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# Analysis of the variables that promote professional insertion based on critical thinking

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Critical thinking is currently one of the most demanded competencies and skills in professionals and, therefore, constitutes one of the fundamental aspects to be developed by educational systems. This is especially important for the development of work tools for future labor insertion. The first objective of the present study was to determine the demographic variables (school type, gender, level education, work experience and volunteering) that can be used to predict the development of critical thinking in students undertaking vocational training or secondary education. The second objective was to determine whether the variables considered to be the most effective predictors are able to distinguish between higher and lower levels of critical thinking. For this purpose, a sample of students undertaking vocational training or secondary education in southern Spain ( $n=3.132$ ) was recruited. A quantitative study was then conducted, performing regression and decision tree analysis to identify predictors. Based on study outcomes, it can be concluded that a need exists to work on critical thinking at these educational stages and throughout life while considering the variables that influence critical thinking such as educational level, work experience and volunteering.

## KEYWORDS

competencies, critical thinking, education, professional inclusion, skills

## 1. Introduction

General consensus exists that critical thinking should be given a special place amongst the most essential competencies of the 21st century (Lipman, 2001; Moseley, 2004; Phillips and Bond, 2004; Sadler and Zeidler, 2005; Jiménez-Aleixandre, 2010; Solbes et al., 2010; Díaz Moreno and Jiménez Liso, 2011; Solbes and Torres, 2013). Critical thinking has been defined as “reasonable, reflective thinking that is focused on deciding what to believe or do” (Fisher, 2011, p. 4) and forms a fundamental basis for a number of skills, which are necessary both in the present day and are likely to be needed in the occupational setting (Vargas et al., 2020; Olmos-Gómez et al., 2022), not only when starting out in the working world but, also, for securing a long-lasting place in the job market (Suárez, 2019).

Cunalema Fernández and Reyes Ojeda (2019) revealed a relationship between a number of variables and higher levels of critical thinking. These variables include the absence/presence of work experience, type of educational institution, age (Veenman and Spaans, 2005; Van Stel et al., 2010), activity type, development within the educational system (Pithers et al., 2000; Ku and Ho, 2010; Magno, 2010), improved working both individually and in a team (Jiménez Rodríguez et al., 2021; Rivadeneira Barreiro et al., 2021; Zambrano et al., 2021), the educational stage (Rollano Vilaboa, 2004; Madariaga and Schaffernicht, 2013; Gómez and De la Herrán Gascón,

2018; Martínez León et al., 2018; Moreno-Vera, 2018; Álvarez and Artigas, 2019; Durán Simón, 2019; Arce Saavedra, 2021); employability (Tito and Serrano, 2016; Bakhshi et al., 2017; Araya and González, 2019; Rueda and Portilla, 2019; Tseng et al., 2019; Dubey and Tiwari, 2020; Ginting et al., 2020; Hariti and Rejeki, 2020; Keng, 2020; Pluzhnikova et al., 2021), professional experience (Quintero Vargas and Rodríguez Herrera, 2019; Wang, 2019) and gender (Gallagher et al., 2000; Zhu, 2007; Hyde et al., 2008; Hyde and Mertz, 2009; Lindberg et al., 2010; Alabau et al., 2020), amongst others.

Of these various variables, the present research will take a more in-depth look at those related with the type of educational institution, gender, educational level, professional experience and volunteering. These were selected because they have produced more diverse outcomes and are of the greatest interest in the present day.

With regards to the type of educational institution, research stands out that has revealed differences between state- and mixed-funded schools (Macías Ayuso, 2016). In consideration of conclusions reached by Cimiano (2020), it has been concluded that, above all, state-funded institutions provide greater quality when it comes to developing, amongst other aspects, critical thinking.

