A study of critical thinking in higher education students

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Abstract

The study shows a proposal on specific diagnosis of critical thinking skills in higher education students according to literal, inferential and critical reading levels. A literature review on Critical thinking was done to support concepts. This proposal is adapted from the variables of the information obtained. One of the conclusions shows that the career profile is a determining factor in the result and that motivation and interest are outstanding in the reading and writing processes. Teaching students to evaluate their own processes and helping teachers to include critical readings in their curricula will help to develop effective skills associated with critical thinking. The general objective of the research project is to strengthen Critical Thinking and the argumentative capacity of the students of the schools of Administration, Health Sciences, Engineering and Architecture, Social Sciences, Humanities and Theology through strategies of reading and writing. A mixed methodology was used; the researches designed and administered 2 critical reading texts, each with 10 questions and organized in 3 reading levels (literal,inferential and critical), to 158 students; then, a data analysis on how students infer, interpret and analyze text content before they start a communicative course was done. The results show that

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according to the professional profile, some students are more argumentative that others and that students lack Critical Thinking skills.

Key words: Critical thinking, Reading levels, Critical reading, ICFES, Nacional Ministry of Education

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Resumen

El estudio muestra una propuesta a partir de un diagnóstico específico de habilidades de pensamiento crítico en la educación superior en los estudiantes en función de los niveles de lectura literal, inferencial y crítica. Para apoyar los conceptos, se revisa la literatura en el pensamiento crítico. Además, se utilizó una metodología mixta, comenzando con la aplicación de la prueba de lectura, el análisis de datos sobre cómo los estudiantes infieren, interpretan y analizan el contenido de un texto antes de comenzar un curso comunicativo. La propuesta se adapta a partir de la información de variables obtenidas. Una de las conclusiones muestra que el perfil profesional es un factor determinante en el resultado y que la motivación y el interés son sobresalientes en el proceso de lectura y escritura. Del mismo modo, enseñar a los estudiantes cómo evaluar sus propios procesos y ayudar a los maestros a incluir lecturas críticas en sus planes de estudio ayudará a desarrollar habilidades efectivas asociadas con el pensamiento crítico. El objetivo general del proyecto de investigación es fortalecer el Pensamiento Crítico y la capacidad argumentativa de los estudiantes de las Facultades de Administración; Ciencias de la Salud; Ingeniería y arquitectura; Ciencias sociales, humanidades y teología a través de estrategias de lectura y escritura. Se utilizó una metodología mixta donde los investigadores diseñaron y evaluaron 2 textos de lectura crítica. Cada texto tiene 10 preguntas organizadas en 3 niveles de lectura (literal, inferir y crítico). Luego 158 estudiantes tomaron el examen y finalmente se obtuvieron datos de diferentes variables. Como resultado, es sorprendente que, de acuerdo con el perfil profesional, algunas carreras serán más argumentativas que otras. Algunas conclusiones evidencian la falta de pensamiento crítico entre los estudiantes.

Palabras clave: Critical thinking, Reading levels, Critical reading, ICFES, Nacional Ministry of Education

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Introduction

There are various definitions around Critical thinking, authors have defined this concept based on studies associated to different contexts: "Critical thinking is a term that continues to manifest itself in many classrooms around the globe. While many institutional leaders are concerned about enhancing student learning outcomes, they also recognize the fundamental issues impacting this development." (Magno, 2010, p.18). Critical thinking was also recently defined by the Association of American Colleges and Universities as "a habit of mind characterized by the comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating." (Liu, Frankel and Roohr, 2014). Liu, Mao, Frankel Xu (2018) explain that 2016), Critical thinking has been pictured as a ubiquitous skill for citizens to thrive in acknowledge society. It is also a skill that has received particular attention from higher education since 95% of the chief academic officers surveyed by the Association of American Colleges and Universities (AAC&U, 2011) believe that critical thinking is one of the most important learning outcomes expected of their college graduates.

