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Artículo de Investigación

Effects of an intervention program on the development of critical thinking in chilean university students

Efectos de un programa de intervención sobre el desarrollo del pensamiento crítico en universitarios chilenos

Efeitos de um programa de intervenção no desenvolvimento do pensamento crítico em estudantes universitários chilenos

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Abstract

Introduction: critical thinking is a cognitive process oriented to the interpretation, inference, evaluation, analysis and reflection of context situations, through knowledge and intelligence, to arrive effectively at the most reasonable and justified position on an issue. **Objective:** to analyze the effects of an intervention program based on chain meeting, transformative triangulation and controversy about critical thinking in students of the social work career of a Chilean university. **Materials and Methods:** the study is framed in the quantitative paradigm, of quasi-experimental design with preprogramming and posttesting with a single group. The sample consisted of 33 university students. The intervention program consisted of a total of six sessions, in which three critical thinking development strategies corresponding to chain meeting, transformative triangulation and controversy were implemented; It also included face-to-face and virtual counseling. **Results:** it was found that there are positive effects on the critical thinking of the participating students, after the development of the intervention program. Conclusions: Critical thinking development strategies promote the construction of knowledge, the ability to adopt a posture, the self-assessment of one's own thinking and the recognition of divergent points of view.
Keywords: Critical thinking; Strategies for development; University students.

Resumen
Introducción: el pensamiento crítico es un proceso cognitivo orientado a la interpretación, inferencia, evaluación, análisis y reflexión de las situaciones del contexto, a través del conocimiento y la inteligencia, para llegar de forma efectiva a la posición más razonable y justificada sobre un tema. Objetivo: analizar los efectos de un programa de intervención basado en meeting en cadena, triangulación transformadora y controversia sobre el pensamiento crítico en estudiantes de la carrera de trabajo social de una universidad chilena. Materiales y Métodos: el estudio se enmarca en el paradigma cuantitativo, de diseño cuasiexperimental con preprueba y posprueba con un solo grupo. La muestra se conformó por 33 estudiantes universitarios. El programa de intervención se constituyó de un total de seis sesiones, dentro de las cuales se implementaron tres estrategias de desarrollo de pensamiento crítico correspondientes a meeting en cadena, triangulación transformadora y controversia; así también, se incluyó asesorías presenciales y virtuales. Resultados: se encontró que existen efectos positivos en el pensamiento crítico de los estudiantes participantes,

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posterior al desarrollo del programa de intervención. Conclusiones: las estrategias de desarrollo de pensamiento crítico promueven la construcción del conocimiento, la capacidad de adopción de una postura, la autoevaluación del propio pensamiento y el reconocimiento de puntos de vista divergentes.

Palabras clave: Pensamiento crítico; Estrategias de desarrollo; Estudiantes universitarios.

Resumo

Introdução: o pensamento crítico é um processo cognitivo orientado para a interpretação, inferência, avaliação, análise e reflexão de situações contextuais, por meio do conhecimento e da inteligência, para chegar efetivamente à posição mais razoável e justificada sobre uma questão. **Objetivo:** analisar os efeitos de um programa de intervenção baseado em reuniões em cadeia, triangulação transformadora e controvérsia sobre o pensamento crítico em estudantes de serviço social de uma universidade chilena. **Materiais e Métodos:** o estudo está enquadrado no paradigma quantitativo, com um projeto quase experimental com pré-teste e pós-teste em um único grupo. A amostra foi composta por 33 estudantes universitários. O programa de intervenção consistiu em um total de seis sessões, nas quais foram implementadas três estratégias para o desenvolvimento do pensamento crítico, correspondentes a reuniões em cadeia, triangulação transformadora e controvérsia; também incluiu aconselhamento presencial e virtual. **Resultados:** constatou-se que há efeitos positivos no pensamento crítico dos alunos participantes, após o desenvolvimento do programa de intervenção. **Conclusões:** as estratégias de desenvolvimento do pensamento crítico promovem a construção do conhecimento, a capacidade de adotar uma posição, a autoavaliação do próprio pensamento e o reconhecimento de pontos de vista divergentes.