As discussed above, research studies to have focused on the variable of gender include those carried out by Battista (1990), Pajares and Kranzler (1995), Hyde et al. (2008), and Lindberg et al. (2010). These studies have concluded that both girls and boys perform similarly in problem solving and work tasks. Along similar lines, Doktor and Heller (2005) confirmed that, in relation to secondary education, boys and girls do not present meaningful differences in the performance of problem solving. Likewise, findings reported by Hyde and Mertz (2009) and Alabau et al. (2020) are in accordance with those presented by Piquer et al. (2021). These authors stated that girls have reached parity with boys when it comes to problem solving, with absolutely no effect of gender being seen on problem solving performance. In contrast, other conducted research studies argue that boys outperform girls when it comes to solving complex problems (Gallagher et al., 2000). This body of research highlights that boys perform significantly better than girls, at the outset of secondary education, in complicated tasks (Hyde et al., 2008). A similar viewpoint has also been proposed in research conducted by García Medina et al. (2020) and Pérez Escoda et al. (2021), who argue that clear differences can be seen in relation to the digital gender gap. This is due to the fact that males consider themselves to be more capable at solving technical problems and disseminating content, while females show more concern for the quality and presentation of academic work and are more prudent at the time of sharing content. This points to gender differences with regards to problem solving.

Given the diversity seen in obtained outcomes, the present research deems it of particular interest to examine whether it is essential to consider the gender variable at the time of designing interventions related with the development of critical thinking. This is particularly interesting when considering that it is widely accepted to be an essential competence at the time of accessing and remaining in the workforce (Suárez, 2019; Vargas et al., 2020; Vera, 2021) with, according to different sources (Comisión Europea, 2020; Moral, 2021), differences continuing to exist as a function of gender.

In addition, a large number of research studies (Van Peppen et al., 2021; Rasa et al., 2022) exist which point to the importance of developing critical thinking throughout the different educational stages. This is

important for preparing students to go out into the working world, in the sense that it is related with other fundamental skills, such as creative-innovative performance and self-efficacy (Arce Saavedra, 2021).

On the other hand, given the increase in research on the object of study of this article and, according to Kert et al. (2022), it is necessary to know well what the conditions are, in which the researchers carry out their researches to get to understand why each study marks a series of results, which, in many cases, can vary from each other, in a notorious way especially if we take into account that.

Our primary tool for reasoning and making better decisions, and thus to avoid biases in reasoning and decision making, is critical thinking, which is generally characterized as “purposeful, self-regulatory judgment that results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations on which that judgment is based” (Facione, 2007, p. 2).

Because critical thinking (CT) is essential for successful functioning in one’s personal, educational, and professional life, Kert et al. (2022), Minciu and Dumitru (2023), and Rivas et al. (2023) Precisely, analyzing the results provided by different researchers is what is intended in this part of this article.

Turning attention to Early Childhood Education, it is crucial to establish the need to develop critical thinking given that this concerns a hugely important stage at which students must be able to form arguments and defend their positions. These arguments must be based on information which has been previously acquired or generated by themselves and, at the same time, students must learn to contemplate and respect the opinions of others, even when they are contrary or different to their own opinions (Álvarez and Artigas, 2019). For this, it is crucial to promote imagination, capacity for reflection, debate skills and freedom of opinion. All of this will assist in equipping individuals to be more independent and capable of searching for alternative solutions when confronted with any type of problem (Rollano Vilaboa, 2004; Durán Simón, 2019).

Further, at the Primary Education stage, the development of critical thinking is fundamental to understanding in students (Moreno-Vera, 2018). Above all, this is the case when it is considered that, in the present day, few individuals would fail to recognize that, in current students, the tendency exists to think linearly. This is problematic in a world that demands a type of thinking that is similar to hypertext (nonlinear; Madariaga and Schaffernicht, 2013).

By way of concluding this brief examination of the relationship between the educational stage and the development of critical thinking, focus will now be placed on information garnered from the existing body of evidence on the Secondary Education stage. At this stage, students present huge difficulties when it comes to using, not only critical thinking but, also, all abilities pertaining to higher thinking, such as the ability to analyze, infer, associate, synthesize (Gómez and De la Herrán Gascón, 2018) and construct well-founded personal opinions (Martínez León et al., 2018).

Thus, it can be deduced that the teaching of critical thinking affects the academic life of students, in the sense that it facilitates the acquisition of useful skills. Such skills may include the ability to follow a series of steps in order to perform a complex search for information, the selection and application of reasonable criteria, ability to concentrate on the issue at hand, and persistence when dealing with challenges, amongst many others (Facione, 2007; Gómez, 2015). At

the same time, academic training determines the likelihood that individuals will secure a job position and, subsequently, keep their position in the working world (Boostrs, 2020). In this sense, academic training promotes the development of soft skills, such as effective communication, problem solving, critical thinking, teamwork, adaptability, creativity, coordination, time management, work ethics and negotiation (Vera, 2021).

