



# The relationship between critical thinking dispositions and problem-solving abilities of Portuguese undergraduate students

Eva Morais<sup>1</sup>, José Lopes<sup>2</sup>, Felicidade Morais<sup>3</sup> and Helena Silva<sup>4</sup>

<sup>1</sup>Department of Mathematics, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal & Centre of Mathematics (CMAT), University of Minho, Portugal (ORCID: 0000-0002-3815-9821)

<sup>2</sup>Department of Education and Psychology, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal & The Centre for Research and Intervention in Education (CIE), University of Porto, Portugal (ORCID: 0000-0002-6845-8371)

<sup>3</sup>Department of Letters, Arts and Communication, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal & Center for Studies in Letters (CEL), University of Trás-os-Montes e Alto Douro, Vila Real, Portugal (ORCID: 0000-0001-5772-8930)

<sup>4</sup>Department of Education and Psychology, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal & The Centre for Research and Intervention in Education (CIE), University of Porto, Portugal (ORCID: 0000-0003-2855-9634)

**Corresponding Author:** Eva Morais, [emorais@utad.pt](mailto:emorais@utad.pt)

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## Abstract

Critical thinking and problem-solving are widely recognized as essential skills for success in the 21st century. However, research exploring the association between the critical thinking dispositions of higher education students and their perceived problem-solving abilities remains limited. This study aims to analyze the relationship between these constructs and to examine the potential influence of demographic and academic factors such as age, gender, and study field. A cross-sectional study was conducted with 412 undergraduate students from a Portuguese public higher education institution, representing two study fields: Health and Welfare, and Social Sciences. Data were collected using the Critical Thinking Dispositions Scale and the Portuguese adaptation of the Problem-Solving Inventory. Statistical analyses were performed to examine associations and predictive effects among the variables. Findings suggest a highly significant association between students' critical thinking dispositions and their perception of problem-solving abilities. Among the demographic and academic variables considered, only gender emerged as a significant predictor of critical thinking dispositions. No significant differences were found between students in their PSI scores. These results highlight the importance of promoting critical thinking dispositions in higher education as a means to enhance students' problem-solving abilities. The study reinforces the need for pedagogical strategies that intentionally foster these competencies and calls for further research to deepen understanding of their interrelations across diverse educational contexts.

**Keywords:** Critical thinking dispositions; Cross-sectional study; Higher education students; Problem-solving abilities

## 1. Introduction

In addition to possessing excellent academic credentials, individuals must also have other higher-order skills and be willing to utilize them to succeed in today's society, where problems are highly complex, and the nature of information is constantly and rapidly changing, as reflected in their work profile. Critical thinking and problem-solving are among the skills that several international and academic organizations (European Commission, 2016; OECD, 2018) have identified as essential for citizens to succeed in all areas of life in the 21st century. Valuing these skills has implications in the educational field, requiring higher education institutions to aim centrally at developing students' critical thinking and problem-solving skills (Güven & Kürüm, 2008; Küçük & Uzun, 2013; OECD, 2018; Özsoy-Güneş et al., 2015; Polat & Tümkaya, 2010; Tümkaya et al., 2009). These skills enable students to consider and examine different opinions and perspectives, make informed decisions, and find more effective alternatives to solve the problems they face in their professions and daily lives as citizens.

Critical thinking is a necessary skill for problem-solving (Kök & Duman, 2023; Rizki et al., 2024; Tapper, 2014). Problem-solving requires a high level of cognitive effort, and a good problem solver should possess higher-order thinking skills, such as critical thinking (Bimbim et al., 2026; Boso et al., 2021; Kludze, 2026). McPeck (2016) argues that individuals with critical thinking skills can make critical reflections, understand problems clearly, and make decisions by connecting with their prior knowledge and using the acquired knowledge effectively. According to Buku et al. (2016) and Kozikoğlu (2019) critical thinking is essential for solving problems and problem-solving enhances the application of critical thinking. However, this does not mean that possessing critical

thinking and problem-solving skills enables one to have an immediate response to situations or problems; instead, both skills provide the ability to evaluate problems and find solutions in a reasonable amount of time (Hill-Briggs et al., 2006).

### 1.1. Critical Thinking

Critical thinking has several definitions. For Facione (1990, p. 3), it is "intentional, self-regulated thinking that results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidence, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based". According to Elder and Paul (2013), critical thinking involves using appropriate standards of evaluation to reach a well-formulated judgment, thinking openly, and attempting to discern the genuine concern, virtue, or value of something. In 1987, Ennis included, in addition to cognitive skills (the cognitive component), the dispositions (the motivational component) in the definition of critical thinking.