Keywords: *Pensamento crítico; Estratégias de desenvolvimento; Estudantes universitários.*

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Introduction

Critical thinking is defined by Paul and Elder (2003) as a process that allows the individual to take hold of the structures inherent to the act of thinking, subjecting them to intellectual standards that demand the formulation of questions with precision and clarity, the evaluation of the information obtained and the establishment of solutions and conclusions based on self-directed, self-disciplined, self-regulated and self-corrected judgment, elements that together improve the quality of thinking.

In this framework, the relevance of critical thinking in higher education emerges, given that it constitutes a key aspect for the achievement of a sustainable society, whose central axis is education for life and the exercise of a transformative action that impacts in the short and long term the educational, professional, personal and social spheres of the subject (Bezanilla et al., 2018; Henríquez et al., 2019).

In the current context, different researches have been conducted to evaluate critical thinking in the student population, such is the case of the study by Robles et al. (2016) in undergraduate and graduate students in Mexico, which reports low levels of this attribute in the dimensions of reasoning, decision making and problem solving. Similarly, there is a research exercise developed in the Colombian Caribbean Coast, whose results show the existence of deficiencies in the levels of critical thinking in students from fourth to sixth semester of Bachelor's Degrees in Education (Steffens et al., 2018).

The research of Macedo (2018) in Peruvian students of the Faculty of Economic Engineering, Statistics and Social Sciences, evidenced the prevalence of medium and low levels of critical thinking, particularly in the ability of inference. Similarly, data from a study in Peruvian university students from the Faculty of Education indicated that more than half of the sample evaluated was placed at a medium level of critical thinking (Pineda and Cerrón, 2015).

Specifically in Chile, Betancourth, et al. (2017) show the results of a research carried out with Law students, showing as main findings the presence of low levels of development of critical thinking skills. At the same time, a study on the evaluation of critical and scientific thinking in pedagogy students of a Chilean university concluded that the overall performance level of this attribute presented a relatively low mean in contrast with the maximum score of the applied test (Ossa et al., 2018).

The aforementioned reflects that the levels of critical thinking in university students are located in medium and low ranges, thus making visible the existence of limitations and insufficiencies in higher education regarding the development of the skills it includes and, therefore, the need to make changes in the educational systems in order to reverse this problem (Palacios et al., 2017).

It is relevant to recognize that critical thinking is essential nowadays, since society is permanently facing crises in its social, political, economic, cultural and other dimensions, demanding from the subjects the development of cognitive skills for the achievement of autonomy in their thinking (Jaimes, 2016). Thus, Tünnermann (2003) argues that: "The innovative trends that are currently observed in higher education cannot escape the influence of the two phenomena that most affect its performance: globalization and the emergence of knowledge societies" (p.108).

It should be noted that a process of discussion has been promoted from different spheres regarding the quality of the education provided in university classrooms, thus triggering the renewal of educational methodologies, focusing on the adoption of a competency-based approach,

The aim is to articulate the training processes with the needs of the local, national and international environment, in order to have an impact on the role played by teachers and students (Bezanilla et al., 2018).

However, in Chile one of the greatest difficulties reported in the implementation of this type of educational models refers to the heterogeneity of competencies present in students entering university, which is why one of the ineluctable challenges is to narrow these gaps through the design and implementation of a curricular system that responds to the guidelines of the current legal regulations. This, with the aim of promoting a comprehensive training that will enable university students to acquire knowledge and strengthen generic and specific competencies, which are required for their subsequent insertion into the labor market (Villarroel and Bruna, 2014).

From this perspective, the social work career of a Chilean university has undertaken as an initiative the implementation of a new curriculum based on competencies and circumscribed under a seal of critical thinking, as a transversal element in the training of its students. Although this is an important advance in Chilean university education, there is still a need for methodological and curricular innovations that transcend the classroom and generate learning from interaction in dynamic social spaces that lead to self-knowledge, self-recognition of learning styles and the establishment of tangible educational goals (Espinosa and Estévez, 2013; Palacios et al., 2017).

In order to achieve the development of these critical thinking skills and positions, there are teaching techniques and strategies, such as Socratic discussion (Betancourth et al., 2012), critical debate (Fuentes, 2011), problem-based learning (Guevara, 2010), analysis of texts, news and media (Montoya & Monsalve, 2008), as well as those used in this study, which include chain meetings, transformative triangulation and controversy.

