Universidade de Trás-os-Montes e Alto Douro

# PENSAMENTO CRÍTICO NA EDUCAÇÃO: DESAFIOS ATUAIS

## CRITICAL THINKING IN EDUCATION: ACTUAL CHALLENGES

**Caroline Dominguez**
**(Coord. ed.)**

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UTAD - Universidade de Trás-os-Montes e Alto Douro
Universidade de Trás-os-Montes e Alto Douro
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# Índice

## PARTE II
## PENSAMENTO CRÍTICO NO ENSINO PRÉ-UNIVERSITÁRIO

# CRITICAL THINKING IN COLLEGE: DIFFERENTIAL ANALYSIS BY ACADEMIC YEAR AND SCIENTIFIC AREA

**Amanda Franco** & **Leandro S. Almeida**

*Institute of Education, University of Minho, Braga, Portugal*

amanda.hr.franco@gmail.com; leandro@ie.uminho.pt

## Abstract

Critical thinking is associated to multiple advantages in academic, personal, or professional life, such as higher quality decisions, a more efficient ability to solve problems, or active citizenship. To analyze the quality of critical thinking of the average college student, we assessed a sample of freshmen students taking a degree course (n=177) or a master's degree (n=155), in the scientific area of social sciences and humanities, or science and technology, with the *Halpern Critical Thinking Assessment* (Halpern, 2012). Results indicate differences in critical thinking according to academic year and scientific area, with master students taking a course in the area of science and technology scoring higher on this critical thinking assessment test. Higher education may have a positive impact on the quality of students' critical thinking.
Keywords: Critical thinking, Higher education, Assessment, Teaching.

## 1 - INTRODUCTION: DEFINITION AND RELEVANCE OF CRITICAL THINKING

We live in a world replete with change and challenges, which entails a set of requirements that, although fairly complex, are now seen as rather basic, hence, everyone is expected to master: to understand information that is complex, ambiguous, and contradictory; to make rational decisions; to solve problems; to participate in a democratic society that calls for an informed stand, or an opinion; to enter and stay in a job market that is more and more unpredictable and competitive; to update skills and forever be a lifelong learner; and more (Kek & Huijser, 2011).

In such a world, critical thinking (CT) is crucial. CT can be defined as having a set of cognitive skills, and being in the disposition to actually use them to increase the chances of success (Halpern, 2014). According to the literature (Nieto & Saiz, 2011; Vieira, Tenreiro-Vieira & Martins, 2011), this kind of "good" thinking is a combination of skills such as verbal reasoning, argument analysis, hypothesis testing, using likelihood and uncertainty, and decision making and problem solving (Halpern, 2014), along with attitudes of a critical thinker such as self-awareness, curiosity, deliberateness, flexibility, persistence, creativity, or mindfulness (Halpern, 2014).

When able of "good" thinking, there is a higher possibility of success in academic settings, in the job market, and in daily life (Butler, 2012; Butler et al., 2012; Franco, Butler & Halpern, 2014). CT has a positive impact on academic performance, seeing that critical thinkers think more effectively, and are more motivated to use suitable learning strategies (Halpern, 2014). In the job market, CT skills "have risen to the top of the list of competencies needed to lead organizations effectively into the future" (Brotherton, 2011, p. 24). As for everyday life, CT assists "good" decisions in many domains of life (Butler, 2012), thus helps to minimize the influence of external opinions and allegations (Halpern, 2014).

Such implications demand a particular attention from the educational system. CT requires deliberate systematic teaching, regular practice, and explicit constructive feedback (Halpern, 2014). With such in mind, our aim was to analyze the quality of CT of the average college student, to better understand the impact of (higher) education on the development of this transversal set of skills and dispositions.

## 2 - MATERIAL AND METHODS

A sample of 332 students from a public university located in the North of Portugal was considered. Age ranged from 17 to 51 ($M$ = 22.03, $SD$ = 5.66), and a majority was female (75.6%). Students were in the first year of a degree course (53.3%) or a master's degree (46.7%), in the scientific field of social sciences and humanities (SSH: 47.9%), or science and technology (ST: 52.1%). Students were assessed with the *Halpern Critical Thinking Assessment* (HCTA; Halpern, 2012), which presents 25 scenarios from different areas (such as health, social welfare, advertising, education, or politics) of current affairs. The HCTA presents both constructed and forced choice items, which appeal to free recall or to recognition (respectively), and assesses five core dimensions of CT: *verbal reasoning* (VR), the ability to comprehend and identify persuasive techniques in language; *argument analysis* (AA), to estimate the quality of reasons, to identify conclusions, and to appreciate the validity of arguments; *hypothesis testing* (HT), scientific skills such as the consideration of control conditions, or the identification of rushed generalizations; *likelihood and uncertainty* (LU), comprehension and use of probability and likelihood in the process of decision making; and finally, *decision making and problem solving* (DMPS), to identify a problem, to set goals, to create/select alternatives of action, and includes skills to attain that goal.

## 3 - RESULTS

Our findings suggest an interaction effect between academic year and scientific area on VR, $F(1,332) = 7.622$; $p = .006$, with students taking a master's degree in the field of ST scoring higher in the HCTA, when compared to students taking a degree course and SSH students. Regarding the AA dimension, master students scored higher than students taking a degree course, $F(1,332) = 5.455$;

*p* = .020, and ST students scored higher than SSH students, *F*(1,332) = 20.964; *p* = .000. The same happened in HT, with master students, *F*(1,332) = 9.041; *p* = .003, as well as ST students, *F*(1,332) = 22.582; *p* = .000, scoring higher. In regard to LU, ST students scored higher than SSH students, *F*(1,332) = 42.422; *p* = .000. Similarly, ST students scored higher in DMPS, *F*(1,332) = 26.093; *p* = .000, when compared to SSH students. Overall, when it comes to CT, we found an interaction effect between academic year and scientific area, *F*(1,332) = 4.407; *p* = .037, with master students taking a course in the scientific area of ST scoring higher than students taking a degree course and SSH students. Mean scores for the groups tested are presented in Table 1.