This position, commonly assumed by different authors, implies that a good critical thinker must possess both critical thinking skills and dispositions (Ennis, 1987, 1996; Facione, 1990; ten Dam & Volman, 2004). In other words, critical thinking requires more than the use of skills in different contexts: it requires the dispositions (attitudes) necessary to elaborate the reasoning inherent to the use of these skills (Halpern, 2014). That is, even though individuals possess critical thinking skills, they may decide not to use them.

Dispositions are a consistent internal motivation that determines engagement in problem-solving. They involve the predisposition, desire, willingness, and tendency for the individual to use his/her critical thinking skills to solve problems (Dwyer, 2017; Facione, 2000; Nieto & Valenzuela, 2012). That is, individuals who are willing to use their critical thinking skills have critical thinking dispositions (Tishman et al., 1993). Critical thinking dispositions are crucial from the perspective of transferability and long-term use of critical thinking (Mousazadeh et al., 2021; Pu et al., 2019).

These dispositions include truth-seeking, open-mindedness, confidence in reasoning, analytical and systematic thinking, curiosity, persistence, flexibility, and cognitive maturity (Dwyer, 2017; Ennis, 1996; Facione et al., 1994; Halpern, 1998). Individuals with these traits question ideas before accepting them and analyze information systematically to identify accurate information and solutions (Ruggiero, 2014).

### 1.2. Problem-Solving

There are many definitions of problem-solving, some emphasizing the cognitive dimension, others the behavioral, and still others valuing the cognitive, affective, and behavioral dimensions. It is in this perspective that Heppner and Krauskopf (1987) consider problem-solving to be a process involving highly complex, often recurrent, cognitive, affective, and behavioral operations that attempt to respond to what are usually stressful internal and external demands. For the OECD, problem-solving is "An individual's capacity to engage in cognitive processing to understand and resolve problem situations where a method of solution is not immediately obvious. It includes the willingness to engage with such situations to achieve one's potential as a constructive and reflective citizen" (OECD, 2014, p. 30). Similar to the importance of critical thinking skills, the affective dimension is also recognized in problem-solving. In both proposals, the importance of dispositions in the problem-solving process is highlighted.

The primary goals of problem-solving are to help individuals identify problems as causes, recognize the resources available to them to confront their difficulties, find a systematic method to deal with and overcome current and future problems, and implement a sense of control over these problems (D'Zurilla et al., 2004; Orhani & Alija, 2026). A problem is a conflict situation that arises when an individual is unable to find an immediate solution based solely on their current knowledge, which hinders their ability to achieve their goals (Bransford & Stein, 1993).

An individual's problem-solving ability is shaped by their beliefs and expectations about how to tackle problems. Individuals with positive perceptions of their problem-solving abilities may be

more effective at problem-solving than those with negative perceptions of that ability. In other words, perceived problem-solving ability plays a central role in how an individual perceives and experiences various aspects of problem-solving (Sulaiman, 2013). Studies in the related literature (e.g., Demir, 2022; Halpern, 2014; Memduhoğlu & Keleş, 2016; Meyers, 1986; Sternberg, 1985) suggest that individuals with dispositions to utilize their critical thinking skills can solve problems effectively. Dispositions of critical thinking foster problem-solving and decision-making (Boran & Karakuş, 2022; Giancarlo & Facione, 2001; Mehrabian et al., 2025; Orhan, 2022).

Besides the relationship between critical thinking dispositions and perceived problem-solving abilities, some empirical studies have considered the relationship with socio-demographic variables (mainly age and gender) and academic variables (such as field of study, academic level, and achievement). Most of these studies relate these variables to critical thinking dispositions (Lopes et al., 2021) or problem-solving skills (Akyol & Akdemir, 2019; Güleç, 2020). Tumkaya et al. (2009), in their study of university students, identified a significant relationship between critical thinking dispositions and perceived problem-solving abilities, as well as differences associated with gender, field of study, and academic year.

Studies involving pre-service teachers further reinforce these findings. Memduhoğlu and Keleş (2016) observed a moderately positive correlation between critical thinking tendency and perceived problem-solving abilities. Comparable results were reported by Ocak and Eǧmir (2016), who identified a significant positive relationship between these variables. These authors also found that problem-solving skills vary according to the level of critical thinking dispositions. However, no differences emerged when considering the combined effects of gender, field of study, and academic year.

Similarly in nursing, research on the relationship between critical thinking dispositions and problem-solving skills has produced mixed findings. Erzincanli and Zaybak (2015) reported a significant but low-level correlation between the two constructs among nurses, suggesting that critical thinking may contribute to problem-solving, albeit modestly. However, Erkus and Bahcecik (2015) found no significant association, indicating that this relationship may not consistently emerge across contexts or samples. In contrast, Kim and Han (2016) identified a strong, high-level correlation, highlighting that in some settings critical thinking dispositions appear to play a substantial role in nurses' problem-solving abilities.