Critical thinking of students has become an interesting field of study. It is worth starting with the approaches of Bloom (1956) who made a taxonomy of the skills and characteristics of critical thinking, among them: Analyze, apply, understand, know, synthesize and evaluate. Raths et al. (1978), a pioneer in developing the value clarification approach, believes this process helps people develop values "that represent the free and thoughtful choice of intelligent humans interacting with complex and changing environments." In addition, this author says that the following are fundamental characteristics of this type of thinking: comparing, summarizing, observing, classifying, interpreting, organizing, supposing, imagining, gathering data, applying, formulating hypotheses, deciding, designing, investigating and coding. In other words, this is a posture of necessary actions that lead others to scientific thinking. Opinion or conclusion. 'Benedict (2013). Niu *et al*, cited in Halpern (2001), affirm "critical thinking skills refer to the abilities to analyze, synthesize, and evaluate information as well as the disposition to apply these abilities."

This paper is the result of a research project about strengthening Critical Thinking in the UCM undergraduate students, supported by the Catholic University of Manizales (agreement 084 of June 26, 2018). The project is aligned with the National Ministry of Education of Colombia (MEN) that seeks for students to think critically, which occurs when they use their cognitive skills that increase the probability of a desirable

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outcome. (Black 2005; Halpern 1998; Kuhn and Dean 2014; Nickerson 1994; Schroyens and Schaeken, 2005). It also considers the objectives of sustainable development, Goal 4: Quality Education: "the learners are able to use all opportunities for their own education throughout their life and to apply the acquired knowledge in everyday situations to promote sustainable development" (UNESCO, 2017, p.18). And as a subject matter inside the classroom "Critical thinking is a term that continues to manifest itself in many classrooms around the globe. While many institutional leaders are concerned about enhancing student learning outcomes, they also recognize the fundamental issues impacting this development." (Magno, 2010, p.18).

Considering higher education concern about critical thinking development, the students who start at UCM are enrolled in real social, economic, and political meaningful situations, and they also start having difficulties when they have to use their critical thinking skills. Students exposure to different texts increase anxiety levels, therefore, it is mandatory to show a way to deal with them. How to support the development of critical thinking based on quality standards of higher education and social challenges? Domínguez (2018, p. 9) highlights the relevance of this type of study when he states that "Critical Thinking (CT) is pointed out as one of the main skills of the 21st Century to be promoted in Higher Education."

The institution is also aware of the lack of competence in the reading process; the results of the national test Pruebas Saber Pro has also showed a low reading level among academic programs. This is not an exclusive concern of the Catholic University of Manizales, but one of all national and international universities. Cited by Rao, Cameron and Gaskin (2009).

Besides, Institutions of higher education are increasingly aware of the need to assess core competencies so that graduating students are able to think and read critically, research and use information, analyze quantitative data, and write effectively and fluently. Accreditation requirements and the job market are placing greater importance on mastery of the core competencies of critical thinking, information literacy, critical reading, quantitative reasoning, and writing (Breivik, 2005; Van Dusen, 1997).

The strategic platform supported by the Catholic University of Manizales states core 1: To be renowned as a diverse, inclusive and multicultural community, which contributes to a more just, supportive and fraternal society, objective 1.3 "to build capacities for a global performance." All programs built critical thinking abilities which

contribute to develop a better impact into a community and society. Evidences of this impact are exhibited at the university web page. UCM declares in its mission that "knowledge must have a high humanizing character in order to transform society and culture by educating and shaping new citizens and generating integral development in our people and their surroundings." (Caicedo, 2020).

This paper aims at helping to show how current educational interventions and practices seek to promote skills in higher education students. There are also several findings around the barriers and about what is now important to improve college higher education. "Student requires constant interaction with the teacher/instructor to obtain everything necessary for their resolutions." (Rivas and Saiz, 2016). Being aware of the level of reading that each one possesses allows the strengthening of critical thinking.