Along these lines, critical thinking development programs have been carried out in countries such as Spain (Saiz and Rivas, 2011), Colombia (Betancourth et al., 2013, 2020) and Chile (Lazo and Herrera, 2011; Núñez et al..., 2017), aimed at analyzing the effects of intervention proposals framed in strategies of argumentation, decision, problem-solving in daily situations, controversy-socratic, critical debate, pedagogy and problem-based learning, respectively, which show positive results in a common way regarding the increase in the level of critical thinking in the evaluated students. However, there are still gaps in knowledge in this field of study, which would allow us to make proposals for the strengthening of this cognitive process and at the same time evaluate its effect on critical thinking in the university student population.

II. OBJECTIVE

To analyze the effects of an intervention program based on chain meetings, transformative triangulation and controversy on critical thinking in students of a social work career at a Chilean university.

III. METHODOLOGY

Type of study and design

The study was quantitative, using a quasi-experimental design with pre-test and post-test with a single group, since it considered a predetermined group of participants, in this case, students enrolled in the second year of the social work program at a Chilean university (Hernández et al., 2014).

Study variables

Dependent variable: Critical thinking, a construct defined as a cognitive process oriented to the interpretation, inference, evaluation, analysis and reflection of con- situations.

text, through knowledge and intelligence, to effectively arrive at the most reasoned and justified position on an issue (Bernal et al., 2019; Facione, 2007). It was assessed through the Critical Thinking Test before and after the intervention program.

Independent variable: The intervention program, made up of three critical thinking development strategies corresponding to chain meeting, transformative triangulation and controversy, which were implemented within the framework of the assignment: Skills and abilities for social work.

Participants

The research process was developed with a total of 33 second-year social work students from a Chilean university. A non-probabilistic convenience sampling was carried out, according to the declared intention of the students to participate in the study.

Data collection instrument

The version adapted and validated for the Chilean context of the Prue- ba de Pensamiento Crítico (Betancourth et al., 2018) was used as a measurement instrument.

The factor analysis of the test yielded a single factor, called critical thinking. As for the psychometric properties, the reliability of the instrument evaluated through Cronbach's alpha was 0.90, indicating a high level of internal consistency. In conjunction, content validity was performed through expert judgment and construct validity through the application of the Rosenberg Self-Esteem Scale (Betancourth et al., 2018).

The instrument contains 27 closed-response statements, whose categorical values are given on a frequency scale of 1 to 5, where 1 corresponds to never, 2 to rarely, 3 to sometimes, 4 to almost always and 5 to always. The identification of the level of critical thinking of the students

The evaluation was based on the distribution of the scores in 5 categories: very low (27 to 88 points), low (89 to 96 points), medium (97 to 106 points), and low (89 to 96 points).
points), high (107 to 113 points) and very high (114 to 135 points) (Betancourth et al., 2018). A sociodemographic data characterization form was also applied to the participants.

Procedure

In the first instance, written authorization was requested from the students to participate in the study, through an informed consent form. Next, the application of the pre-test of the Critical Thinking Test was carried out. Subsequently, the intervention program was developed, with a total length of six sessions; finally, one week after the program, the post-test was applied. The test was administered in paper and pencil format.

The intervention program integrated the implementation of three critical thinking development strategies corresponding to: chain meeting, which consists of the construction of shared arguments on a topic, recognizing and challenging the account of another person to anchor it to one's own arguments (Vilà et al., 2005); transformative triangulation, takes up the essay as a means for the evaluation and construction of arguments, incorporating the personal position, theoretical basis and ethical/political/legal elements (Álvarez, 2013); controversy, refers to the process of adopting a position and discussing it, in order to subsequently change it, establish agreements and synthesize the arguments presented (Betancourth et al., 2019).

The program included face-to-face and virtual counseling through the use of ICTs (e-mail, social networks and virtual course in Moodle), organized in schedules according to the availability of the participants.

Chain meeting: A session was held for the application of the thinking strategy

The following stages were developed: a) socialization of the methodology of the strategy; b) random assignment of guiding questions; c) construction of arguments; d) plenary discussion of arguments; and e) feedback. To this end, the following stages were developed: a) socialization of the strategy methodology; b) random assignment of guiding questions; c) construction of arguments; d) plenary discussion of arguments; and e) feedback. The strategy was evaluated by means of a checklist previously designed by the research team and the feedback given to each work team.