Taken together, the literature review reveals that studies examining the relationship between critical thinking dispositions and problem-solving skills, as well as demographic and academic variables, have yielded contradictory results. It was also found that these studies have been carried out mostly with participants in the areas of nursing and teacher training. On the other hand, it was concluded that there are few studies that analyze the influence of critical thinking dispositions on the perception of problem-solving skills. These findings, together with the fact that there are no studies in Portugal that relate critical thinking dispositions to the perception of problem-solving abilities, nor studies that relate dispositions and problem-solving skills to demographic and academic variables, justify the need to conduct studies that can contribute to clarifying the relationships between all these factors.

Based on these considerations, the following hypotheses were advanced:

H1. Students' critical thinking dispositions differ significantly by gender.

H2. Students' perceived problem-solving abilities differ significantly by gender.

H3. Students' critical thinking dispositions differ significantly according to their field of study.

H4. Students' perceived problem-solving abilities differ significantly according to their field of study.

H5. Students' critical thinking dispositions differ significantly by year of course.

H6. Students' perceived problem-solving abilities differ significantly by year of course.

H7.A significant relationship exists between students' critical thinking dispositions and their perceived problem-solving abilities.

H8. Academic and demographic variables (gender, field of study, year of course, and other academic factors) significantly predict students' critical thinking dispositions and perceived

problem-solving abilities.

## 2. Method

### 2.1. Research Design

Drawing on a quantitative research approach (Creswell, 2014), a descriptive, cross-sectional study was designed to analyze the critical thinking dispositions and the perception of problem-solving abilities of Portuguese undergraduate students at a single point in time, as well as the association between both variables regarding participants' gender, age, and study field.

### 2.2. Participants

The participants in this study were from a convenience sample of 412 undergraduate students of Social Sciences study programs, composed by 163 Psychology students (39.5%), 108 Social Work students (26.2%), Communication Sciences students (13.8%), 48 Languages and Business Relations students (11.7%), 18 Psychomotor Rehabilitation students (4.4%), and 18 Sociocultural Animation (4.4%). Most of the students were female (346 students, 84.0%) and their age ranged from 18 to 60 years ( $M = 20.8$ ,  $SD = 5.21$ ). Regarding the students' academic year (the course program's year they are attending), 140 (34.0%) were first year students, 158 (38.3%) were second year students, and 114 (27.7%) students were in the third and final curricular year of their study program.

According to their study program, participants were assigned into the two broad fields specified by the ISCED-F 2013 international classifications (UNESCO, 2015): health and welfare (144 students, 35.0%) and social sciences, journalism and information (268 students, 65.0%).

This study employed non-probability convenience sampling, which restricts the generalizability of the findings. Because participants were selected based on availability and willingness to participate, the sample may not accurately represent the wider student population, introducing sampling and self-selection biases. The absence of randomization also limits internal validity, as uncontrolled differences among participants may influence the observed relationships. Additionally, the reliance on convenience sampling may reduce the reliability and replicability of the results. These limitations should be considered when interpreting the study's conclusions.

### 2.3. Data Collection

Two instruments were used for data collection, namely the Critical Thinking Dispositions Scale [CTDS] (Lopes et al., 2021), and the Problem Solving Inventory [PSI] (Heppner, 1988). The CTDS was recently proposed and validated for the Portuguese higher education students' population ( $\alpha = .939$ ; Lopes et al., 2021). It consists on a 5-point Likert scale of 35 items with a seven-factor structure based on the 7 well-known critical thinking dispositions that stemmed from the American Psychology Association [APA] Delphi study, which has later contributed to the design of the California Critical Thinking Dispositions Inventory [CCTDI] (Facione, 1990; Facione & Facione, 1992; Facione et al., 1994, pp. 4-5): Inquisitiveness, Systematicity, Analyticity, Truth-seeking, Open-mindedness, Self-confidence, and Cognitive Maturity. The total score in the CTDS ranges between 70 and 350 points, with each disposition score between 10 and 50 points. Lopes et al. (2021) established cutoff points for the score on the scale, rating the individuals with high disposition toward critical thinking if he/she has a EDPC score equal or greater than 280, positive disposition if he/she has a score between 210 and 279.9, an ambivalent disposition if he/she has a score between 140 and 209.9, and has a low disposition/opposes to critical thinking if scored below 140 points. The corresponding cutoff points for the score on each subscale are 39, 30, and 20 points. The Cronbach's alpha observed for the 412 participants was .93 and the subscales' alphas ranged from .55 – .79.