The main objective is to demonstrate that strategies of reading and writing strengthen Critical Thinking and argumentative capacity of the students. It is fundamental that teachers help students enhance linguistic competence to guide them to use adequate rules and to use tools to argue and think critically. This paper will help teachers to change or improve curricula for literacy and to put into practice techniques oh how to develop CT skills. Mohd Zin, Bee and Rafik-Galea (2014) claim that it is important to foster critical thinking and reading skills among students. At the same time, it is also crucial to foster positive thinking and reading dispositions among the students as the results showed that they also lack the willingness or inclination to think and read critically.

Methodology

Since research around Critical Thinking is predominantly qualitative (Domínguez, 2018), this research includes a pragmatically mixed methodology. Literature articles were reviewed according to authority, topicality and relevance. Critical reading workshops were done and diagnostic tests were administered to 158 first-semester students from 6 undergraduate programs of the Catholic University of Manizales: Advertising, Architecture, Environmental Engineering, Nursing, Bacteriology, and Business Administration in Tourism.

Population

Catholic University of Manizales UCM	
Undergraduate programs	
Schools	**Academic programs**
Health Sciences	Bacteriology
	Nursing
Engineering and architecture	Environmental Engineering
	Architecture
Social Sciences, Humanities and Theology	Advertising program
Administration	Business Administration in Tourism

Table 1: Schools of Catholic University of Manizales

Although 158 students began the university programs only 125 took the test. The students attended two sessions: the first part consisted of a reading and the second part was a diagnostic test. Table 2 shows the number of students who attended the workshop and the number of students who took the test.

Catholic University of Manizales UCM		
Academic programs	**Students who started first week. (Introductory week)**	**Students who took the test**
Bacteriology	20	12
Nursing	47	31
Environmental Engineering	17	15
Architecture	35	31
Advertising program	18	15
Tourism administration	21	21

Table 2: Number of students who took the diagnostic test

Text revision and design in Critical thinking

Selection of text for diagnostic evaluation (2 texts-20 questions)

Two continuous texts were selected: the types corresponded to literary and journalistic level. Both texts were approved by communicative language teachers and analyzed in prior session with the students.

	LITERARIOS	INFORMATIVOS (descriptivos, expositivos, argumentativos)
Continuos	Novela, cuento, poesía, canción, dramaturgia	Ensayo, Columna de opinion, crónica
Discontinuos	Caricatura, cómic	Etiqueta, infografía, table, diagrama, aviso publicitario, manual, reglamento.

Table 3: Type of text. Guidelines Nacional Ministry of Educaction-2018

	Literary texts	Informative texts(descriptive, expository, argumentative)
Continuous	Novel, short story, poetry, song, drama	Essay, opinion column, chronicle
Discontinuous	Cartoon, comic	book Label, computer graphics, table, diagram, advertisement, manual, regulations.

Table 3: Type of text. Guidelines Nacional Ministry of Educaction-2018

Based on the analysis of the test and the eventual redefinition of learning results, this research wants to emphasize the skills associated with the Critical Reading competence, reducing prevalence and prominence to the passive memorization of knowledge. (DiCarlo, 2009). This is important because learning is not committing a set of facts to memory but the ability to use resources to find, evaluate, and use information. In fact, memorizing anything discourages deep thinking. Deep thinking is essential because understanding is the residue of thinking. To encourage thinking we must create a joy, an excitement, and a love for learning. We must make learning fun because if we are successful, our students will be impatient to run home, study, and consider to really learn.

Formulation of CT questions under the ICFES model

Text 1	Literal questions 1-2-3	Inferential questions 4-5-6	Critical questions 7-8-9-10
Text 2	Literal questions 11-12-13	Inferential questions 14-15-16	Critical questions 17-18-19-20

Table 4: Diagnostic evaluation questions

Model in CT reading ICFES parameter. SABER PRO tests

NIVELES DE DESEMPEÑO		
SEGÚN ICFES		
NIVEL	**PUNTAJE**	
	DESDE	**HASTA**
1	0	125
2	126	160
3	161	200
4	201	300

Table 5: performance level

Performance levels		
ACCORDING TO ICFES		
LEVEL	**SCORE**	
	FROM	**TO**
1	0	125
2	126	160
3	161	200
4	201	300