Transformative triangulation: A session was held for the application of the critical thinking strategy of transformative triangulation, focused on the theme of language and action, following the stages described below: a) socialization of the strategy methodology; b) elaboration of the triangulation diagram (personal position, theoretical basis and ethical, political and legal elements); c) plenary; and d) feedback. The strategy was evaluated by means of a rubric constructed by the researchers and the feedback provided to the work teams.

Controversy: Two sessions were used for the application of the controversy strategy focused on the thematic, theories of language development. Thus, the following stages were carried out in session 1: a) socialization of the strategy methodology; b) assignment of positions; and c) delivery of reading material and elaboration of arguments. In session 2, the following stages were carried out: a) initial discussion; b) exchange of positions; and c) feedback. The strategy evaluation process was carried out by means of rubrics and checklists structured by the researchers and feedback provided to the work teams.

Data analysis

A descriptive analysis of the socio-demographic variables corresponding to gender, age, belonging to native or indigenous peoples, socioeconomic stratum, origin of educational institution and score on the University Selection Test (TSE) was carried out

versity (PSU). Subsequently, a descriptive analysis of the scores obtained in the application of the Critical Thinking Test was carried out in order to identify the level of critical thinking of the participants in the pre-test and post-test and to determine the existence of statistically significant differences between the two measurements. Finally, a contrast was made between the results of the test and the socio-demographic variables of the participants, in order to demonstrate the presence of relationships between them.

Results

The purpose of the research was to determine the effectiveness of an intervention program based on strategies such as: meeting in cha- dence, transformative triangulation and controversy on the development of critical thinking in students of the social work career of a Chilean university. In this order of ideas, the results of the characterization of the participants are presented below, as well as the findings derived from the program implemented.

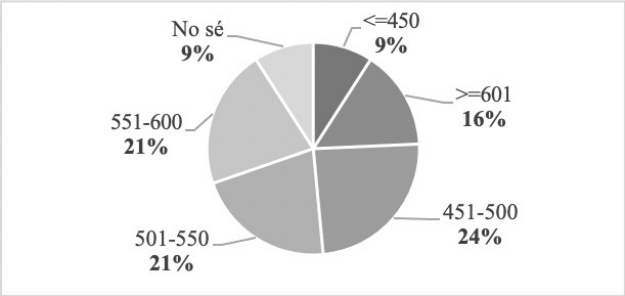
Characterization of participants

The sample consisted of 33 second-year social work students from a Chilean university, of whom 24 were women (72.7%) and 9 were men (27.3%), whose ages ranged from 19 to 30 years (mean= 21.03 years). Likewise, 39.4% of the participants indicated that they belonged to native or indigenous peoples and 60.6% that they did not.

On the other hand, 54.5% of the students indicated that they come from a municipal education institution and 45.5% from a subsidized private institution. In relation to the results obtained by the students in the University Selection Test (PSU), which is a requirement for admission to the country's Higher Education Institutions, the scores for the Social Work career were 24% in the range of 451 to 550 points, followed by 58% with scores of 451 to 550 points with scores of 451 to 550 points.

551, on a standard scale of 150 to 850 points, as shown in Figure 1.

Figura 1.
Puntajes PSU.



Effects of the intervention program on critical thinking

First, a descriptive analysis of the results obtained in the pre- and post-test was carried out in order to recognize the level of critical thinking of the students in these measurements. Subsequently, the Sha- piro-Wilk normality test was applied for samples of less than 50 cases, which yielded a p-value of 0.03 indicating that the data set does not present a normal distribution; based on this, the Wilcoxon nonparametric test was used to identify the existence of significant differences between the pre- and post-test, using in parallel the ranges obtained to determine whether they are positive, negative or neutral.

Finally, Spearman's Rho correlation test was used to demonstrate the existence of relationships between the total scores obtained in the Critical Thinking Test and the sociodemographic variables. The results were as follows:

Figure 2 shows that 7 students obtained a very high level of critical thinking in the pre-test, 9 students a high level, 7 students a medium level, 7 students a low level and 3 students a very low level.

Figure 3 shows that 11 students presented a very high level of critical thinking in the post-test, 9 students a high level, 7 students a very high level of critical thinking in the post-test, 9 students a high level of critical thinking, 7 students a very high level of critical thinking, and 4 students a very high level of critical thinking students medium level, 4 students low level and 2 students very low level.