**Table 1.** Mean scores by academic year and scientific area

| CT dimension | Academic year | Scientific area | *M* (*SD*) |
|---|---|---|---|
| ***VR*** Range: 0-22 | *Degree* | SSH | 10.63 (2.74) |
| | | ST | 12.59 (2.97) |
| | *Master* | SSH | 12.34 (2.95) |
| | | ST | 12.52 (2.97) |
| ***AA*** Range: 0-41 | *Degree* | SSH | 21.33 (4.77) |
| | | ST | 24.32 (4.10) |
| | *Master* | SSH | 23.23 (3.65) |
| | | ST | 24.69 (5.08) |
| ***HT*** Range: 0-46 | *Degree* | SSH | 22.71 (3.67) |
| | | ST | 24.89 (4.14) |
| | *Master* | SSH | 24.09 (4.28) |
| | | ST | 26.27 (4.49) |
| ***LU*** Range: 0-24 | *Degree* | SSH | 11.13 (3.10) |
| | | ST | 13.30 (2.59) |
| | *Master* | SSH | 11.71 (2.69) |
| | | ST | 13.47 (2.50) |
| ***DMPS*** Range: 0-61 | *Degree* | SSH | 36.99 (5.01) |
| | | ST | 40.58 (4.30) |
| | *Master* | SSH | 38.83 (4.65) |
| | | ST | 40.48 (4.70) |
| **CT** Range: 0-194 | *Degree* | SSH | 102.78 (13.02) |
| | | ST | 115.67 (11.29) |
| | *Master* | SSH | 110.19 (11.30) |
| | | ST | 117.43 (13.29) |

## 4 - CONCLUSIONS

The differences found by academic year and scientific area may suggest a relevant impact of higher education (HE) on the development of CT, seeing that master students scored higher on three of the five dimensions of HCTA, and also, on the total score of CT, when compared to students taking a degree course. Moreover, the scientific area seems to have an impact on CT, with ST students scoring higher than their SSH peers. Perhaps there are differences in the pedagogical approach followed in each scientific area, or even, maybe the option for a given course in either scientific area follows from a previous background where CT has been more or less stimulated. Nevertheless, seeing that this is not a longitudinal study, and that we did not follow a pre/post-testing design, these are simply possible interpretations, and further research is required to put them to test. Nonetheless, despite such limitations, it is important not only to examine our results, but to analyze them in light of the findings in the literature.

On the one hand, in concern to academic year, HE may have a positive impact on the quality of CT, with students with more years of academic education showing more CT (Pascarella, Bohr, Nora & Terenzini, 1996). For example, in studies using HCTA, participants who scored higher in this test had more years of academic education (Butler, 2012; Butler et al., 2012). As for the present study, the differences found in favor of master students, when compared to students taking a degree course, in the same scientific area, may derive from different variables, from which the higher number of years of education of master students must be stressed. More schooling implies new learning experiences and the development of cognitive functions, as well as more elaborate ways of reasoning. Along with schooling, there is another important variable associated to the transition from a degree course to a master's degree: students who apply for and take a master's degree will, presumably, possess more cognitive abilities, as well as a stronger resolve towards learning and task performance, which, in turn, may impact the quality of CT.

On the other hand, regarding the impact of the scientific area on CT, divergent findings come from research (Li, Long & Simpson, 1999). Some authors state that it is not a determinant factor (Pike & Killian, 2011); others, that cognitive skills develop differently by academic major, being less evident in the SSH field (Kim & Sax, 2011). Yet, this may suffer the impact of a different variable: the interaction between student and teacher. According to Brint, Cantwell and Saxena (2012), differences in CT by scientific area may rely more on the pedagogical approach to which students are exposed to than on the academic field itself. As for our results, there might be a particular academic and cognitive background that sets the two groups apart. The ST curriculum may appeal to a higher ability of analysis and synthesis, presentation of arguments and counter arguments, test of hypotheses, or problem solving - the kind of cognitive processes that are very closely linked to tasks that evaluate CT. There are other variables to account for, however. In Portugal, there is a higher number of students from a higher social class taking ST courses, while SSH students are generally from lower social classes. Moreover, the rate of students in each scientific area varies by gender: more women take SSH courses. Overall, in light of our data and the literature, we believe that future research must consider such variables.

On the grounds of our findings, we make some implications concerning the possible impact of HE, and of the course taken. Although this is not an original line of study, it strengthens data from previous research, and gives continuity to the relevant research using HCTA, a groundbreaking CT test. Also, these findings contribute for the literature concerned with the need to include CT in the curriculum. Indeed, by introducing transversal skills in the curriculum, HE will be developing, besides technical skills, what is called "the right mix of skills" (New Skills for New Jobs Report, 2010, p.5). Skills such as the ones included in CT, transferable to new situations, and used according to circumstantial nuances. In a time when change and complexity and challenge seem to be part of people's everyday lives, it is necessary to take one step further and develop what is needed to face such changes and complexities and challenges. Social, economic, and cultural demands call for singular key-skills. They call for CT.

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