Table 5: performance level

Administering the CT test

Text 1

Questions from 1 to 10 were designed from the philosophical text known as Plato's Myth of the Giges Ring. The test challenges, motivates and makes new students enjoy the university and the academic life. The answers require a mental exercise than implies considering hypotheses, contrasting solutions, pondering possible alternatives and making decisions. Beyond presenting a set of questions around a continuous text, the test seeks to have students interact as well as to challenge and involve them in a discussion based on hypothetical situations. Besides, using practical examples, argumentation as the foundation of all research work is encouraged (Niu, Behar-Horenstein and Garvan, 2013).

Text 2

Could it be that Google is turning this into us? The category of the text according to the ICFES classification corresponds to a continuous text of an informative-argumentative type. Questions 17-20 move students to the critical level, seeking their reflection on the text as an evaluation criterion of its content. It also evaluates the identification of assumptions, the derivation of implications, and the recognition of argumentative and rhetorical strategies. McKoon and Ratcliff (2018). A decision-making model combined with tests of particular comprehension processes can lead to further understanding of reading skills. In addition, Critical thinking involves an interaction among cognitive skills, associated character traits, dispositions, and motivations. I call these and other aspects of critical thinkers "virtues of critical thinking" that lead them to the intellectual excellences of character, cultivated by people who tend to aim at making reasoned judgments about what to do or believe." (Hamby, 2014, p.4).

Selection of type of questions

Each text included 10 multiple-choice questions classified in 3 levels: literal, inferential and critical. Those were aligned to the guidelines of the ICFES (2018). The performance level (according to the scale proposed by the ICFES, Levels 1, 2,3,4).

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Competencia	Porcentaje de preguntas
Interpretación	34 %
Formulación y ejecución	33 %
Argumentación	33 %

Table 6: Questions percentage. Guidelines Nacional Ministry of Educaction-2018

Competence	Percentage of questions
Interpretation	34 %
Formulation and execution	33 %
Argumentation	33 %

Table 6: Questions percentage. Guidelines Nacional Ministry of Educaction-2018

Measurement and analysis of CT based on PRUEBAS SABER PRO (2018)

NIVELES DE DESEMPEÑO		
SEGÚN ICFES		
NIVEL	**PUNTAJE**	
	DESDE	**HASTA**
1	0	125
2	126	160
3	161	200
4	201	300

Table 7: performance level

Performance levels		
ACCORDING TO ICFES		
LEVEL	**SCORE**	
	FROM	**TO**
1	0	125
2	126	160
3	161	200
4	201	300

Table 7: performance level

Students placed in level 1, from 0 to 125, were able to identify elements of the text such as the theme, the structure, among others, as long as they appear explicitly. Therefore, students recognized the communicative intention of the author and answered specific questions about information provided in the text. Likewise, some linguistic and discursive resources that allowed to understand the local meaning of the statements could be identified.

Similarly, students in level 2, from 126 to 160, apart from having the skills described for students in level 1, recognized the macrostructure of the text; that is, they understood the global meaning from the cohesion elements that allow the coherence of the text, and identified textual typology, discursive strategies, and the functions of language to understand the meaning of the text

Likewise, students in level 3, from 116 to 200, apart from having the skills described for students in levels 1 and 2, were able to go beyond the explicit information in the text and mastered the text comprehension strategies. In addition, they projected writing based on the information in the text

Finally, students in level 4, from 201 to 300, apart from having the skills described for students in levels 1, 2 and 3, were able to value the global content of the text based on local elements, the relationships between them, and their position in a given context from a hypothetical perspective.

