



FACULDADE DE MEDICINA  
UNIVERSIDADE DO PORTO

## MESTRADO INTEGRADO EM MEDICINA

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Tiago Adrega Cardoso

Linking Critical Thinking to Academic and Scientific Performance  
in Medical Education

Abril, 2011

# FMUP



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**Mestrado Integrado em Medicina**

**Área: Educação Médica**

**Trabalho efectuado sob a Orientação de:  
Professora Doutora Maria Amélia Ferreira**

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**Faculdade de Medicina da Universidade do Porto**  
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# **LINKING CRITICAL THINKING TO ACADEMIC AND SCIENTIFIC PERFORMANCE IN MEDICAL EDUCATION**

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<sup>1</sup> Sixth year medical student, Faculty of Medicine of the University of Porto, Portugal

## **ABSTRACT**

**INTRODUCTION** Critical thinking is gaining an increasing interest as a core competence in medical education. This study aims to assess the students' perceived critical thinking competences promoted during the 6 years in medical school and its association with academic and scientific performance.

**METHODS** The Faculty of Medicine of the University of Porto was the selected medical school. From the population enrolled in this study, 544 students (67.6% response rate) have participated in this study. A critical thinking questionnaire was adopted and translated to Portuguese. Principal components analysis, Cronbach's alpha, item-total correlation coefficient, Pearson correlation, student t-test, analysis of variance and analysis of covariance were estimated.

**RESULTS** Students express their perception that attending medical school improved their critical thinking competences, and students concluding the first cycle of studies have the highest perception of critical thinking improvement. Academic and scientific performances were not determinants to critical thinking competences. The Portuguese version of the questionnaire was validated.

**DISCUSSION** The results obtained in this study reinforce the importance of critical thinking competences in undergraduate medical education, call for the necessity of progression and support the formal introduction of critical thinking training strategies in the medical curriculum.

## **KEY WORDS**

Critical thinking; undergraduate medical education; Portuguese questionnaire

## **KEY PHRASES**

1. Critical thinking is an important core competence in medical education.
2. Students have the perception that medical education contributes to promote critical thinking competences.
3. Students concluding the first cycle of studies presented the highest perception of critical thinking improvement.
4. Academic and scientific performances were not determinants to critical thinking competences.
5. Efforts in promoting critical thinking in medical undergraduate studies should be implemented.

## **RESUMO**

**INTRODUÇÃO** O pensamento crítico tem suscitado interesse crescente como competência nuclear na educação médica. Este estudo visa identificar a opinião dos estudantes sobre a promoção de competências de pensamento crítico durante os 6 anos de Curso de Mestrado Integrado em Medicina e avaliar a sua associação com realização académica e científica.

**MÉTODOS** A Faculdade de Medicina da Universidade do Porto foi a escola médica escolhida para o estudo, tendo participado 544 estudantes (taxa de resposta de 67.6%). Foi adoptado e traduzido para Português um questionário de pensamento crítico. A análise de componentes principais, o alfa de Cronbach, o coeficiente de correcção de item-total, a correlação de Pearson, o student t-test, a análise de variância e a análise de co-variância foram estimados.

**RESULTADOS** Os estudantes concordam que a sua frequência na Faculdade de Medicina melhorou as suas competências de pensamento crítico e os estudantes que estão a terminar o Ciclo de Ciências Básicas da Saúde (1º ciclo de estudos) são os que têm a maior percepção de melhoria de pensamento crítico. A realização académica e científica não foram determinantes para as competências de pensamento crítico. A versão portuguesa do questionário foi validada.

**DISCUSSÃO** Os resultados obtidos neste estudo salientam a importância das competências de pensamento crítico na educação médica, alertam para as mudanças necessárias e apoiam a implementação de estratégias para tornar mais significativa a introdução do pensamento crítico no currículo médico.

**PALAVRAS-CHAVE** - Pensamento crítico; educação médica pré-graduada; questionário em português

## **FRASES-CHAVE**

1. O pensamento crítico é uma componente nuclear importante na área da educação médica
2. Os estudantes têm a percepção que a educação médica contribui para a promoção de competências do pensamento crítico.
3. Os estudantes que concluíram o primeiro ciclo de estudos apresentaram uma maior percepção de melhoria de pensamento crítico.
4. A realização académica e científica não foram determinantes para aumentar as competências de pensamento crítico.
5. Devem ser empregues esforços na promoção de pensamento crítico na educação médica pré-graduada.