In recent years, a greater number of research studies have been conducted. These studies have conducted work on the outcomes of applying new methodologies in order to encourage the development of critical thinking within different professional categories and the working world, in general, and in professional training, specifically (Llorens Largo et al., 2017; Frutos Frutos et al., 2019; Loli Quincho, 2020).

Given the impact of the development of this ability in the current occupational setting, many researchers have analyzed its relationship with employability (Tito and Serrano, 2016; Bakhshi et al., 2017; Araya and González, 2019; Rueda and Portilla, 2019; Tseng et al., 2019; Dubey and Tiwari, 2020; Ginting et al., 2020; Hariti and Rejeki, 2020; Keng, 2020; Pluzhnirova et al., 2021) and, more specifically, with different professional categories and professional experience (Andreu-Andrés and García-Casas, 2014) given that, in one way or another, critical thinking is considered to be especially useful and relevant (Passow, 2012). With regards to professional experience, Lopez et al. (2017) argue that better critical thinking is intimately related with greater professional experience (Quintero Vargas and Rodríguez Herrera, 2019; Wang, 2019).

It must be held in mind that many individuals do not find it easy to access the working world. On many occasions, this leads them to find alternative routes to access the job market. This may include volunteering given that, through this route, individuals are able to develop many of the skills they need to become exercising professionals.

Amongst the skills that may be developed through volunteering, the following stand out: experience reality in order to create aware, critical and committed citizens; promote participation in order to create change initiatives and alternative for a fairer and more equal world; develop empathy; favor critical thinking; improve emotional and social intelligence; encourage respect for others by valuing personal identity and enabling personal change (Alvarado Asensio et al., 2019).

Given that they share many similarities with the skills acquired as one obtains professional experience and engages in volunteering, it would not appear to be a bad idea to acquire these competencies as one moves along these same paths, this would include development of critical thinking. It should not be forgotten that many other abilities are inherent to volunteering and are not shared by the job market, although this is also changing (Careaga, 2020), meaning that they are increasingly more aligned (García, 2018; Jiménez Lara, 2021).

These standpoints were developed many years ago and refer to volunteering as an excellent generator of skills and abilities that are valuable to the social fabric, generally, and to business, specifically. In this way, the acquisition of these skills through volunteering will improve employability, above all, in young people (Babušyté, 2019).

Indeed, in some countries, efforts have been made, for a number of years, to put initiatives into practice which seek to identify and certify the skills developed through volunteering. Examples come from Holland (VPL), Scotland (VSkills), Germany (Volun-teeer Pass

and Spain (VOL+, Reconoce and Talante Solidario), with European initiatives also being seen in Youthpass and Europass, which seek to identify developable skills through volunteering (Candela and Ruiz, 2021). Despite this, there is still a long way to go in this respect.

Following analysis of the theoretical framework that forms the basis of the selected variables, the analytical approach taken in the present article is presented, outlining the methodological elements of the conducted research. The aims that serve to guide the present study are as follows:

- a. Determine which of the following variables, namely, educational institution type, gender, educational level, work experience and volunteering are most effective at predicting levels of critical thinking in secondary education students.
- b. Establish student profiles, based on the variables considered to be the most effective predictors, which are capable of distinguishing between high and low levels of critical thinking.

## 2. Materials and methods

### 2.1. Participants

Following a process of convenience sampling, a total of 3.132 participants were recruited to the present study. With regards to sociodemographic variables, 28.4% of surveyed students were undertaking an intermediate vocational training course, another 29.3% were registered on higher level vocational training courses, 3.2% were undertaking basic level vocational training and the remaining 39% were undertaking baccalaureate studies. With regards to the types of participating educational institutions, 90% were state-funded, 9.1% were subsidized and 0.9% were privately-funded. With regards to gender, 1,457 (46.51%) of those surveyed were male and 1,675 (53.48%) were female. Age was distributed between 15 and 58 years, with 80.2% being aged 15–20, 14.6% being aged 20–30 and 5.2% being aged 30 and older ( $M = 20.59$ ,  $SD = 6.75$ ). Of the overall sample, 30% reported being in employment, relative to 69.9% who were not. Finally, 13.3% stated that they were volunteers, compared with 86.5% who stated that they were not.