Selection of critical reading percentages based on ICFES-SABER-PRO TEST

Tipo de texto		Porcentaje de preguntas
Continuo	Literario	15 %
	Informativo	70 %
Discontinuo	Literario	7%
	Informativo	8%
Total		100 %

Table 8: performance level

Text type		Porcentage of questions
Continuous	Literary	15 %
	Informative	70 %
Discontinuous	Literarry	7%
	Informative	8%
Total		100 %

Table 8: performance level

Methodology summary

1	Bibliography review Critical Reading and CT
2	Test revision in CT
3	Test Design in CT
4	Formulation of CT questions under the ICFES model
5	Model in CT Reading ICFES parameter: SABER PRO test.
6	Implementation of CT test
7	Measurement and analysis
8	Selection of Critical Reading and Written communication strategies
9	CT Characterization

Mixed Research

CT
100%

Quantitative &
Quantitative
100%

◼ Quantitative & Quantitative
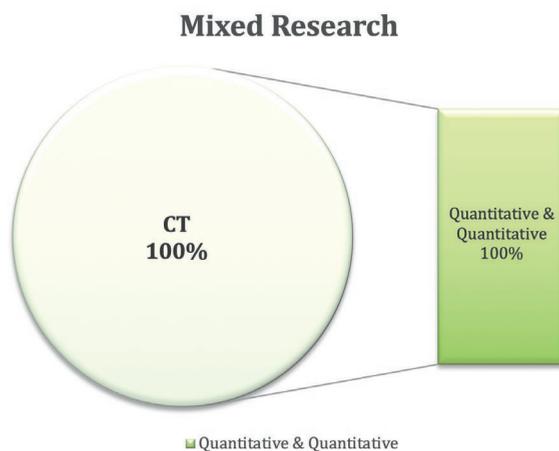
Table 9: Methodology

Finding and results

CT characterization
The results are showed based on program profile
General results from level performance

Performance levels were established according to ICFES criteria in order to complete the numerical score given to students. The fact that 22% of the students are different from this type of test is alarming. Likewise, 30% of the students evaluated had the lowest performance level. Table XX shows the other data related to performance levels:
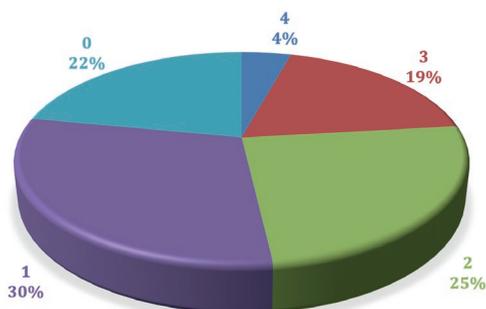

Table 10: General Results

School of Social Sciences, Humanities and Theology
Advertising
15 students from 18 took the diagnostic evaluation.
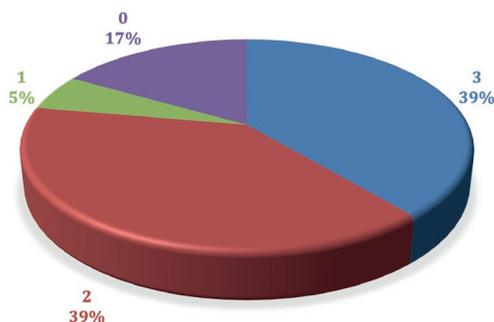
Table 11: Advertising

39% of Advertising students are in level 4: Critical readers; 39% are in level 3: inferential readers, 5% are literal readers, and 17 % did not take the test.

School of Administration
Tourism Management
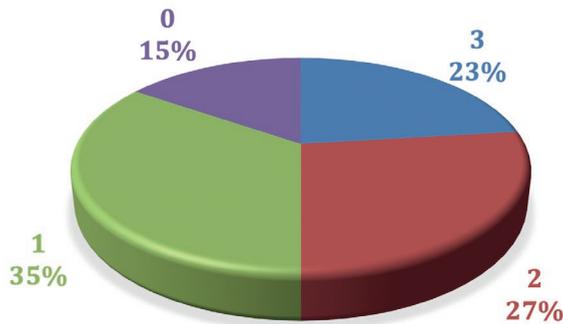21 from 21 Students took the diagnostic evaluation.

Table 12: Tourism Management

23% of Tourism Management students are in level 4: Critical readers; 27% are in level 3: inferential readers, 35% are literal readers, and 15 % are low readers.