## INTRODUCTION

Institutions involved in training health professionals are permanently concerned with improving the quality of their graduates for meeting healthcare demands. <sup>[1]</sup> Based on recent significant investigations, important educational developments were made, following reports from the Bologna Declaration<sup>[2-4]</sup>, Global Minimum Essential Requirements, <sup>[5]</sup> the Middle States Commission on Higher Education, <sup>[6]</sup> the consensus reached by the Association of American Colleges and Universities in 2004 <sup>[6]</sup> and the Tomorrow's Doctor recommendations from the General Medical Council. <sup>[7, 8]</sup> These documents consider critical thinking as a core skill that medical students should acquire and demonstrate during their undergraduate study. In this context, medical schools have been recently highlighting the importance of critical thinking in their educational strategies. <sup>[6, 8-12]</sup>

Critical thinking was born concomitantly with philosophy and has always thrilled those intrigued by the wonders of human thought, <sup>[13, 14]</sup> gaining a special place in education during the last century. <sup>[6, 13, 15-17]</sup> Although its conceptualization has evolved, it is a rather subjective topic of much debate and a universally accepted definition has not naturally emerged. <sup>[13-15, 18]</sup> Nevertheless, there are some cognitive skills and affective dispositions inherent to the ideal critical thinker, which can be applied across various fields. <sup>[6, 8, 14, 15, 17-21]</sup>

The academic and personal benefits of critical thinking are well established in different contexts. <sup>[6, 10, 11, 16, 18, 19, 22]</sup> In Medical Education, critical thinking facilitates the transition to the clinical environment and prevents the tendency of becoming non-critical and non-discerning. Critical thinking also inhibits the practitioner's performing perfunctory examinations and helps preparing the practitioner for effectively dealing with the various clinical situations one will meet. <sup>[9, 13]</sup> It can be a powerful tool, resolving the need for creating lifelong learners able to face new challenges <sup>[2-4, 9, 11, 13, 23]</sup> and who understand the role of research in the quality of medical practice. <sup>[5, 9, 13]</sup>

In fact, health professionals have to face problems they were never confronted with or heard about during their medical education and/or problems that do not have a single or absolutely correct answer. <sup>[13]</sup> Very often clinical decisions must be made about complex tasks with little guidance, and limited time and resources. Critical thinking can provide broader perspectives, creative solutions, multiple pathways and more self-regulation, <sup>[20]</sup> which enhances the providing of safe and comprehensive care to patients and the preventing of negligent practice. <sup>[5, 9, 10, 13, 15, 17, 18, 20, 21, 23]</sup> Due to the great amount of information in health sciences today, critical thinking may allow the search and adaptation of the best



answer in a given context and the openness to examine other perspectives. <sup>[5, 13, 15, 17, 18, 20, 24]</sup> Some authors advance the idea that critical thinking is common to both clinical and ethical reasoning, being as important as practical experience and knowledge content. <sup>[13, 24]</sup>

Considering that critical thinking is a transversal core competence in medical education, this study aims to assess the self-perceived critical thinking of medical students throughout a medical course and its association with academic and scientific performance, aiming to establish a sound foundation of critical thinking in medical education.

## **METHODS**

To answer the proposed objectives, the Faculty of Medicine of the University of Porto was selected. The Master Degree Course in Medicine is adequate to the Bologna model, has the duration of 6 years and it is organized in 2 cycles: a first cycle corresponding to Degree in Basic Health Sciences with a duration of 3 years and a second cycle, organized in 2 years of Clinical learning and a last year of Professional Clinical Clerkship, which includes the elaboration of the Master Degree Thesis. The participants consist on the students of the first, fourth and sixth year of the Master Degree Course of Faculty of Medicine of the University of Porto actively enrolled in the 2010/2011 academic year, corresponding to the freshman students, those who concluded the first cycle of studies and those that are concluding the second, respectively. From a total of 805 illegible students, 544 (67.6% response rate) have participated in the study – 231 (75.7% response rate) from the first year, 156 (59.8%) from the fourth and 157 (65.7%) from the sixth. From the respondents, 326 (63.9%) were females and 184 (36.1%) were males, 7 (1.3%) students had already another graduation, 14 (2.6%) have published at least one scientific paper, 45 (8.3%) are or have been enrolled in a research group and 48 (10.6%) have failed at least one year during their studies. The students had received no formal teaching of critical thinking skills to answer the questionnaire.

