



# Cognitive Processes and Creative Lateral Thinking in Students of the Naval School of Peru

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## Abstract

The present research focused on identifying the influence of cognitive processes in the creative lateral thinking of high school students. The work was developed under the positivist paradigm; it was classified as basic, of explanatory level, with quantitative approach, non-experimental design and cross-sectional. The sample, calculated through probabilistic sampling, consisted of 221 students. Two data collection instruments were used: the cognitive processes questionnaire and the lateral thinking questionnaire, which were subjected to content validity by expert judgment and reliability and internal consistency analysis by Cronbach's alpha, reaching values of 0.908 and 0.802, respectively. The analysis of verification by Spearman's rho obtained was 0.762, which determined the significant influence between cognitive processes and lateral thinking. It was concluded that, if procedures and actions that lead to the acquisition of knowledge in a constructive way and by discovery are practiced, creative and perceptive lateral thinking would be developed; then the individual would exhibit imagination and creative behaviors.

**Key Words:** Cognitive Processes, Attention, Reasoning, Perception, Creative Lateral Thinking.

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10

## Introduction

Peruvian university education is subject to the competency-based approach, which seeks to develop students' skills (Zambrano et al., 2019). In this regard, Casimiro et al. (2019) stated that the main purpose of the university is to provide adequate technical and professional preparation, and not only limit itself to transmitting instrumental knowledge; it should be oriented to the development of competencies related to the work activity under the triad: knowing, knowing how to do and doing (Ruiz, Ruiz and García, 2012). According to what has been stated, it is possible to conceive professional competencies as a series of personal attributes that include capabilities, personality traits, aptitudes, attitudes, values, personal properties and individual resources (Casimiro et al., 2019).

The operation of any university level institution in Peru is subject to University Law No. 30220 which aims at continuous improvement to consolidate educational quality under the competency-based approach. However, at the Naval School of Peru, an institution attached to the Navy, cadets and officer candidates show traits that hinder their learning and the achievement of cognitive levels ranging from the simplest to the most complex such as remembering, understanding, applying, analyzing, evaluating and creating; such traits are required in university and/or higher education. These levels, when not developed, tend to hinder understanding, the ability to follow instructions, remember teachers' directions, poor mastery of basic reading skills and difficulties in developing simple activities.

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These deficiencies are limiting factors for creativity, innovation and problem-solving skills. Creativity is related to brain activities that store, share previous experiences and generate new ideas. Therefore, Zambrano et al. (2019) stated that innovation is one of the primary supports of the creative capacity that, in the case of university students, would imply unifying everything experienced from the school stages and, in turn, reusing what has been learned at a personal level to generate a professional profile capable of providing innovative solutions to possible difficulties or problems related to their professional performance.

Regarding what has been stated, an adequate professional should graduate from the higher level; however, when contrasted with reality, it can be observed that, in many cases, university students finish their training with a scarce development of competencies, given that they exhibit some difficulties in the deployment of skills such as remembering specific facts, following a defined protocol, processes, outlining and elaborating a frame of references to address some thematic (Llanga et al., 2019; Hidayat et al., 2018; Núñez et al., 2017 and Nieto, 2015). Students show difficulties in the development of some capabilities; for example, understanding new knowledge, creativity, following habitual trend patterns, lacking ideas to explore possible solutions, not organizing lateral thinking processes necessary to solve everyday problems. In the university environment, the development of creativity in students is highly demanded, since its absence tends to affect personal and professional competence (Zambrano et al., 2019).

In accordance with the above, it is crucial to reflect on the processes to be followed in order to ensure optimal training for graduates with greater relevance, reducing the gap between what is taught and learned in universities and what is demanded by the socio-labor context of Industry 4.0, understood as the fourth labor revolution characterized by its marked basis in digitization and the rapid advancement of knowledge (Martínez and Gonzales, 2019). There is no doubt that the university is a fundamental axis that guides the development and growth of countries by promoting confidence, projection, hope, progress and welfare; based on the product of competitive students, adapted to the current levels of demand typical of the era of globalization that require individuals with creative, innovative capacity and a plasticity in problem solving (Núñez et al., 2017). Therefore,

this study will identify or diagnose the influence of cognitive processes on lateral thinking that will allow the implementation of creativity, an aspect required in the knowledge society.