The Problem Solving Inventory (Heppner, 1988) is a 35-item instrument (3 filler items), and adapted to Portuguese by Ferreira (Ferreira, 2009), that measures the individual's perceptions regarding one's problem-solving abilities and problem-solving style in the everyday life. As such, it measures a person's appraisals of one's problem-solving abilities rather than the person's actual problem-solving skills. It consists of three factors, thus yielding three separate subscales. Problem-

Solving Confidence (11 items) assesses self-perceived confidence, belief and self-assurance in effectively solving problems (e.g., "I am usually able to think up creative and effective alternatives to solve a problem."). Higher scores on PSC are associated with lower levels of problem-solving confidence. Approach-Avoidance Style (16 items) assesses whether individuals tend to approach or avoid problems (e.g., "When a solution to a problem was unsuccessful, I do not examine why it didn't work."). Higher scores reflect a style of avoiding rather than approaching problems. Personal Control (5 items) assesses elements of self-control on emotions and behavior (e.g., "I make snap judgments and later regret them."). Higher scores on PC reflect a more negative perception of personal control on one's problems. All items are scored on a six-point Likert scale, ranging from 1 = Strongly Agree to 6 = Strongly Disagree. A total score can be calculated as a general index of problem-solving appraisal that ranges from 32 to 192. Lower scores on each factor and on the total PSI score are considered more functional. Students are rated as having a high perception of problem-solving if their PSI score is up to 75, middle/moderate if their PSI score is between 76 and 100, and low if their PSI score is above 100 points (Veerasingam et al., 2019). The Cronbach's alpha was .89 and the factors' alphas ranged from 0.77-0.85. A confirmatory factor analysis was conducted to test the three-factor structure of the PSI obtained by Ferreira (2009). The chi-square test was significant ( $\chi^2(461)=2721.0, p < .001$ ) which is expected in the presence of large samples. We concluded that there was a moderate fit with the model according to the fit values (RMSEA=.11, CFI=.92, GFI=.95) and the factor loadings (ranged from .32 to .82, all significant).

Both instruments were included in an online self-completion questionnaire made available to participating students. Data was collected in the classroom with the supervision of the faculty teachers involved in the study.

## 2.4. Data Analysis

The data analysis was carried-out using IBM SPSS Statistics (v.25) and JASP (v.0.16.3). The comparison of the scores obtained by different groups of students in the scales was performed through t testing and analysis of variance [ANOVA]. Hierarchical multiple regression models were used in order to identify predictors of the total CTDS and PSI scores. The validity of all the assumptions required for the statistical analyses performed were confirmed.

## 3. Results

The data indicate a high level of internal consistency of the CTDS ( $\alpha = .934$ ) and of the PSI ( $\alpha = .891$ ). All the items of each subscale of the CTDS and of the PSI are positively correlated. The correlations with the total of the respective subscale and scale are statistically significant: the correlations between the CTDS items score and the total score ranged from 0.483 and 0.875, and the correlations between the PSI items score and the total score ranged from 0.270 and 0.843.

Table 1 presents the descriptive statistics for the CTDS and PSI.

Table 1

*Description of results in CTDS and PSI (N = 412)*

<i>Scale and categories</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>%</i>
CTDS				
High disposition	302.629	17.8926	247	60
Positive disposition	261.009	16.0372	160	38.8
Ambivalent	184.460	23.5778	5	1.2
PSI				
High perception	66.18	8.298	72	17.5
Moderate perception	88.35	7.053	204	49.5
Low perception	111.81	8.842	136	33.0

Students showed a high average disposition toward critical thinking (M = 285.0, SD = 28.8). Most students were classified as having a high disposition (60.0%), followed by a positive disposition (38.8%), while only 1.2% were ambivalent.

Regarding the PSI, students' average perception of their problem-solving ability was moderate

( $M = 92.2$ ,  $SD = 17.8$ ). About half of the students showed a moderate perception (49.5%), whereas 17.5% showed a high perception and 33.0% a low perception.

The participants' CTDS and PSI scores, categorized by gender, are presented in Table 2.

Table 2

Results according to participants' gender

	Male (N = 66)		Female (N = 346)		
	M	SD	M	SD	
CT Truth-seeking	41.6	6.00	43.7	4.89	$t(410)=-3.09, p=.002, d=-0.415$
CT Open-mindedness	40.0	5.44	41.6	4.70	$t(410)=-2.54, p=.011, d=-0.341$
CT Analyticity	39.8	4.84	41.0	5.31	$t(410)=-1.65, p=.099, d=-0.222$
CT Systematicity	39.5	5.05	40.8	4.86	$t(410)=-2.06, p=.040, d=-0.277$
CT Self-Confidence	36.2	5.02	36.7	5.30	$t(410)=-0.69, p=.491, d=-0.093$
CT Inquisitiveness	39.8	5.28	41.6	4.62	$t(410)=-2.96, p=.003, d=-0.397$
CT Cognitive Maturity	40.0	5.55	41.1	5.04	$t(410)=-1.60, p=.111, d=-0.214$
Total CTDS	276.9	30.4	286.6	28.3	$t(410)=-2.53, p=.012, d=-0.340$
PSI Confidence	29.7	6.14	30.6	6.35	$t(410)=-1.01, p=.312, d=-0.136$
PSI Approach/Avoidance	21.8	5.58	21.2	6.13	$t(410)=0.68, p=.499, d=-0.091$
PSI Personal Control	39.9	10.1	40.6	9.79	$t(410)=-0.48, p=.629, d=-0.065$
Total PSI	91.4	17.2	92.4	17.9	$t(410)=-0.40, p=.691, d=-0.053$