To assess critical thinking, a questionnaire published by Castle (2006) <sup>[14]</sup> was used, after author's permission. The questionnaire was accordingly adapted to the Portuguese cultural background. The validation of the Portuguese version of the questionnaire followed two cycles of translation. The first stage consisted of a forward translation completed by two independent professional translators, resulting in two initial Portuguese versions. The two versions were synthesized by the translators to create a consensus version. Afterwards, two different independent translators completed a backward translation.

Finally, a committee of a physician, an epidemiologist and a pharmacist reviewed and compared the final Portuguese translation and the back translations to obtain a final version.

The questionnaire has two main sections. The first comprises academic performance (current year in medical school, year of enrolment and another graduation), scientific performance (publication of a scientific article and member in a research group), gender and a self appreciation of students' critical thinking skills. The second section of the questionnaire consists of 12 items (8 positive and 4 negative) that include appropriate aspects of critical thinking; <sup>[14]</sup> students are asked to indicate to what extent they agree or disagree with the item in relation to their current course, using a five category question Likert scale ranging from 1 to 5 (where 1 equals to strongly disagree and 5 equals to strongly agree). Another question aims to assess if the students consider, in a global way, their critical thinking skills were enhanced during the Medical course, using the same five category Likert scale.

To assess the dimensionality of the questionnaire, principal components analysis was used. Cronbach's alpha and item-total correlation coefficient were estimated to evaluate the internal consistency. A good level of consistency was accepted if alpha higher than 0.70. <sup>[25]</sup> The score of the critical thinking domain was obtained through the mean of the 12 items that constitute the questionnaire. The Pearson correlation was used to evaluate the association between the critical thinking score with the mean value of the question that assesses the students' global perception. To compare two independent samples, it was used the student t-test, and analysis of variance was used to compare more than two independent samples. The analysis of covariance was used to assess the main effect of the curricular years on critical thinking, controlling the effect of self-perceived critical thinking and adjusting for gender. The significance level was set at 0.05. For the data analysis, it was used the IBM SPSS Statistics 19<sup>®</sup> software.

## **RESULTS**

### **Descriptive**

The descriptive analysis of the questionnaire's items is represented in Table 1. The items mean of the scale ranges from 3.47 (SD 0.90) to 4.40 (SD 0.64), from items "Most tutors have encouraged me to explore the ideas, theories, assumptions and procedures related to the subject area" and "My interest in issues and questions related to my subject area has increased", respectively (Table 1).

## **Dimensionality**

The scree plot (Figure 1) shows that the first eigenvalue is approximately 3 times higher than the second. First component accounts for 35% percent of the variance and that the second accounts for only 12%. Considering only one component, all positive questions have a factor loading value above 0.4 and all the negative questions have a factor loading value less than -0.4 (Table 1).

## **Internal consistency**

Cronbach's alpha is 0.82 and its value always decreases if any of the 12 items is deleted. Additionally, 11 of the 12 items have an item-total correlation coefficient above 0.40 (Table 1).

## **Construct Validity**

The correlation between the critical thinking score with the students' global perception is 0.62 ( $p < 0.01$ ) and the correlation between the critical thinking score with the student's own critical thinking appreciation is 0.21 ( $p < 0.01$ ).

## **Critical thinking**

The mean of critical thinking score is 3.93 (SD 0.43) (Table 2). The critical thinking score is higher for females (3.97; SD 0.41) than males (3.87; SD 0.42) ( $p < 0.01$ ). There are no significant differences between students who have another graduation (3.84-3.93;  $p 0.57$ ), have published at least one scientific paper (3.94-3.93;  $p 0.95$ ), are or were enrolled in a research group (3.94-3.93;  $p 0.91$ ) or have failed at least one year during their studies (3.81-3.94;  $p 0.11$ ) (Table 2).

The effect of curricular years on critical thinking (reference first year) was determined by controlling the effect of self-perceived critical thinking and adjusting for gender. The first year obtains 3.88 (IC 95%: 3.83-3.94), the fourth 3.98 (IC 95%: 3.92-4.05) and the sixth 3.91 (IC 95%: 3.84-3.98) (Figure 2). It is observed that, medical students feel medical school provides higher critical thinking in fourth year as compared with first year. The first and sixth years are considered similar, with no significant differences.