### Cognitive Processes

With respect to evolutionary psychology, it can be said that the cognitive aspects, due to their enormous complexity, have repercussions on it, since they tend to sustain and link with the philosophical system about the aspects of knowledge; but, from the biological perspective, since it makes use of the genetic epistemological support of psychology, the same that Piaget called genetic psychology and that this branch focuses on discerning the background on which the various types of knowledge are based, which derive from the thinking of the individual in its most elementary forms (Gutiérrez, 2005).

Piagetian theory maintained a clear description of the various stages of development, and also focused on establishing the functional and explanatory aspects in order to understand the evolution of being. This aspect, until today, has a highly relevant value because it tries to distinguish and discern the social, affective and cognitive development under which the behavior and intelligence of individuals is developed and circumscribed. From the perspective of developmental psychology, the cognitive fact tends to evoke the description and explanation derived from the psychology of cognitive development in relation to the nature and evolutionary changes that usually occur, emphasizing specifically the diversity of problems that are characteristic of the continuity and discontinuity of development, in addition to the problems of the various stages in order to discern and differentiate individuals with respect to their level of evolution and their respective ages. According to Pérez (1995), developmental psychology proposes the study of cognitive development based on methodologies and techniques that are of enormous importance for evolutionary development, since it conceives that the progress of the individual is related to the multiple components that encompass the various stages of cognitive development of the being. For his part, Deval (1988) mentioned that developmental psychology could be related to pedagogical psychology since, according to this researcher, experimental studies, based on indirect methods from observation, inference from the introspective and subjective, allow obtaining



results of a structuralist nature, which are extremely necessary in child psychology in order to observe the higher processes and the knowledge of the stages of being.

On the other hand, developmental psychology influences the reactivation of cognitive development under the approach of the American psychology current treated by Piaget and Vygotsky (Smith and Kosslyn, 2008). Based on this parameter, Piaget's developmental psychology was focused on various proposals related to developmental theory, mainly between the 1960s and 1980s (Gutiérrez, 2005). In this regard, Piaget's theory can be understood as the theory of cognitive development, which addresses from the most complex to the most systematic aspects, due to the enormous influence he exerted within evolutionary psychology. This influence can be understood from the reactions of feeling, which establish foundations based on the biological theory of knowledge, the same that pretend to give a philosophical support that allows the birth of the so-called genetic epistemology to explain the aspects referred to knowledge from the philosophical approach. According to Deval (1988), Piaget held the idea that genetic epistemology was oriented to the roots of knowledge from different points of the development of the fundamental levels of psychological experimentation.

The characterization of knowledge represents Piaget's theory in itself, even more so if we take into account the preceding arguments, since, according to his position, the bases that form knowledge must be invented, must be created, since they are not preformed within the individual and much less are they emulations of the outside world. In this sense, it can be said that Piaget assumes that knowledge is the individual's own creative nature, because he himself has the urge to know, perceive and react to any stimulus and, thus, be able to react according to the given relationship between the object and the subject itself (Pérez, 1995). In relation to the latter, it can be inferred that, for the so-called subject → object reaction to occur, it is required to fix the notion of knowledge in order to observe the reaction and the possible interactions between subject and object. This aspect allows to state that it is possible to mention the results of a construction generated by the subject. According to the aforementioned perspective, Piaget's theory, based on cognitive development, is aimed at describing and postulating intellectual development from an

endogenous perspective. Due to such support, this theory exhibits features of adaptation of the individual's reality based on processes and structures that emerge from egocentric evolution, so that the evolutionary development can be understood, in a directional way, as a flow from the inside to the outside, with which cognitive processes are identified (Wang, 2019).

