate their learning are called learning strategies, defined as voluntary and intentional procedures that, in order to meet an established objective, are valuable, complementary and make the acquisition of knowledge possible [5, 6]. The efficient use of learning strategies will depend on how the student faces the academic, social and technological demands in these times of pandemic by COVID-19. Universities were not prepared to face non-face-to-face education; however, the adaptation of remote classes emerged in a mandatory way, students with or without technological resources had to continue with the tasks entrusted by teachers, generating in students mental health diseases such as anxiety, fatigue, exhaustion in a higher percentage, academic stress by virtual classes; as a result, some students withdrew from the course and others decided for university desertion [7, 8].

Mental health was affected during quarantine and

social isolation, this was due to many stressors that raised levels of anxiety and depression [9]; in the academic context, there are conditions that saturate students known as academic stressors causing lack of control and consequent academic failure [10]. Identifying stressors in a timely manner allows improving well-being and academic training [11]. Academic stress is found when the student lacks study habits and does not implement methods to cope with those situations that he/she considers as threatening [4]. We must consider the social, economic, family, cultural and institutional conditioning factors that generate stress and that presents physical, behavioral and psychological manifestations, among which we can highlight the lack of concentration, lack of self-confidence and distractibility [12]. There are three groups of academic stressors that affect university students: the first are those linked to assessment processes; the second to those related to the excess of tasks or work and the third to other factors of the teaching-learning process [13]. The mental well-being of students is affected in these times of virtual teaching as a result of the lack of physical support among peers, scarcity of academic resources within reach, isolation, anxiety associated with the pandemic, [14]. E-learning has shortcomings and, despite these, it is accepted by students who believe that it should continue; it is an important change that must be maintained and progressively improved [15]. The changes make think about the future digitalization of universities and they are working on comprehensive plans that define this new educational model aimed at people empowered with technology [16]. The importance is that students must know and use learning strategies that allow them to perform their activities efficiently and effectively, which will reduce stress levels.

Theories of learning strategies and academic stress

The processes that allow the individual to access knowledge and develop teaching-learning strategies are explained by learning theories; we have cognitivism that emerged in the seventies, which considers that learning is acquired through the promotion of mental processing to assimilate knowledge, its basic principles are based on prioritizing that the student is actively involved in the learning process, in structuring, organizing and sequencing information for processing and creating environments that allow you to relate it to what was previously learned [17]. We can add that cognitive theory point out, primarily, that learning should be meaningful and that students should be instructed in structuring and linking recent information with previous knowledge nested in memory [18]. Finally, on information processing, we can mention Orbegoso [19] who points out that this theory focuses

on how people pay attention to what happens in their context, encodes the information they need to assimilate and relates it to the knowledge they retain, accumulates recent information in their memory and replenishes it when needed.

In relation to academic stress, the interaction-based theory is mentioned, whose exponent Richard Lazarus highlights the importance of cognitive factors found between stressful stimuli and stress responses, giving the subject an active role in the onset of stress, originating in their relationships with their threatening and complicated context to face [20], the level of stress is determined by an individual appreciation of the stressor, social and cultural means available to them [21]. Lazarus and Folkman, in their transactional model of stress, point out that, in situations of great stress, there is a cognitive evaluation of what happens, which determines both the emotions and the strategies that will be used to manage the stressful situation, this leads to a more or less adaptive process, which can damage to a greater or lesser extent their state of physical and psychological health [22]; from this model, the cognitivist systemic model of academic stress arises with components of physiological, cognitive, environmental and emotional stress as processes that occur to assess stressful stimuli of the environment to systemically balance the person-environment relationship [20].

Learning strategies are defined as a student's decision-making process to select and coordinate rescue all the knowledge he or she needs to achieve a goal or request [23]. Sanchez *et al.* [24] add that they are all kinds of thoughts, behaviors, actions, beliefs and emotions that contribute to the acquisition and retrieval of information in their interaction with previous knowledge; definitions agree that the student performs in an intentional and controlled way on procedural activities to facilitate their learning [25]; finally, we can say that learning strategies are a complex construction of cognitive, metacognitive, motivational and behavioral elements. On the other hand, academic stress is defined as a negative response that causes an imbalance in people who suffer it, due to the distinctions between pressure and the ability to withstand it [26]; similarly, Pozos consider that it is a physiological reaction, in which different defense mechanisms are found to withstand a situation that is considered as intimidating or very demanding; academic stress is an emotional situation and physical pressure associated with the demands of the academic environment [27]; it is suffered by students of all educational levels from the initial level to the university level, originated by stressors linked to academic activities, because of internal or external demands that impact on their academic

performance [11]. This type of stress develops in three moments: first, when the student presents stress due to many academic demands; second, there is an imbalance in their physical, cognitive and psychosocial health caused by stressors and, third, the attempt to restore the systemic balance by the subject to adapt [25].