### 2.2. Method and instrument

The study was carried out in accordance with an *ex post facto* design and employed non-probabilistic, incidental and cross-sectional sampling. A quantitative methodology was employed which established and met requisites for reliability and validity, in this way, ensuring higher study quality.

The instrument used to measure perceptions of critical thinking was based on the scale developed by Lower et al. (2017). This was used to gather the opinions of young people as a function of teamwork ability. This instrument is composed of 10 items whose responses are given along a Likert scale which runs from totally disagree (1) to totally agree (5).

The present study distinguishes between two types of variables. On the one hand, the independent variables or predictors which were, in themselves, made up of different levels:

- a. Educational institution: State-funded, subsidized or privately-funded.
- b. Gender: male or female.
- c. Educational level: basic vocational training, intermediate vocational training, advanced vocational training or baccalaureate.
- d. Work experience: yes or no.
- e. Volunteering: yes or no.

As the dependent variable, the degree of critical thinking was considered. This was operationalized according to two levels by fusing together low and medium levels of critical thinking into a single level and comparing this with high levels of critical thinking.

- a. Low-medium levels of critical thinking: Participants with overall scores  $\leq 40.67^1$  (p-value<sub>66</sub>).
- b. High level of critical thinking: Participants with overall scores  $> 40.67$  (p-value<sub>66</sub>).

### 2.2.1. Reliability and validity of data collection instruments in the present study

The critical thinking questionnaire (CTQ) scale pertains to a previously validated instrument. The instrument, overall, is made up of two sub-scales (Sosu, 2013). On the one hand, the reflective critical thinking sub-scale (CTQ<sub>ref</sub>) is made up of items 1, 6, 7, 8, 9, 10 and 11 and, on the other hand, the executive critical thinking sub-scale (CTQ<sub>exe</sub>) is made up of the items 2, 3, 4 and 5.

With regards to reliability, internal consistency was estimated according to Cronbach's  $\alpha$  and McDonald's  $\omega$  coefficients. In the case of concurrent validity, corrected item-total correlation coefficients were calculated. Outcomes for all of these tests are presented and discussed below.

As can be seen in the Table 1 presented immediately prior to the Cronbach  $\alpha$  and McDonald's  $\omega$  reliability coefficients, moderately strong internal consistency is demonstrated for the CQT scale both overall and according to the two sub-scales that make it up (McDonald, 1999; Katz, 2006). With regards to the CTQ overall (critical thinking questionnaire), a Cronbach  $\alpha$  of 0.770 and a McDonald's  $\omega$  of 0.825 were produced. In consideration of the individual sub-scales, the reflective CTQ sub-scale obtained a Cronbach  $\alpha$  of 0.720 and a McDonald's  $\omega$  of 0.729. Finally, the executive CTQ sub-scale obtained a Cronbach  $\alpha$  of 0.683 and a McDonald's  $\omega$  of 0.701. All of these results indicate that minimally acceptable Cronbach  $\alpha$  and McDonald's  $\omega$  values were produced (Zumbo et al., 2007).

Finally, with regards to criterion validity, corrected item-total correlations or item-rest correlation were calculated. In all cases,  $r > 0.35$  was obtained, both for the scale overall and for each of the individual sub-scales.

TABLE 1 Reliability outcomes pertaining to the scale/sub-scales.

CTQ subscale and overall scores	Cronbach's $\alpha$	McDonald's $\omega$
CTQ <sub>ref</sub>	0.720	0.729
CTQ <sub>exe</sub>	0.683	0.701
CTQ	0.770	0.825

Developed by the authors.

## 2.3. Research design and procedure

Data collection was performed during the 2020–2021 academic year, starting in November 2020 and finishing in June 2021. The process of data collection was initiated following the receipt of authorization from the Andalusian Education Authority. Once permission was obtained, members of the research team proceeded to contact the directors of the institutions, via email, and, once permission from the institution was obtained, the questionnaire was administered to students in person. During questionnaire administration, the voluntary and anonymous nature of the study was indicated and its purpose and aims were described. Likewise, approval was received from the Research Ethics Committee of the University of Granada (reference number: 1678/CEIH/2020). Data collection in each group-class took approximately 20–30 min and took place prior to the end of class. A member of the research team was present at all times to respond to any potential doubts to arise during the process.