The analysis using a *t*-test showed that female students had significantly higher dispositions toward critical thinking than male students in the total CTDS and in dispositions of truth-seeking, open-mindedness, inquisitiveness, and systematicity. Regarding the students' perception of their problem-solving abilities, there was no significant difference in the average scores of males and females on the PSI score and its subscales. The effect size estimates, expressed as Cohen's *d*, were small across the CTDS total and dimensions ( $|d|$  ranging from 0.214 to 0.415), and negligible for CT Self-Confidence ( $|d| = 0.093$ ). Likewise, for the PSI total and dimensions, the effect sizes were very small ( $|d|$  ranging from 0.053 to 0.136).

The results in the scales according to the students' study field are presented in Table 3.

Table 3

Results according to participants' study field

	Social Sciences, Journalism and Information (N=268)		Health and Welfare (N=144)		
	M	SD	M	SD	
CT Truth-seeking	43.3	5.22	43.4	5.00	$t(410)=-0.32, p=.745, d=-0.034$
CT Open-mindedness	41.0	4.82	42.0	4.87	$t(410)=-2.04, p=.041, d=-0.211$
CT Analyticity	40.7	5.34	41.1	5.08	$t(410)=-0.81, p=.418, d=-0.084$
CT Systematicity	40.6	5.00	40.7	4.76	$t(410)=-0.26, p=.799, d=-0.026$
CT Self-Confidence	36.9	5.12	36.0	5.47	$t(410)=1.72, p=.086, d=0.178$
CT Inquisitiveness	41.3	4.93	41.4	4.48	$t(410)=-0.231, p=.817, d=-0.024$
CT Cognitive Maturity	41.0	5.30	40.8	4.83	$t(410)=0.36, p=.720, d=0.037$
Total CTDS	284.8	29.5	285.5	27.7	$t(410)=-0.25, p=.802, d=-0.026$
PSI Confidence	30.0	6.16	31.3	6.54	$t(410)=-2.04, p=.042, d=-0.211$
PSI Approach/Avoidance	21.2	5.96	21.5	6.21	$t(410)=-0.40, p=.69, d=-0.041$
PSI Personal Control	39.8	10.2	41.7	9.02	$t(410)=-1.89, p=.059, d=-0.196$
Total PSI	91.0	17.8	94.5	17.4	$t(410)=-1.91, p=.057, d=-0.197$

These results show that there were no significant differences between the scores in the CTDS and dispositions subscales obtained by students of the two study fields, and the Health and Welfare students had a significantly higher average score in their confidence to solve problems than students of Social Sciences, Journalism and Information. The effect sizes were small or very

small for all dimensions of CTDS ( $|d|$  ranging from 0.024 to 0.211) and for all dimensions of PSI ( $|d|$  ranging from 0.041 to 0.211).

Table 4 presents the students' scores in CTDS and PSI by academic year.

Table 4

Results according to participants' academic year

	1 <sup>st</sup> year (N=140)		2 <sup>nd</sup> year (N=158)		3 <sup>rd</sup> year (N=114)		
	M	SD	M	SD	M	SD	
CT Truth-seeking	43.6	5.45	43.4	5.04	42.9	4.88	$F(2,409)=0.69$ , $p=.502$ , $\eta^2=.003$
CT Open-mindedness	41.6	4.72	42.0	4.89	40.3	4.84	$F(2,409)=4.26$ , $p=.015$ , $\eta^2=.020$
CT Analyticity	40.9	5.33	41.2	5.36	40.3	4.99	$F(2,409)=0.93$ , $p=.397$ , $\eta^2=.005$
CT Systematicity	40.9	4.87	40.8	5.08	40.0	4.71	$F(2,409)=1.20$ , $p=.303$ , $\eta^2=.006$
CT Self-Confidence	36.5	4.84	36.6	5.70	36.8	5.16	$F(2,409)=0.08$ , $p=.927$ , $\eta^2<.001$
CT Inquisitiveness	41.4	4.77	41.6	4.80	41.0	4.76	$F(2,409)=0.61$ , $p=.544$ , $\eta^2=.003$
CT Cognitive Maturity	41.0	5.12	40.9	5.35	40.8	4.87	$F(2,409)=0.04$ , $p=.963$ , $\eta^2<.001$
Total CTDS	285.8	27.5	286.6	30.0	282.0	28.8	$F(2,409)=0.89$ , $p=.411$ , $\eta^2=.004$
PSI Confidence	30.9	6.46	30.3	5.95	30.1	6.64	$F(2,409)=0.58$ , $p=.560$ , $\eta^2=.003$
PSI Approach/ Avoidance	21.2	6.63	21.3	6.04	21.4	5.30	$F(2,409)=0.05$ , $p=.953$ , $\eta^2<.001$
PSI Personal Control	41.0	9.76	41.2	9.80	38.9	9.85	$F(2,409)=2.00$ , $p=.137$ , $\eta^2=.010$
Total PSI	93.0	18.4	92.8	17.2	90.4	17.6	$F(2,409)=0.81$ , $p=.446$ , $\eta^2=.004$