The cognitive processes of information processing with which the brain works are those of acquisition, encoding and retrieval, these require the collaboration of metacognitive, affective and social processes called support strategies. It is determined that cognitive learning strategies are mental tasks that are activated with the purpose of allowing the acquisition, storage and/or use of information [29, 30]. Two strategies are found in the process of information acquisition, those that favor attention and those that optimize repetition. It is essential to focus on attentional strategies because they are the ones that choose, change and transmit the information from the environment registering it to the senses, in this group, we find scanning, linear underlining, idiosyncratic underlining and epigraphy; the next step are the repetition strategies that interact with the previous strategies and transfer the information registered by the senses to short-term memory (STM) here we find the review aloud, mental review and repeated review [30]. The encoding of information is a process that is responsible for passing the information from the MCP to the MLP, whose strategies are those of nemotecnización (external encoding of information through nemotecnias), those of elaboration that is based on the intramaterial association to learn, here are the intra-content relationships, shared relationships, images, metaphors, applications, self-question and paraphrases and finally those of organization that makes the previous knowledge more meaningful and manageable, here we find the groupings, sequences, concept maps and diagrams. Information retrieval is made up of strategies that retrieve the knowledge stored in the MLP, these are the search strategies, here are the search for codifications and clues. There are also those of response generation, we have the planning of answers and written response.

Finally, the processing support process that helps and enhances the previous processes and increases their performance through motivation, self-esteem, etc. This process is divided into metacognitive strategies, these strategies allow the student to learn from start to finish and achieve their goals, manage what is being acquired and can change it if it is not adequate; thus, there is self-knowledge, self-management planning, self-management regulation/evaluation; and socio-affective strategies, divided into affective related to how the mood can

affect learning as social interactions that assess how to avoid conflicts, help, etc.. and motivational strategies that serve to stimulate, regulate and maintain study habits, which are intrinsic/extrinsic motivation and escape motivation [29].

Academic life has events that generate stress in university students and focuses on three groups of stressors: 1) those linked to the evaluation processes, 2) those related to the excess of tasks or jobs and 3) other factors of the teaching-learning process [13]. The evaluation process considered as the first group of stressors is systematic, thorough and information assessment, applied in education, gives a value judgment on its what has been achieved, with the aim of continuously improving learning [31]; here we find the exam that impacts the student by the realization and preparation for it, by the dates or even when talking about them, also their academic performance; that is, the perception of control they have over their performance and self-efficacy; and finally, we have the interventions in public that cause impacts when standing in front of the blackboard, expressing themselves aloud or exposing a topic in front of their peers; Overwork, as a second group of stressors such as academic overload, the student's perception of the time they have to overcome the academic requirements and the lack of value of the contents with little interest, and the benefits in the future that may have in their studies [13]; finally, the conditions of the teaching-learning process as the third group of stressors are the space where the main actor is the student and the teacher becomes the facilitator of the learning processes [32], there are the methodological deficiencies of the teacher, the negative social climate as the unfavorable social environment in the academic context, the lack of support and the degree of competitiveness among students; finally, we find the difficulties of participation that refer to the lack of active participation in their student life [13].

Instrument and Methods

It was developed positivist paradigm guidelines by hypothesis testing [33], problem approach having the role of the researcher and object of study [34]; the approach was quantitatively based on numerical measurements, data collection process, the use of standardized instruments and control of variables, research context [35]. It was the .basic type, causal correlational design because we are going to explore, discover and explain the prevalence and relationships [9, 36]. The sample was 201 university students calculated through probability sampling [37] to whom the ACRA strategies scale [30] and ECEA academic stress questionnaire [13] were administered; both instruments were standardized with content, construct and reliability validity with values 0.990 for both.

Findings

76% of the university students that receive remote classes in time of pandemic did not use nor put in practice the strategies of codification of information that consist of the use of images, metaphors, applications, paraphrases, conceptual maps, diagrams (19% under and 57% moderate); therefore, strategies oriented to the formation by competencies were not being used and only 24% used it.