## 3. Results

In order to analyze collected data, the program SPSS v. 26 was used. This program was used to conduct various types of multivariate analysis which served to address proposed research aims. The outcomes of these analyses are presented next.

### 3.1. Binary regression analysis

In order to address research, aim 1, binary regression analysis was conducted in which critical thinking provided the dependent variable, with this being divided into two levels (low-medium CT and high CT). Educational institution type, gender, educational level, work experience and volunteering were considered as predictors of each of the included variables. This approach was chosen over other potential approaches (such as multiple linear regression, etc.) due to the fact that it is ideal for the development of profiles, the formation of which was a later intention of the present study. Profiles were to be later established, via a segmentation technique (chi-squared automatic interaction detection [CHAID]), in order to address research aim number 2.

The binary logistic regression model was developed using forward step (Wald) estimation. Nonetheless, before proceeding to discuss the outcomes obtained from this analysis it is important to indicate that the appropriateness of this analysis was examined prior to its estimation (assumption checks). Firstly, the absence of collinearity was confirmed according to the tolerance index, alongside the reciprocal variance inflation factor (VIF) in Table 2. For all considered predictors,

<sup>1</sup> Minimum scale score=11, maximum scale score=55. First group (low CT group  $\leq 25.33$  or p-value<sub>33</sub>), second group (medium CT group: between 25.34 and 40.67 or values of between P<sub>33</sub> and P<sub>66</sub>) and third group (high CT group  $> 40.67$  or  $> P_{66}$ ).



TABLE 2 VIF and tolerance values pertaining to examined predictors.

Predictors	VIF	Tolerance
Academic institution type	1.01	0.989
Gender	1.02	0.978
Level education	1.05	0.950
Work experience	1.06	0.939
Volunteering	1.04	0.963

tolerance values close to 0.9 were obtained, in addition to VIF that were slightly above 1.

In consideration of suggestions made by Chatterjee and Simonoff (2013) and Belsley (1991) to inform interpretation, VIF values <10 and tolerance values close to one indicate the absence of collinearity. From this, it can be concluded that assumptions were met for all predictors.

As another important aspect, a number of statistics were also calculated that provide information about the fit of the final model as inferred in step 3. Firstly, the outcome of the Hosmer-Lemeshow test ( $\chi^2 = 5.50, df = 6, p = 0.481$ ) was associated with a value of  $p > 0.05$ . This indicated good fit given that it shows the absence of statistically significant differences between that predicted by the finally inferred model in step 3 and actual data. The McFadden's R2 also produced a fit value of 0.18, while this value is not excellent, it can be considered as moderately indicative of fit (McFadden, 1974). Finally, and with regards to the efficacy of the predictive model, it can be seen that the proportion of accurately predicted cases by the model reaches almost 64%. The next figure corresponds to the predicted probabilities produced in step 3 (the final step of model development). Using a cut-point of 0.5, it can be seen that the left-hand side of the figure is completely empty, with all correctly or incorrectly predicted cases being produced in the right-hand side. The majority of cases are associated with the symbol h (correct), as opposed to the symbol l (incorrect). Indeed, correctly predicted cases pertain exclusively to observed high CT vs. predicted high CT, with  $1972/3090 = 0.683 \times 100 = 63.8\%$ .

Following confirmation that data met required assumptions and examination of model fit, model outcomes were examined and the main outcomes are presented here.

Considering the table presented above (Table 3) and turning attention to the final step (step 3), it can be appreciated that the final model comprises 3 predictors (educational level, work experience and volunteering), with the 2 outstanding predictors (educational institution type and gender) being eliminated.

In this way, the logistic regression equation for the final model contained an intercept or constant of  $\beta_0 = 1.469 (p < 0.001)$ , alongside three predictors with the following slopes:  $\beta_1 = 0.162$  (educational level),  $\beta_2 = 0.435$  (work experience) and  $\beta_3 = 0.346$  (volunteering). The three predictors were associated with statistically significant Wald statistics ( $p = 0.000$ ). For this reason, they were included in the final model as effective predictors. This means that lower levels of education are associated with low-medium levels of critical thinking, while high education is associated with high levels of critical thinking. In the same way, identical outcomes were obtained for work experience and volunteering, in the sense that students with work experience and experience of having volunteered had higher critical thinking and vice versa. For this reason and in order to address the second proposed

TABLE 3 Binary logistic regression model.