In addition to the above, it is worth mentioning the spectrum of study of cognitive psychology that focuses on the study of mental processes generated by mental activity in order to know and understand what is the aspect referred to cognition from the deepening of the so-called cognitive brain, an aspect that, from the perspective of neuroscience, is related to brain functions. On this aspect, Smith and Kosslyn (2008) marked a milestone by mentioning that almost none of the so-called cognitive functions is circumscribed to a single brain area; rather, it is the product of the joint work of a multiplicity of brain areas that are concatenated and articulated with the purpose of allowing the performance of specific tasks; taking into account that each of the areas of the brain surface develops certain defined and unique functions. This diatribe beyond being a dilemma is envisioned as a mechanism that will allow elucidating the integrated functioning of the human brain (Paninski and Cunningham, 2018; Bears et al., 2016). Due to the aforementioned, there is an urgent need to allude to neuronal cells and their diverse varieties that allow an integrated work ranging from the stimulus-response circuits formed by sensory, intercalary and motor neurons to those specific to forgetting in the hippocampal nucleus, all in conjunction with the other structures of the central and peripheral nervous system.

### **Creative Lateral Thinking**

According to Syahrin, Suwignyo, and Priyatni (2019), creative lateral thinking is understood as the mental activity employed to construct ideas. On the other hand, Hidayat, Susilaningsih, and Kurniawan (2018) stated that creative lateral thinking is a thinking process that generates new ideas in a broad and varied way. Lateral thinking is linked to the generation of new ideas. There is a feeling of curiosity that the new idea is related to the discovery of the technique. This is a very small aspect of the problem. The new idea is an element of change and progress in all fields of science from engineering to art, from politics to someone's happiness (De Bono, 2000).



De Bono (2000) proposed the restructuring of the idea of thinking, the same that would be immersed in the stimulation of the being, which is denominated as lateral thinking. Therefore, the aforementioned author stated that lateral thinking has creativity guidelines, being divergent and provocative. Creative thinking contains measurable competencies in problem solving. In creative problem solving, it is necessary to increase the level of confidence. The exploration of creativity exposed by De Bono (2000) represents the idea of lateral thinking in the way of a behavior that embraces art, passing through science, ethical points, the realization of being and necessity; therefore, no way or means of solution to a certain problem is rejected, since false steps can be taken, but many of them will provide light on different solutions to the already conventional ones. Lateral creative thinking allows exploring the subject in depth, generating reinforcement links on the process of interactions and new ideas focused on the solution of the problem.

According to De Bono (2000), lateral thinking develops a new structure that already existed in the mind; but in such a way that it offers the possibility of generating new creative and intelligent ideas by using the information of a topic or problem. In the teaching-learning process, it is important to mention that lateral thinking is not intended to replace vertical thinking since both are important; that is, both complement each other: vertical thinking is selective and lateral thinking is creative; the latter focuses on research, as well as on the verification of primary concepts given by vertical thinking. Therefore, it is inferred that lateral thinking is a habit and a mental attitude that offers alternatives and ideas for vertical thinking to increase its effectiveness.

Many times it is fundamental the attitudes towards lateral thinking because they allow the disaggregation of the pre-established information in the mind; in this way, an automatic restructuring is produced, it is there, where the necessity of the use and practice of the technique that lateral thinking possesses is seen; this thinking achieves that the creative capacity increases the stimulus to obtain the new information, ideas and images that are constituted as new information. In other words, lateral thinking is necessary to generate different ways of seeing the solution of things. Seen in this way, we can infer that lateral thinking increases the effectiveness of vertical thinking, since lateral thinking gives alternative ideas that are important

for vertical thinking to select and elaborate adequate information and not to have limitations when facing established models (De Bono, 2000).