School of Health Sciences
Bacteriology
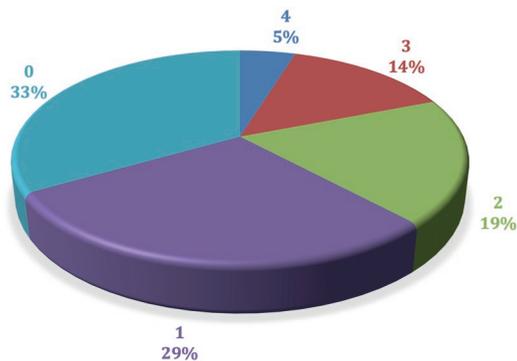Students who took the diagnostic evaluation 12 from 20.

Table 13: Bacteriology

19% of Bacteriology students are in level 4: Critical readers; 19% are in level 3: inferential readers, 29% are literal readers, and 33 % did not take the test.

Nursing
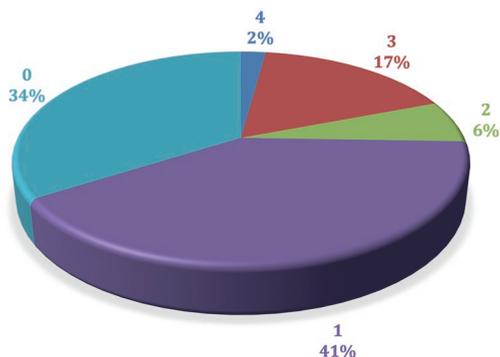Students who took the diagnostic evaluation 31 from 47 students.

Table 14: Nursing

19% of Nursing students are in level 4: Critical readers; 6% are in level 3: inferential readers, 41% are literal readers, and 34 % did not take the test.

School of Engineering and Architecture
Environmental Engineering
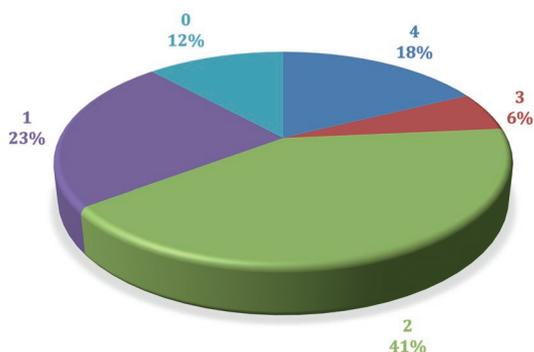15 from 17 students took the diagnostic evaluation.

Table 15: Level of Performance Environmental Engineering

18% of Environmental Engineering students are in level 4: Critical readers; 6% are in level 3: inferential readers, 41% are literal readers, and 12 % did not take the test.

Architecture
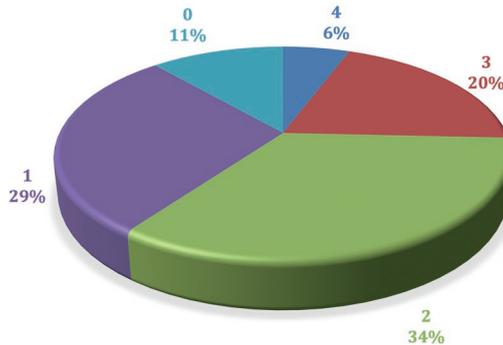31 from 35 Students who took the diagnostic evaluation.

Table 16: Level of Performance Architecture

6% of Architecture students are in level 4: Critical readers; 20% are in level 3: inferential readers, 34% are literal readers and 11% did not take the test.