Figura 2.
Resultados preprueba pensamiento crítico

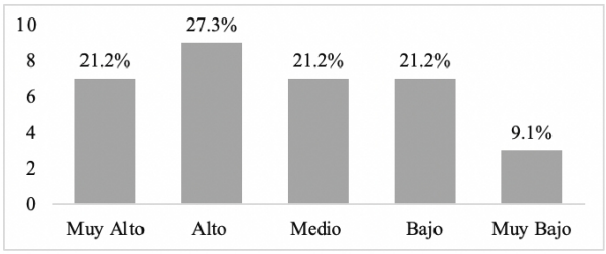


Figura 3.
Resultados posprueba pensamiento crítico.

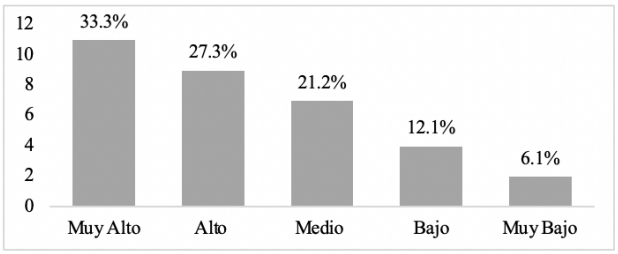
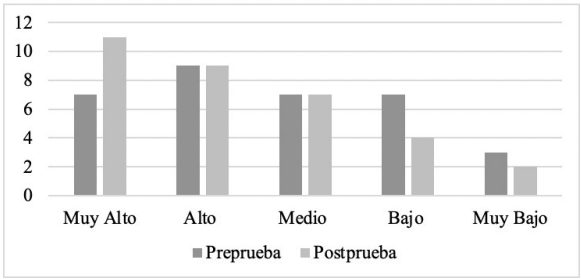


Figure 4 presents the contrast of the results obtained in the pre- and post-test measurement in terms of the levels of development of critical thinking. With respect to the very high level, there is an increase in the number of students who obtained this level in the post-test compared to the pre-test. In the case of the high and medium levels, there is evidence of a regularity in the number of people who obtained these levels in the measurements taken. Finally, for the low and very low levels, there is a decrease in the number of people who presented these levels in the post-test compared to the pre-test.

Figura 4.
Contraste resultados pre y posprueba pensamiento crítico.



From the results obtained in the Wilcoxon test, whose p-value was less than 0.05, it is evident that there are significant differences in critical thinking between the pre-test and post-test of the students, as illustrated in Table 1.

Tabla 1.
Resultado de la prueba de Wilcoxon para el pensamiento crítico

	Post-prueba – Pre-prueba
Z	-2,273[b]
Sig. asintótica (bilateral)	,023

Corresponding to Table 2, there were 22 out of 33 positive ranks, i.e., 22 students out of 33 in total increased their critical thinking after the intervention program. The data within the tie box show that one student maintained the same score. Likewise, there were negative ranges in the results, indicating that 10 students decreased their scores on the study variable.

Tabla 2.
Rango de la prueba de Wilcoxon para el pensamiento crítico

		N	Rango promedio	Suma de rangos
Post-prueba - Pre-prueba	Rangos negativos	10[a]	14,25	142,50
	Rangos positivos	22[b]	17,52	385,50
	Empates	1[c]		
	Total	33		

On the other hand, when comparing the results of the test with the sociodemographic variables, it is identified that there are no correlations between them, since the p-values obtained by Spearman's Rho correlation test were higher than the p-values obtained by Spearman's Rho correlation test.
0.05 in all cases.

Finally, it can be concluded that there are effects of the independent variable on the dependent variable, i.e., the critical thinking of the second year students of the Social Work Career increased with the intervention program developed.

IV. CONCLUSIONS AND DISCUSSION

The objective of the research was to analyze the effects of an intervention program based on the strategies of chain meeting, transformative triangulation and controversy on critical thinking in students of social work at a Chilean university. Regarding the results, statistically significant differences were observed between pre-test and post-test measurements, showing the effectiveness of the program in the development of intellectual skills.

The above is contrasted with studies that similarly implemented critical thinking development strategies in the university population, such as those conducted by Acosta (2002) and Betancourth et al. (2012; 2013), which were aimed at determining the effectiveness of the syncratic-controversy in the acquisition and strengthening of skills of this type. These studies conclude that the strategy is effective and promotes the construction of knowledge, the ability to adopt a position, the self-evaluation of one's own thinking and the recognition of divergent points of view on a topic.