		B	SE	Wald	df	Sig.
Step # 1:						
Predictors	Work experience	-0.405	0.084	23.185	1	0.000***
	Constant	1.261	0.150	70.761	1	0.000***
Step # 2:						
Predictors	Educational level	0.168	0.043	15.622	1	0.000***
	Work experience	0.473	0.086	30.181	1	0.00***
	Constant	0.866	0.180	23.178	1	0.000***
Step # 3:						
Predictors	Educational level	0.162	0.043	14.436	1	0.000***
	Work experience	0.435	0.087	24.991	1	0.000***
	Volunteering	0.346	0.119	8.455	1	0.004***
	Constant	1.469	0.276	28.295	1	0.000***

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

research aim, outcomes obtained following application of profile classification or decision-tree techniques (chi-squared automatic interaction detection [CHAID]) will now be presented. Following identification of the most effective predictors of critical thinking, the next step was to determine the type of student profile associated with low-medium critical thinking and the type of profile associated with high critical thinking.

### 3.2. CHAID decision tree outcomes

Configuration of the inferred model using CHAID analysis, with regards to the growing method, dependent variable, etc., was as shown in Table 4.

As shown in the figure presented immediately above (Figure 1), the model, in line with the outcomes produced by the binary logistic regression, includes the 3 aforementioned predictors, namely, work experience, educational level and volunteering. If node 0 is included, a total of 7 nodes emerge from which two clearly delineated profiles can be outlined.

In the left hand-side of the treemap, profile 1 is presented, constituted by nodes 1, 3 and 4. In the right hand-side of the treemap, profile 2 is found, made up of nodes 2, 5 and 6. Node 1 pertains to students who lack work experience, relative to node 2 which pertains to students who have work experience. Significance testing (Bonferroni  $\chi^2$ ) of differences between the percentages obtained for each category of the dependent variable (pertaining to levels of critical thinking) produced an empirical value of  $\chi^2 = 22.879 (df = 1; \text{adj.} = 0.000)$ . This first deviation denotes that 38.80% of students without previous work experience reported low-medium levels of critical thinking, relative to 29.9% of students with work experience. On the other hand, 61.2% of those without work experience reported low-medium critical thinking, relative to 70.1% of those with work experience.

Within profile 1, a marked difference is found between students as a function of work experience. Within this profile, students are found who do not have previous work experience, with educational

TABLE 4 Analysis specifications using the CHAID technique.