We found significant differences only in their disposition toward open-mindedness and critical thinking. *Post hoc* analysis revealed that students in the second year had a significantly higher average level of open-mindedness than those in the third year. There were no other significant differences in the CTDS and PSI scales and subscales of students in different academic years. Consequently, the effect sizes, expressed as eta-squared ( $\eta^2$ ), were very small for all the CTDS and PSI dimensions, with values below 0.10, indicating minimal practical differences despite the observed statistical significance for CT Open-mindedness ( $p=.015$ ).

The influence of the participants' age on the results in the CTDS and the PSI was analyzed by computing the correlations (see Table 5). The students aged 21 and over were grouped in a single class (103 students, 25.0%), as they had the most academic and/or professional experience.

We found that all correlations between age and the PSI scale and subscales are negative, so older students had lower scores and their perception of problem-solving abilities was higher than younger students. The only statistically significant correlation was verified between the students' age and the score in subscale PSI Personal Control ( $r(410)=-.105$ ,  $p=.033$ ). There were no significant correlations between the age and the scores in the CTDS and its subscales.

All correlations presented in Table 5 between CTDS and PSI total scores and subscales scores are negative and statistically significant ( $p < .001$ ), which shows that the students with a greater disposition toward critical thinking are also those who have the perception that they have higher problem-solving abilities. There is a highly significant correlation between total CTDS and total PSI ( $r = -.602$ ). The highest correlation is verified for disposition Self-Confidence and PSI Confidence ( $r = -.622$ ).

Table 5  
Correlations between participants' scores in CTDS and PSI

	PSI Confidence	PSI Approach/Avoidance	PSI Personal Control	Total PSI
Truth-seeking	-.250	-.436	-.240	-.370
Open-mindedness	-.333	-.450	-.304	-.439
Analyticity	-.310	-.488	-.288	-.436
Systematicity	-.369	-.547	-.379	-.527
Self-Confidence	-.622	-.409	-.389	-.576
Inquisitiveness	-.416	-.502	-.359	-.517
Cognitive Maturity	-.400	-.531	-.452	-.573
Total CTDS	-.474	-.588	-.422	-.602

A hierarchical multiple regression analysis was conducted to assess the prediction of the students' CTDS and PSI scores from the demographic variables (age and gender) and academic variables (students' study field and academic year). The results are presented in Table 6.

Table 6  
Hierarchical models of CTDS total score

Model		B	SE	$\beta$	t	p
1	Age	-0.53	1.39	-0.02	-0.38	.703
	Gender	9.69	3.85	0.12	2.52	.012
2	Age	0.55	1.83	0.02	0.30	.765
	Gender	9.71	3.87	0.12	2.51	.012
	Academic Year	-2.16	2.39	-0.06	-0.90	.368
	Study Field	-0.03	2.98	-0.001	-0.01	.992

According to these results, in Model 1, the independent variables are students' age and gender, and in Model 2, variables such as students' study field and academic year were added to the set of independent variables in the regression. For the CTDS, model 1 was statistically significant ( $R^2 = .011$ ,  $F(2,409) = 3.27$ ,  $p = .033$ ) and model 2 was not statistically significant ( $R^2 = .018$ ,  $F(4,407) = 1.84$ ,  $p = .121$ ). The  $R^2$  values suggest that the demographic variables account for 1.1% of the CTDS total score, while the addition of the academic variables to the multiple regression model is associated with a non-significant  $R^2$  change value of 0.003 ( $F(2,407) = 0.409$ ,  $p = .665$ ). The only statistically significant predictor of the CTDS total score is students' gender.

The corresponding estimates for the hierarchical models of PSI total are in Table 7.