Lateral thinking is the series of mental operations, strategies and representations that someone uses in their experience of the world in order to capture situations, phenomena and objects of knowledge as complex units and from different dimensions (Maldonado, 2014). Lateral thinking aims to solve problematic situations in a creative way to achieve a degree of satisfaction; the person who develops his lateral thinking is able to achieve better learning, build new knowledge giving meanings and sense to the different aspects that are framed in the memoristic and subordinated to conventional patterns; above all, to the repetition of information; that is, rote learning. We want the person to achieve that, with lateral thinking, the information obtained is under experimentation, testing and exploration of the different applications and not just a mechanical configuration that appropriates the knowledge without reflecting on what is being learned.

Lateral thinking allows us to notice sinuous aspects that daily life does not allow us to perceive and that represent obstacles to achieve happiness and quality of life (De Bono, 2000). The problems that arise daily are solved bearing in mind aspects that allow time to improve immediately, such as poor school or university performance. All cognitive processes should focus on how new information is processed. In this sense, Maldonado (2014) argued that the transcendent role of lateral thinking is to allow the mind to explore and use heuristic dynamics to achieve ideal learning that generates skills and cognitive attitudes for the resolution of everyday problems. Therefore, this thinking is associated with creativity. Problem solving requires creative thinking that includes analyzing, clarifying and describing based on information or facts. Creativity is surrounded by a mystical aura as a mysterious talent, which is perhaps justifiable in the artistic world; but it is less required in other fields (De Bono, 2000). According to Shabrina and Kuswanto (2018), the pattern of creative thinking in students' scientific work allows them to produce diverse ideas so that, from these ideas, the most appropriate answer can be chosen in problem solving. It is known that creative thinking is in the cognitive domain. The key elements required by lateral thinking to solve problems are four: checking assumptions, asking the right questions,

creativity and logical thinking which are detailed below.

The first element of lateral thinking is the testing of assumptions, which allows putting into practice behaviors and attitudes such as listening, accepting opinions, seeking alternatives, seeing beyond the obvious and feeling dissatisfied with what is accepted (Almazán, 2009). The second element refers to asking the right questions, an aspect that allows demonstrating behaviors and attitudes such as promoting the use of fantasy, stimulating humor, promoting the use of impossible intermediaries and unstable situations, which are steps to generate new ideas, test or eliminate alternatives and try to transcend assumptions (Almazán, 2009). The third element is creativity; it involves putting into practice a series of behaviors and attitudes such as generating discontinuity, avoiding limiting concepts, and stereotypes obviating unnecessary complexities to opt for a solution (Méndez and Ghitis, 2015). The fourth element is logical thinking which puts into practice behaviors and attitudes such as detaching from dogmatism, arrogance, opposition to a single way of seeing things, keeping in mind the limits of validity of logic and promoting flexibility and openness. According to Almazán (2009), in order to achieve an adequately developed lateral thinking, it is urgent to clarify the analysis, deduction and discipline of reasoning in a logical way since, without these aspects, lateral thinking would become a longing thinking limited to extracting eccentric ideas.

### Methodology

The present research has been framed under the non-experimental design, transactional cut; the type of study was basic. The approach assumed was quantitative and the positivist paradigm in order to ensure the precision and rigor needed by science (Sánchez, Reyes, & Mejía, 2018; Hernández, Fernández, & Batista, 2014). The hypothetic-deductive method was used. The population consisted of 521 cadets of the Naval School of Peru, of a level equivalent to university students. The sample was 221 cadets, calculated by probability sampling with the Alkin Kolthou formula of simple random sampling (Hernández et al., 2014). The inclusion criterion was assumed to be enrolled students of both sexes, and the exclusion criterion was assumed to be those students who were on duty and/or on secondment. The survey technique was used and the instruments were questionnaires of cognitive processes and a test for creative lateral thinking. The reliability analysis yielded Cronbach's alpha values of 0.908 and 0.802 with 46 and 18 items, respectively.