Similarly, studies on critical thinking training programs that focused on the use of other strategies, such as Socratic discussion (Betancourt, 2010), problem-based learning (Hincapie et al., 2017; Núñez et al., 2017; Sánchez and Rivas, 2012; Sastoque et al., 2016) and critical debate (Betancourt et al., 2020; Leitão et al., 2016), stand out. These research exercises point out as main findings the presence of significant improvements in the levels of critical thinking of the participating samples after the implemented programs and, therefore, the effectiveness of the educational work in the implementation of these initiatives.

It can be considered that the critical thinking strategies carried out in this study, those described in other precedents and all those described in other studies, as well as all those

that have as a fundamental basis the development of critical thinking, lead to the construction of educational environments in which the student is the active agent of his or her learning process, thus creating the necessary conditions for each person in a particular way, but based on common elements for all, to achieve the optimal development of skills that allow them to plan reliable judgments and generate effective solutions to the problems of the environment in which they are immersed (González, 2006; Sastoque et al., 2016).

When analyzing the effects of the intervention program based on the number of students who increased, decreased or maintained their scores in critical thinking, it was found that 22 students increased, 10 students decreased and 1 student obtained the same score in the study variable. This could be due, on the one hand, to the fact that the students who decreased their scores in the critical thinking test did not attend all the intervention sessions and, on the other hand, to the fact that the low motivation to carry out the activities proposed in the program strategies influenced the lack of increase in the level of development of the attribute.

Different theoretical references (Ennis, 1996; Fa- cione, 2007; Halpern, 1998; Paul and Elder, 2002) allude that the development of critical thinking depends on two components: skills and dispositions, which are essential in the field of study, since if an individual knows the skills that must be implemented in a given situation, but is not motivated to do so or his purpose is not ethical, he will not be a good critical thinker.

The approach to critical thinking dispositions has been carried out from different but complementary approaches, integrating the analysis of dispositions as a general motivation towards thinking, as intellectual attitudes and as an essential concept that includes sensibility, inclination and ability towards a behavior and its realization (Nieto and Saiz, 2008). In this sense, The incidence of the individual's dispositional component towards critical thinking could account for the results obtained in this research exercise and for the differences observed in the scores of the sample.

Regarding the relationship between critical thinking and sociodemographic variables, it is shown that the results before and after the intervention program do not differ according to gender, age, belonging to indigenous or native peoples, origin of educational institution and PSU score, which corroborates that the implemented strategies of chain meeting, transformative triangulation and controversy allowed the development of this type of thinking.

Specifically, in the sex variable, there are studies that yielded results similar to those of this research, specifying that both men and women develop critical thinking equally, exhibiting the same capacities and skills (Anganoy et al., 2017; Betancourth et al., 2020; Ennis et al., 1985; Loaiza and Osorio, 2018). In contrast, studies by Beltrán and Torres (2009), Molina et al. (2016) and García and Vázquez (2017), showed that female students have higher values of critical thinking development, compared to the results obtained by male participants.

Regarding age, authors such as Aznar and Laiton (2017), Betancourth et al. (2017; 2020) reveal that there are no differences between the age group and the development of the attribute. On the contrary, Bejarano et al. (2014) found that students under 19 years of age presented a higher level of performance in one of the critical thinking skills evaluated, in contrast to participants 19 years of age or older. For their part, García and Vázquez (2017) concluded that the older the age of the students, the higher the score in critical thinking.

In relation to the educational background of the students, such as institutional background and

state test scores, the findings of research in this line differ from those reached in the present study, since they indicate that students from private educational institutions reported higher scores in critical thinking than those from public educational centers (García and Vázquez, 2017; Loaiza and Osorio, 2018).

From this perspective, the preceding discussion leads to consider that the ultimate goal of educational processes is to stimulate higher order skills, regardless of the socio-demographic characteristics of the subjects, hence it should be promoted as a cross-cutting competence in the various disciplinary and professional areas in the entire student population (Molina et al., 2016).

Finally, it is possible to note that in order to make progress in the formation of critical thinking, it is necessary to comprehensively articulate the pedagogical practices from which teaching-learning is structured and developed, conceiving that they are not linear or rote processes, but on the contrary, they demand that the individual continuously confront his thinking, in order to correct or modify his reasoning and act consistently with them (Carrillo, 2000; Gon- zález, 2006).

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