Table 7  
Hierarchical models of PSI total score

Model		B	SE	$\beta$	t	p
1	Age	-1.60	0.86	-0.09	-1.86	.064
	Gender	0.80	2.38	0.02	0.33	.738
2	Age	-1.73	1.13	-0.10	-1.53	.128
	Gender	0.49	2.38	0.01	0.20	.838
	Academic Year	0.37	1.47	0.02	0.25	.802
	Study Field	3.38	1.84	0.09	1.84	.067

We concluded that there was no statistical significance for either model 1 ( $R^2 = .009$ ,  $F(2,409) = 1.81$ ,  $p = .165$ ) or model 2 ( $R^2 = .017$ ,  $F(4,407) = 1.75$ ,  $p = .138$ ). None of the independent variables is a significant predictor of the PSI total score.

#### 4. Discussion and Conclusions

This study aimed to assess the relationship between critical thinking dispositions and students' perceptions of problem-solving abilities in the Social Sciences, Journalism, Information, and Health and Welfare fields. In addition, it analyzed the relationship between the variables of gender,

academic year, and field of study of the participants and their critical thinking dispositions and perception of problem-solving abilities; moreover, it analyzed the effect of these variables as predictors of both critical thinking dispositions and problem-solving abilities according to the formulated hypotheses.

*H1. Students' critical thinking dispositions differ significantly by gender*

Existing research investigating the relationship between gender and critical thinking dispositions is inconclusive, with some studies showing higher scores for females (Lopes et al., 2021) and others reporting no significant difference (Boso et al., 2021; Dennett & DeDonno, 2021; Ghadi et al., 2012; Hunter et al., 2014). However, the analysis of the gender variable in the current study demonstrated that female students obtained statistically significantly higher results in critical thinking dispositions.

*H2. Students' perceived problem-solving abilities differ significantly by gender*

Literature examining gender differences in the Problem-Solving Inventory is divided. Several researchers have reported findings consistent with the current study, observing no statistically significant differences between male and female participants in PSI results (Akyol & Akdemir, 2019; Anwar, 2021; Doo et al., 2021; Güleç, 2020; Karabacak et al., 2015). Conversely, other studies (Biber & Kutluca, 2013; Cihan, 2018), have documented that females achieved higher PSI scores. Reflecting the prevailing consensus of no difference, the current analysis of the overall PSI scores similarly found no significant differences between the two genders.

*H3. Students' critical thinking dispositions differ significantly according to their field of study*

The literature offers a varied perspective on the connection between field of study and critical thinking dispositions. Supporting our findings, some studies also report no significant differences (Cieza-Guevara & Palomino-Ccoillo, 2020; Taşçi et al., 2022). However, this contradicts other research that demonstrates a field-specific influence on these dispositions (Delgado Vásquez et al., 2019; Lopes et al., 2021; Rhoades et al., 2009; Wang et al., 2019). Crucially, the overall results of the present study showed no significant disparity in critical thinking dispositions between the two student groups examined: Social Sciences, Journalism and Information, and Health and Welfare.

*H4. Students' perceived problem-solving abilities differ significantly according to their field of study*

Studies on perceived problem-solving abilities in the literature, although reporting to different scientific fields than those of our participants, have found similar results (Akyol & Akdemir, 2019; Cihan, 2018; Güleç, 2020; Karabacak et al., 2015). The overall results of the PSI dimensions revealed no significant differences between the two groups of students: those from Social Sciences, Journalism, and Information, and those from Health and Welfare.

*4.5. H5. Students' critical thinking dispositions differ significantly by year of course (academic year)*

While some literature, including studies by Hunter et al. (2014) and Mousazadeh et al. (2021), reports that later academic years correlate with significantly higher critical thinking dispositions, other research reports null findings (Boonsathirakul & Kerdsomboon, 2021). Regarding program level, this result contrasts with a prior study at a northern Portuguese university, which found that undergraduates had higher scores than master's students (Lopes et al., 2021). However, it is consistent with the lack of degree-level differences reported by Boso et al. (2021). The current study found no statistically significant differences in the total CTDS scores across the 1st, 2nd, and 3rd academic years.

*H6. Students' perceived problem-solving abilities differ significantly by year of course (academic year)*

Although Tümkaya et al. (2009) reported that students in higher grade levels demonstrated more positive perceptions of their problem-solving abilities, the findings of the present study did not support this pattern. No statistically significant differences were found in the total PSI scores across the first, second, and third years. This discrepancy may be explained, in part, by the nature

of the Problem Solving Inventory, which assesses individuals' self-appraisals of their problem-solving competence rather than their actual problem-solving performance (Heppner et al., 2004). Supporting this interpretation, Alçı and Canca (2011) also found no overall significant difference between students' first- and fourth-year problem-solving appraisal scores, suggesting that advancement through higher education does not automatically translate into stronger self-perceived problem-solving skills. A further plausible explanation in the present study is the relative homogeneity of the participants in terms of age and educational experience, which may have reduced variability across year groups.