72% of students did not use the strategies of information retrieval to achieve their learning (16% under and 56% moderate), and students did not know the strategies such as searching for coding, searching for clues, response planning; only 27% practiced such learning strategies.

About 80% of the university students who received remote or non-face-to-face classes during the pandemic presented a high (47%) and moderate (33%) level of academic stress, caused by the evaluation processes, work overload and the conditions of the teaching-learning process that are present in the different higher institutions.

The information coding strategy had the highest influence on cognitive learning strategies associated with academic stress (Table 1).

Table 1) Logistic regression coefficients of cognitive learning strategies associated with academic stress in university students in times of pandemic

Dimensions	B	Standard error	Sig.	Exp (B)	95% C.I.	
					Lower	Top
Information acquisition strategies	-2.329	0.825	0.005	0.097	0.019	0.49
Information coding strategies	5.155	1.06	0.001	173.298	21.7	1383.956
Information retrieval strategies	-2.625	0.763	0.001	0.072	0.016	0.323
Processing support strategies	-0.14	0.661	0.832	0.869	0.238	3.177

The strategy of epigraphy was the highest affecting factor on information acquisition strategy indicators associated with academic stress (Table 2).

Table 2) Logistic regression coefficients of information acquisition strategy indicators associated with academic stress in university students in times of pandemic

Indicator	B	Standard error	Sig.	Exp(B)	95% C.I.	
					Lower	Top
Exploration	-0.32	0.592	0.589	0.726	0.227	2.319
Linear underline	-1.72	0.494	0.001	0.179	0.068	0.472
Idiosyncratic underlining	1.39	0.542	0.01	4.014	1.388	11.605
Epigraphy	-3.507	0.814	0.001	0.03	0.006	0.148
Review out loud	2.965	0.659	0.001	19.399	5.336	70.531
Mental Review	-0.191	0.464	0.681	0.826	0.332	2.053
Repeated review	1.439	0.372	0.001	4.215	2.032	8.741

The strategy of applications was the highest affecting factor on information coding strategy associated with academic stress (Table 3).

Table 3) Logistic regression coefficients of indicators within the information coding strategy associated with academic stress in college students in times of pandemic

Indicator	B	Standard error	Sig.	Exp(B)	95% C.I.	
					Lower	Top
Mnemonics	1.076	0.802	0.18	2.932	0.609	14.118
Intra-content relations	2.542	0.727	0.001	12.705	3.053	52.868
Shared relationships	0.875	0.701	0.212	2.399	0.607	9.475
Images	0.306	0.74	0.679	1.358	0.319	5.785
Metaphors	-1.497	0.751	0.046	0.224	0.051	0.974
Applications	-4.042	0.972	0.001	0.018	0.003	0.118
Self-questions	3.824	0.825	0.001	45.782	9.08	230.829
Paraphrase	1.889	1.084	0.081	6.612	0.79	55.325
Groupings	-3.164	1.037	0.002	0.042	0.006	0.323
Sequences	0.356	0.565	0.529	1.427	0.472	4.319
Concept maps	-1.517	0.763	0.047	0.219	0.049	0.978
Diagrams	-0.768	1.042	0.461	0.464	0.06	3.573

The strategy of searching for encodings was the highest affecting factor on the information retrieval strategy associated with academic stress (Table 4).

Table 4) Logistic regression coefficients of indicators within the information retrieval strategy associated with academic stress in college students in times of pandemic

Indicator	B	Standard error	Sig.	Exp(B)	95% C.I.	
					Lower	Top
Search for encodings	4.132	1.03	0.001	62.275	8.279	468.458
Search for clues	-3.108	0.746	0.001	0.045	0.01	0.193
Response planning	-1.45	0.541	0.007	0.235	0.081	0.677
Written response	0.429	0.577	0.457	1.536	0.496	4.754

Table 5) Logistic regression coefficients of indicators within the processing support strategy associated with academic stress in college students in times of pandemic

Dimension	B	Standard error	Sig.	Exp(B)	95% C.I.	
					Lower	Top
Self-knowledge	1.660	0.837	0.047	5.261	1.02	27.138
Self-management/Planning	0.219	0.578	0.705	1.245	0.401	3.866
Self-management/Regulation and evaluation	0.349	0.844	0.679	1.417	0.271	7.404
Self-instructions	1.905	0.934	0.041	6.720	1.077	41.950
Self-checking	1.535	0.369	0.001	4.641	2.251	9.569
Counter-distractors	-3.273	0.786	0.001	0.038	0.008	0.177
Social interactions	-5.048	1.022	0.001	0.006	0.001	0.048
Intrinsic and Extrinsic Motivation	1.7	0.767	0.027	5.475	1.217	24.636
Escape motivation	0.601	0.558	0.281	1.825	0.611	5.447

The strategy of social interactions was the highest affecting factor on processing support strategy associated with academic stress (Table 5).