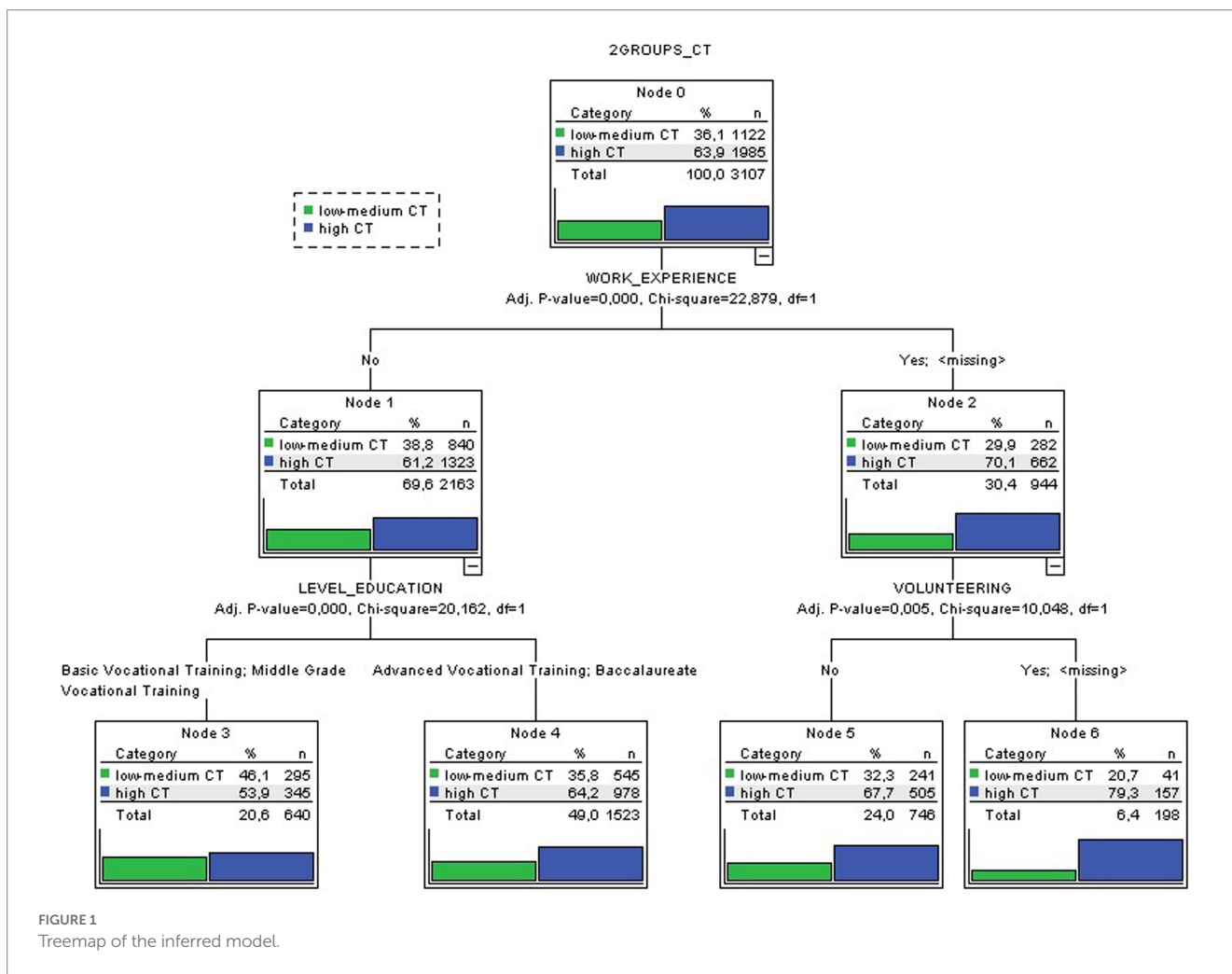
Specifications	
Growing method	CHAID
Dependent variable	Level CT (2 groups CT)
Independent variable	Gender, educational institution type, educational level, work experience, and volunteering
Validation	None
Maximum tree depth	3
Minimum cases in parent node	100
Minimum cases in child node	50

Results	
Included independent variable	Educational level, work experience, and volunteering
Number of nodes	7 (when node 0 is computed)
Number of terminal nodes	4
Depth	2

level also being a differentiating factor (nodes 3 and 4). In this sense, it can be observed that a higher proportion (46.1%) of those with lower educational levels, pertaining to basic vocational training and intermediate vocational training, report low-medium levels of critical thinking, relative to 35.8% of students with higher educational levels (advanced vocational training and baccalaureate) who, in contrast, more frequently reported high levels of critical thinking (53.9% of those with a low educational level vs. 64.2% of those with a high educational level). This was associated with an empirical value of  $\chi^2 = 20.162$  (df = 1; padj. = 0.000).

Outcomes for profile 2 showed a large degree of difference from the outcomes discussed above. This profile was composed of students who did possess work experience and tended to report high levels of critical thinking. Within this profile, a further deviation in the data is found which originates from nodes 5 and 6. Taking a closer look, it can be observed that students who start out having already engaged in a form of occupational activity and, further, have experienced volunteering tend to report higher levels (low-medium CT = 20.7% vs. high CT = 79.3%) of critical thinking than those who have not had this aforementioned experience (low-medium CT = 32.30% vs. high CT = 67.70%). These findings are further supported by an empirical value of  $\chi^2 = 10.048$  (df = 1; padj. = 0.005).