*H7. A significant relationship exists between students' critical thinking dispositions and their perceived problem-solving abilities*

Across the literature, findings regarding the relationship between critical thinking dispositions and perceived problem-solving abilities are generally positive but show some variability. Several studies report significant positive associations (Erzincanlı & Zaybak, 2015; Ibrahim et al., 2020; Kirmizi et al., 2015), while Kim and Han (2016) identified a particularly strong correlation in nursing populations. However, other investigations present divergent results: Erkus and Bahcecik (2015) found no significant relationship, and Yang (2013) reported a statistically significant negative correlation between CCTDI and PSI. Collectively, these findings suggest that although critical thinking dispositions often align positively with problem-solving, this relationship may differ across contexts, populations, and measurement frameworks.

The present study revealed a statistically significant negative correlation between students' critical thinking dispositions) and their scores on the Problem-Solving Inventory. Since the PSI is inversely scored (lower scores = higher perceived ability), this correlation indicates that stronger critical thinking dispositions are associated with a greater perceived ability to solve problems. The majority of participants were characterized by high critical thinking dispositions and a moderate perceived problem-solving ability. This relationship was exemplified by subscale scores: students highly self-confident in their critical thinking registered low scores on the PSI. Self-Confidence subscale signifies strong self-assurance in their perceived problem-solving abilities.

*H8. Academic and demographic variables (gender, field of study, year of course, and other academic factors) significantly predict students' critical thinking dispositions and perceived problem-solving abilities*

With respect to the contribution of demographic and academic variables as predictors of critical thinking dispositions, the present study found that only gender significantly predicted these dispositions. However, the low  $R^2$  values indicate that this effect accounts for only a minimal proportion of the variance, underscoring the limited explanatory power of gender despite its statistical significance. This highlights the need for more comprehensive analytical models that incorporate additional individual, contextual, and educational factors to more accurately capture the determinants of critical thinking dispositions.

As regards the contribution to problem-solving abilities, the results showed that none of the variables predicted the results obtained in the PSI. Other studies, whether with undergraduate students, trainee teachers, or in-service teachers, have reported results that are contradictory to those obtained in the present study. For instance, Ming (2019) found that gender was not a predictor of critical thinking dispositions. Wang et al. (2019), in a study with educators in service, found that age and gender influenced the perceptions of problem-solving abilities. Kourmousi et al. (2016) found that age had a negative correlation with the perception of problem-solving abilities: according to the authors, together with greater work experience, age provides educators with the confidence and control needed to deal more effectively with everyday problems. Sucu and Bedel (2021), who also conducted a study with undergraduate students, obtained results showing that gender is a predictor of problem-solving abilities.

## **5. Limitations and Recommendations**

This study presents several limitations that should be acknowledged when interpreting the findings. The sampling structure relied on convenience sampling, and data were collected from a

single institution, which restricts the representativeness of the sample and limits the generalizability of the results. The use of self-report measures may also introduce response biases, such as social desirability or subjective misinterpretation of items. Additionally, the cross-sectional design precludes any inference of causal relationships among the variables studied. Finally, the model's elevated RMSEA value (.11) indicates a weaker model fit, suggesting that the proposed structure may not fully capture the underlying relationships in the data. These limitations underscore the need for caution in drawing conclusions and highlight the value of future studies employing more robust sampling strategies, multi-institutional data, longitudinal designs, and refined measurement models.

The findings of this study have significant implications for pedagogical practices in higher education, particularly in the development of essential problem-solving skills. Research suggests that the problem-solving process has an affective component (Heppner & Krauskopf, 1987) and that individuals who are disposed to use critical thinking skills may be more effective problem solvers (Halpern, 2014). Therefore, given the demonstrated link between CTD and perceived problem-solving abilities in this study, higher education institutions must prioritize the promotion of critical thinking dispositions through targeted teaching and learning strategies (e.g., Ennis 1996; Facione, 2000).

Furthermore, observing that female students displayed higher CTD than males suggests a practical application: teachers should consider forming gender-mixed student groups during problem-solving activities. Interaction within these heterogeneous groups could foster the development of both critical thinking and problem-solving abilities for all participants.

Finally, due to the limited research on the relationship between these two variables, particularly within Portuguese higher education, and the contradictory findings regarding sociodemographic and academic factors, further dedicated investigation is strongly recommended to consolidate understanding in this area.

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**Ethics Statement:** This study followed the ethical requirements of the European Federation of Psychologists' Associations as well as the OPP - Ordem dos Psicólogos Portugueses. All ethical principles were respected, ensuring that all participants knew and accepted the principles of informed consent, voluntary participation, and confidentiality of their answers. Ethical approval of the study has been obtained by the Ethical Committee of the higher education institution.

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