Discussion

Analyzing the descriptive results it is obtained that 76% of university-level students who receive non-classroom education during the pandemic context do not use or practice information coding skills, this result contrasts with what was determined by Albo [29] who investigated students from the Faculty of Agricultural Sciences in Argentina and determined that among the least used skills by the students surveyed is the acquisition strategy. In addition, the results establish that 72% of university-level students who receive non-face-to-face education do not use information retrieval skills in order to carry out their learning, agreeing with Albo [29] as it is inferred that the skill of information retrieval is essential attention both in face-to-face and non-face-to-face classes as its scarce use was determined, all this supports the claim that cognitive learning strategies are integrated sequences [30].

It was determined that 81% of college-level students receiving non-face-to-face education during the pandemic context suffer from high and moderate academic stress, this is similar to that determined by Reddy, Menon & Thattil [38] who investigated final year undergraduate students in India, and observed that demand from their parents and expectation on their performance generates academic stress, which results in a burden on students, concluding it is devastating for students both for their wellbeing and mental health.

There was a significant influence with five indicators, corroborating the predominance of the epigraphic indicator, differing from Ortega *et al.* [39] who concluded that the most used acquisition skill among graduate students in Mexico is the review, reaching 90%, linear underlining 88%, scanning 80% and eventually 80%. Ortega *et al.* [39] who concluded that the acquisition skill with the highest use among graduate students in Mexico is review reaching 90%, linear underlining 88%, scanning 80% and eventually epigraphic 80%, also mentioned Little-used skills such as mental review with 44% and review aloud with 49%.

On the skill of coding information, there was a significant relationship with six indicators, with applications predominating among them; however, Ortega *et al.* [40], through their research on students preparing for teacher training in Mexico City, determined that the most used skills are images, obtaining 83%, groupings in 83%, and parables in 83%. Ortega *et al.* [40] through their research to students preparing for teacher training in Mexico City determined that the most used skills are images obtaining 83%, groupings in 83% and paraphrasing

in 82% and being the least used the nemotechnics obtaining 40% and diagrams in 45%, such figures are opposed to ours in the sense that for us applications predominate, considering that they are different skills still remain part of the elaboration group that is why the results could contain certain similarity.

On the strategy of information retrieval, there was a relationship with great significance between three indicators in which the search for codifications has the predominance, our conclusions contradict with Ortega ^[41] who studying graduate students in Mexico determined that the search for codifications is one of the strategies of less use among students obtaining 56% and the written response establishing itself in 64%, for the author the most used techniques are the planning of response determining it with an incidence of 82% and the search for clues in 78%. However, such a result can be opposed to our results because our sample has particular qualities, while Ortega's sample uses students of master's degree in teaching, our sample contains students of architecture so they are closer to the use of the search of codifications thanks to the graphic thinking they have and the type of questions used.

On processing support strategy, we determine the existence of a highly significant correlation between six indicators, being social interactions the predominant indicator, coinciding with Ortega *et al.* ^[40] who point out that social interactions are among the most used skills, obtaining 84% in their research, whose sampling was done to teaching students in Mexico City. This shows us the need for interaction among peers and the lack of physical support during learning indicated by 14 when they deal with non-face-to-face teaching with the COVID-19 situation. Ortega *et al.* ^[40] determines among the least used skills the counter-distractors establishing them 64%, self-control 66% and escape motivation 66%, in contrast to us that counter-distractors along with social interactions are indicators of protection so using them reduces academic stress levels while self-knowledge, self-instructions, self-control and Intrinsic/extrinsic motivation indicate risk so moderating their use is necessary to avoid raising academic stress levels.

Conclusion

The information coding, epigraphy, applications, searching for encodings, and social interactions strategies have the highest effect on cognitive learning, information acquisition indicators, information coding, information retrieval, and processing support, respectively.

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