With regards to the goodness of fit of the produced model, two indicators were considered in accordance with recommendations laid out by [Rokach and Maimon \(2008\)](#). On the one hand, the predictor denominated risk was estimated and produced a value of 0.362 (equivalent to the proportion of incorrectly classified cases) associated with a standard error of 0.009. On the other hand, the proportion of correct predictions (accuracy) achieved by the model was examined. In total, 63.8% of cases were correctly classified, this being identical to that achieved through binary logistic regression.

## 4. Discussion and conclusions

The analysis conducted in the present study was deemed appropriate following confirmation that data collected from the sample met pertinent assumptions. Outcomes demonstrated that the variables of educational level, work experience and volunteering predicted levels of critical thinking. Other studies have also pointed to the importance of the relationship between critical thinking and the educational stage variable. These studies include those conducted by [Rollano Vilaboa \(2004\)](#), [Madariaga and Schaffernicht \(2013\)](#), [Gómez and De la Herrán Gascón \(2018\)](#), [Martínez León et al. \(2018\)](#), [Moreno-Vera \(2018\)](#), [Álvarez and Artigas \(2019\)](#), [Durán Simón \(2019\)](#), and [Arce Saavedra \(2021\)](#).

The analysis carried out also demonstrated that variables pertaining to educational institution type and gender do not predict associations formed with critical thinking. In contrast, [Cunalema Fernández and Reyes Ojeda \(2019\)](#) did find a relationship between critical thinking and the type of educational institution attended by students. The reasons why in our sample it is possible that we have not detected this relationship with respect to the type of institution, is because this variable has homogeneous characteristics, since the methodologies used in the surveyed institutions are similar. All the centers follow the same curriculum with similar general development guidelines both in methodology and in evaluation. The same thing happens with the gender variable, since the programs used are based on equal opportunities and all the centers surveyed were mixed schools, so there are no differences because the same pedagogy is taught to the class group without any type of role distinction.

The present research demonstrated that lower levels of education are related with low-medium levels of critical thinking. In contrast, therefore, higher levels of education are related with higher levels of critical thinking. The same outcome was uncovered with regards to work experience and whether or not individuals engaged in volunteering. Specifically, volunteers exhibited higher levels of critical thinking. Some authors have already indicated that critical thinking may be crucial in the occupational setting ([Vargas et al., 2020](#)) and may also contribute to longevity in this ambit ([Suárez, 2019](#)). When there is a high educational performance, which, although it is related to the qualification based on educational performance, is associated with more innovative and active methodologies, these methodologies imply mental processes in the students of reasoning, debate, attention, etc., that is to say, more executive functions, which therefore, the greater the promotion of these executive functions within thought, there is a better academic result and which concludes in an empowerment of critical thinking.

It is important to consider this finding given the importance of critical thinking as an essential competence in the present day ([Jiménez-Aleixandre, 2010](#); [Solbes et al., 2010](#); [Díaz Moreno and Jiménez Liso, 2011](#); [Solbes and Torres, 2013](#)). Addressing the aim of

the present work, two profiles emerged from the analysis. On the one hand, profile 1 revealed that students without work experience are significantly differentiated from those with this type of experience, with differences also found as a function of educational level. To this end, students with higher levels of critical thinking also had higher levels of education, while students with low-medium levels of critical thinking had lower levels of education.

On the other hand, with regards to profile 2, this was made up by students who had work experience and high levels of critical thinking. In this profile, a deviation is also found in which students emerge who have work experience and have volunteered, with these students also showing higher levels of critical thinking than those lacking this experience.

The present findings are relevant as they demonstrate the need to work to develop critical thinking within the educational system and throughout life. This is important because it is an ability that is considered to be hugely important in the present day. Variables must also be considered which were shown, in the present study, to influence critical thinking. These variables include educational level, work experience and volunteering. These variables should be considered in future studies, in addition to in didactic resources focused on improving critical thinking and, even, in future professionals seeking to enter and/or remain active within the job market.

In relation to the limitations of this study, the procedure of data collection, as explained in this article, was long and we had to work carefully to do it correctly and anonymously. As future lines or research, authors would like to do this research in other cities and address more sample at different educative stages.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by the Research Ethics Committee of the University of Granada (reference number: 1678/CEIH/2020). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

## Author contributions

All authors worked on all parts of the manuscripts. First collecting data and with the idea, then analyzing them, writing this report and the reviewing and changing it whenever it was necessary.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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