General views

From 100% of the population 25% are literal readers, 19% are inferential readers and 4% are critical readers. 30% of the students are at the lowest level of performance and 22% of the students did not take the test.
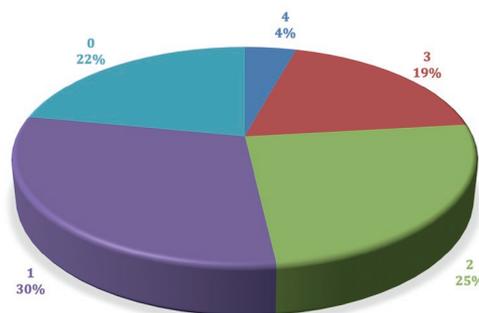
Table 17: Level of Performance UCM overview

CT first place, 39% of Advertising students are in level 4: Critical readers: student's profile has its essence on the personal growth of those who dare to defy creativity with critical thinking, communicative abilities, capacity to persuade, and spirit of research; people able to identify audiences and plan strategies to spread goods, services or an ideology through different media or connection points, all of these with the purpose of focusing on a planned action. There is a high sense of social responsibility and able to understand the dynamics of a globalized world and of an increasingly demanding consumer.

CT second place, 23% of Tourism Management students are in level 4: Critical readers; student's profile scientific and humanistic rationale, also with strategic vision of management, with leadership skills, critical thinking and entrepreneurial spirit.

CT third place, Faculty of Health 19% of Bacteriology and Nursing students are in level 4: Critical readers; student's profile human and professional quality, as well as for its contribution to the context in the scientific, academic and social fields. Professionals also recognize and respect interculturalism, beliefs, and the experiences of society, by promoting educational and developmental practices and processes intended to improve the life and health conditions of the community, the family and the individual.

CT fourth place, 18% of Environmental Engineering students are in level 4: Critical readers; student's profile finds solutions to the environmental problems, which affect the population's quality of life, through development, technological intervention, control, and prevention when natural resources are being used by society. These professionals are characterized for being socially responsible and able to respond to the environmental problems of the country.

CT fifth place, 6% of Architecture students are in level 4: Critical readers; Student's profile transforms the territory to achieve a better quality of life. The architect mind makes it possible to have a constant evolution and innovation of the constructions, allowing the growth of the cities through creativity and design.

It is clear that students learn how to interpret and analyze a text considering their field of knowledge and the way they interact in their social group. People in particular communities learn how to read as they interact with and interpret texts within their culture and their social group (Brandt, 2011). By first forming theories about reading,

they later reinforce or reject them in acts of communication with texts and with others around text. In this way, learning is usually implicit and determined by both students' literate heritage and by the values and norms of their target discourses. (Kuzborska, 2015). The ethnographic study carried out by Jensen and Worth in 2014 states that interactions permit a deeper and more meaningful understanding of texts, there is success in providing the kind of critical interaction that captures students' curiosity.

General overview advertising students

													PREGUNTAS										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	EQ	ACE	Total preguntas
						1		1			1	1	1		1		1	1			8	13	21
		1	1					1		1		1	1	1	1						8	13	21
	1		1			1		1		1				1	1		1				8	13	21
			1	1						1	1	1		1	1	1		1			9	12	21
1	1					1			1	1	1	1		1		1		1			10	11	21
1				1			1	1	1		1	1		1	1	1					10	11	21
1		1		1	1	1				1	1		1		1			1			10	11	21
	1	1	1			1				1			1		1		1	1			9	12	21
	1						1	1	1	1	1	1	1		1			1			10	11	21
	1		1			1			1	1	1	1	1	1	1		1	1			11	10	21
	1			1	1	1			1	1	1	1	1	1		1					11	10	21
	1		1	1		1		1	1			1		1		1	1	1			11	10	21
	1					1	1	1	1	1			1	1	1	1	1	1			12	9	21
1						1	1	1	1	1	1	1	1		1		1				13	8	21
	1	1	1			1	1		1	1	1	1	1	1		1	1				12	9	21
4	3	7	3	8	4	9	7	10	2	13	10	11	13	8	13	4	11	3	9		152	163	315

Respuestas acertadas Publicidad

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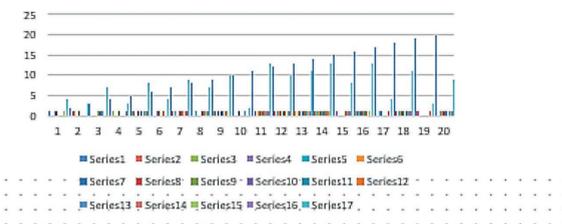Series13 Series14 Series15 Series16 Series17

Table 18. Advertising right answers

Thirty-nine percent of Advertising students are in level 4: Critical readers; 39% are in level 3: inferential readers, 5% are literal readers, and 17 % did not take the test.