### Results

Regarding the interpretation of the descriptive results, levels of ranges were established using the statistical technique of baremation, as shown below in Tables 1 and 2.

**Table 1.** Levels of Descriptive Interpretation (Scales) Cognitive Processes

	Cognitive Process	Perception	Attention	Memory	Reasoning	Languague	Thinking
Outstanding	<170-231>	<68-91>	<24-31 >	<27-36 >	<24-31 >	<21-26 >	<16-21 >
Process	<108-169>	<43-67>	<15-23>	<17-26>	<15-23>	<13-20>	<10-15>
Initial	<46-107>	<18-42>	<6-14>	<7-16>	<6-14>	<5-12>	<4-9>

**Table 2.** Levels of descriptive interpretation (scales) Creative lateral thinking

	Lateral Thinking	Checking assumptions	Asking the right questions	Creativity	Logical thinking
High	<68-91 >	<27-36>	<12-16>	<12-16>	<19-26>
Medium	<43-67 >	<17-26>	<7-11>	<7-11>	<12-18>
Low	<18-42>	<7-16>	<3-6>	<3-6>	<5-11>

**Table 3.** Cognitive process level of university students of the Peruvian Naval School.

Level	Students	%
Initial level	34	15,4
Process level	93	42,1
Oustanding Level	94	42,5
Total	221	100,0

According to Table 3, it was observed that 42.5% of the students showed an outstanding level with respect to the cognitive process; while 42.1% were at the process level and 15.4% were at the initial level.



**Table 4.** Level of creative lateral thinking of university students at the Peruvian Naval School.

Level	Students	%
Low level	25	11,3
Médium Level	126	57,0
High level	70	31,7
Total	221	100,0

The descriptive results of creative lateral thinking shown in Table 4, regarding the evaluation of the 221 cadets, showed that 57.0% of them had developed a medium level, 31.7% showed a high level and 11.3% a low level with respect to the indicated parameter.

**Table 5.** Significance and degree of variable and dimension correlations

Rho Spearman	Variable/ dimensions	Lateral Thinkings	
	<i>Cognitive Process</i>	Sig. (bilateral)	0,000
Correlation coefficient		0,762	
<i>Perception</i>	Sig. (bilateral)	0,000	
	Correlation coefficient	0,654	
<i>Attention</i>	Sig. (bilateral)	0,001	
	Correlation coefficient	0,601	
<i>Reasoning</i>	Sig. (bilateral)	0,000	
	Correlation coefficient	0,659	
<i>Languague</i>	Sig. (bilateral)	0,001	
	Correlation coefficient	0,628	

The results shown in Table 5 showed that the Correlation coefficient (0.762) of cognitive processes and lateral thinking was significant (value: 0.000), which explains that, as long as processes and actions oriented to the acquisition of knowledge are practiced (constructively and by discoveries), creative and perceptive lateral thinking will be developed, facilitating the student to show creative behaviors and imagination. The Correlation coefficient between perception and creative lateral thinking (0.654) meant that a greater sensitivity of cognitive operations manifested in stimulations and cognitive operations as a function of expectations, experiences and personal knowledge would allow students to develop creative lateral thinking manifested in artistic behaviors. The correlation between attention and creative lateral thinking was 0.601 which meant that, if the student is activated, he would begin to capture what he hears, to focus and fix his attention, allowing him to develop routines without much effort, thus developing creativity, insight and ingenuity with spontaneity and independence. The correlation between reasoning and lateral thinking was significant and direct (0.659) which meant that, if the student is involved and seeks answers from the inference of hypotheses, situations, assumptions; then he would develop a creative mental attitude. The results of correlation coefficient between language and creative lateral thinking (0.628) meant that, if the

student was involved in a complex system of communication, articulating phonemes, forming words which articulate with each other forming sentences; then he would be able to identify information, formulate hypotheses, produce new ideas and propose new alternative solutions to problems.

**Table 6.** Significance and degree of variable and dimension correlations

Rho Spearman	Dimensions	Lateral Thinkings	
	Memory	Correlation coefficient	0,251
Sig. (bilateral)		0,002	
Thinking	Correlation coefficient	0,451	
	Sig. (bilateral)	0,002	

It is observed, in Table 6, the influence obtained between memory and lateral thinking (0.251) being the degree of influence minimal; from which it follows that a better capacity for acquisition, encoding, storage and retrieval of information would not mean that lateral thinking would develop in parallel. On the other hand, the relationship between lateral thinking and thinking was low (0.451), which highlights the need to develop better strategies to significantly increase this nexus.



## Discussion

The results of the present research differed from those expressed by Muñoz (2013) who concluded the importance of the use of activities and tools that generate the stimulation of creativity and the development of lateral thinking; since only 31.7% of the analyzed sample showed a high level of lateral thinking. In this sense, it is worth mentioning that there was coincidence with defined by Arboleda (2007), who stated that a person who has developed lateral thinking is able to achieve better learning, build new knowledge giving meanings and sense to the different aspects that are framed in the memoristic and subordinated to conventional patterns, especially to the repetition of information or rote learning.

It is worth mentioning that the results of the present research coincided with the conclusions of Nieto (2015) who manifested the cognitive problems of individuals according to their characteristics, are of great importance for training and learning with the purpose of presenting optimal cognitive coping strategies to achieve maximum performance; since, of the group of respondents, 42.5% exhibited an outstanding level with respect to the cognitive process. In this sense, the results found are reaffirmed by Millar (1993), who stated that cognitive processes are seen from human nature as mental processes in which schemes are built and transformed in an orderly manner in order to consolidate experiences that influence the complex process called learning.

The conclusions of the work of Prado, Viteri and Rojas (2017) were that students managed to develop linguistic intelligence through lateral thinking techniques with the aim of stimulating the development of communication; they coincided with the result of the present research in which 7.2% showed to be at an outstanding level in the language dimension of the cognitive process and a high level with respect to lateral thinking. In this sense, it was possible to verify what Navarro (2008) stated that, within the stages of speech development, there is a pre-intellectual phase and, for the development of thought, a pre-linguistic phase, which generates an independence in this process.

The results of Gonzales and León (2013) indicated that the cognitive processes kept little influence with those pointed out by the theory, and with those that the teacher stimulates; it is equivalent to say that the content analyses of the cognitive processes prescribed in the transversal axis of

thinking are not designed in the content blocks of the learning areas nor are they registered in the procedural type contents. Said results differ from those shown in the present study since a high Spearman's Rho coefficient of correlation coefficient was obtained (0.762) so it was determined that a significant correlation coefficient occurred between the cognitive process variable and lateral thinking.

On the other hand, it is worth mentioning that there was coincidence with the results exposed by Albornoz and Guzmán (2016), who concluded that teachers must have tools for better preparation, higher level of information in order to obtain great early stimulation in students and achieve the purpose of developing cognitive processes in them; in addition to achieving a reasoning that generates early stimulation for the sake of the acquisition of new learning. In this sense, it was found that 36.2% of the respondents showed a process level of the reasoning dimension referring to the cognitive process and that, in turn, they are at an average level of lateral thinking. From the above, the definition given by Navarro (2008) was reaffirmed, who stated that reasoning is a process that allows drawing conclusions derived from hypotheses, which should be categorized both in deductive and inductive reasoning.

Finally, regarding the techniques related to lateral thinking, it was determined that the discourse technique as a simple tool allowed the development of entrepreneurs to face challenges; an aspect that coincided with the results exposed by Villa, Rojas and Coronado (2017), who determined that the discourse technique is a simple tool that allowed the development of entrepreneurs to face challenges. This aspect is aligned with Navarro (2008), who stated that attention should be understood as the psychological manifestation that triggers a series of serial processes by which the individual increases his receptivity to the facts of his environment and, thus, predisposes him to execute a series of actions in an effective manner.

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