Conclusions

ICFES items guide high educational to identify reading levels of difficulty such as low-medium-high, and also reading comprehension levels such as literal-inferential-critical and shows skills dimensions. It becomes an excellent tool of observing CT among students. This paper will help Faculties evaluate their academic programs in relation to reading quality and CT as well as the curriculum they offer on this matter. We expect to contributes to UCM continuous improvement plan 2018-2025. Ahumada and Sanchez (2019) claim that programs related to the quality of education and the curriculum they offer make decisions based on solid foundations to generate improvement actions and strengthen the skills that students need in order to meet the objectives of any institution and achieve educational quality.

Critical thinking abilities will be better developed in a student-centered class, where the learning process is prioritized. Text levels refers to a conscious and reflexive usage of thinking abilities in addition to the deployment and development of research, cooperative work and communication. As Franco, Sousa and Vieira (2019) mentioned a critical thinker will be willing and capable of asking questions, searching for more information, identifying credible sources and legitimate information, being open to question personal beliefs and cognitive bias, among many other dispositions and abilities, while thinking according to criteria based on precision and validity, and on the grounds of knowledge.

Critical thinking and creativity reinforce each other, when students read different texts, they need to understand and interpret first and then reflect upon it. If the text is not part of student's interest, teachers need to be creative in order to involve a real critical thinking. Both promote conceptual richness, coherent organization and exploratory persistence. Students need to know what they learn is meaningful for daily life. In other words CT has a positive impact on academic performance, seeing that critical thinkers think more effectively, and are more motivated to use suitable learning strategies (Halpern, 2014).

The career profile is a determining factor in the result and motivation and interests are outstanding in the reading and writing process. Similarly, teaching students how to evaluate their own processes and helping teachers how to include critical readings in their curricula will help to develop effective skills associated with critical thinking.

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The study of Huber and Kuncel (2016) demonstrated that college is already effective at fostering critical thought, sparing more resources to pursue other educational goals.

Reading into the future (2012), a competent reader for the 21st century will require a combination of knowledge, beliefs, abilities, and processes. It is crucial to expose students to different kind of texts and include techniques in order to motivate and passionate students towards reading. It is reinforced by Roohr, Olivera-Aguilar, Ling and Rikoon (2019). Twenty-first century and higher-learning skills such as critical thinking are highly desired for new college graduates entering the workplace, especially with rapidly changing technology and a more globalized economy.

Different field of knowledge together reading a common text give opportunities to see the same situation from different perspectives, allowing tolerance and respect to each points of view. But, as Weston (2005) affirms, "it is necessary to guide students toward this objective". In other words, students built their arguments in favor of different conclusions and they assess them to consider how strong they really are. After the diagnostic evaluation, the students' perceptions about the results through open questions were that some teachers need to propose better reading activities toward critical thinking questions instead of asking for memorization. It shows the necessity of teachers training of how to develop CT activities. Black (2005) mentioned that, with few exceptions, teachers had muddled notions about critical thinking and little training developing their students thinking skills. This paper shows the necessity to improve a complete system of preparation regarding students as well as teachers. Bartlett (2017) can also be a threat leading educators to a narrow vision of reading education driven solely by performance data.

The analysis of results of the diagnostic evaluation contributes to implement actions among faculties in CT. Students loved when teachers give feedback to critical reading, exchange arguments and confirm data and theories. Gokcora and DePaulo (2018) find out in their pilot study on frequent quizzes and student improvement of reading, that frequent effective feedback is provided through formative assessment. Frequent quizzing is used both before lecture and after class sessions to improve students retention and motivation (McKenzie, 1973).

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