## **DISCUSSION**

This study reveals that medical students consider that Medical School improved their critical thinking competences. Although not the main objective of this work, the Portuguese version of the questionnaire proves to be a reliable and valid instrument suitable to be used in other, similar scenarios. These results are consonant with the modern recommendations of developments in medical education [2-4,

<sup>6-8]</sup> and the literature review allowed the identification of studies with similar results. <sup>[19, 26]</sup> However, studies that showed no improvement of critical thinking competences during undergraduate medical education were not found. There are several factors that might have contributed to this result. Since 2007, Faculty of Medicine of the University of Porto is actively engaged in the Bologna Process, where the development of transversal core competences like critical thinking are highlighted and included in the *curricula*. <sup>[2-4]</sup> A combination of the openness and motivation of medical students towards critical thinking competences, the unique environment of higher-level learning, the contact with idiosyncratic fellows, and the extra-curricular activities and personal changes that occur might also justify the results. <sup>[19]</sup>

This study also shows that students who concluded the first cycle of studies are more likely to agree that medical school contributed towards fostering critical thinking competences when compared with the freshman students. The students who are completing the second cycle show a similar level of self-perceived contribution of medical school when compared to freshman students. The preconceived notions of first year students towards Medicine at the start of their first cycle of studies, and their more informed perceptions after actually finishing it, might explain the first result. During the literature review there were no studies found that showed similar results expressing the difference in the appreciation of critical thinking, observed between the fourth year and the end of the undergraduate medical education. The fear of becoming incompetent practitioners, <sup>[27]</sup> the overloading of demanding academic tasks (the master thesis and access to medical residence programs) during the last year, the more precise appreciation of medical education in the final year of undergraduate degree, the unfulfilled expectations of the clinical cycle, the unswerving reliance on evidence-based results and/or the curricular differences between the two cycles of studies might be possible explanations for this difference.

Additionally, this study shows that academic and scientific performances were not determinants to critical thinking competences. It was only observed significant difference in gender, with females thinking that medical school had a heavier contribution in fostering critical thinking competences than males, which fits with other study that also show that females have higher critical thinking scores. <sup>[14]</sup>

The main limitation of this study is its cross-sectional nature. It is not totally clarified if differences observed are between cohort of students or real differences between years.

Although critical thinking is gaining increasingly more interest among medical educators and students are motivated towards critical thinking, more should be done to actively widespread it as a

current practice in medical education. Medical Faculties are well positioned to model higher-level thinking for their students in the clinical setting <sup>[6, 28]</sup> and they could make a better use of this opportunity. Educational interventions aiming to sensitize and educate teachers, adoption of suitable teaching strategies and technologies <sup>[6-10, 12, 16, 18, 22, 24]</sup> and assessment methodologies as triggers to actively encourage students towards critical thinking, should be promoted. <sup>[16]</sup> As Paul (2005) says “deep change takes time, patience, perseverance, understanding, and commitment” <sup>[18]</sup> but ultimately might be the needed answer.

The results obtained in this study reinforce the importance of critical thinking competences in undergraduate medical education, alert the medical community to the necessity for progress and support in the formal introduction of critical thinking training strategies in the medical *curriculum*.

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Table 1 – Items descriptive statistics, factor loading and internal consistency

		Item-mean (SD) <sup>*</sup>	Factor loading <sup>†</sup>	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1	I have learnt more about how to approach complex issues in a variety of ways	4.05 (0.61)	0.72	0.59	0.79
2	I have seldom found myself actively engaged in thinking about complex issues ‡	3.89 (0.82)	-0.45	0.35	0.81
3	I have improved my ability to judge the value of new information or evidence presented to me	3.97 (0.58)	0.67	0.53	0.80
4	I have learnt more about how to analyse the key issues in my subject area	4.08 (0.53)	0.63	0.49	0.80
5	I have not improved my ability to give sound reasons for my beliefs, opinions and ideas ‡	4.08 (0.75)	-0.65	0.54	0.80
6	I have developed a more open-minded approach in interpreting, analysing and judging alternative points of view	3.96 (0.63)	0.65	0.52	0.80
7	My interest in issues and questions related to my subject area has increased	4.40 (0.64)	0.51	0.40	0.81
8	I have developed a more focused and systematic way of thinking	3.94 (0.72)	0.59	0.47	0.80
9	I have learnt more about how to justify why certain procedures are undertaken in my subject area	3.95 (0.71)	0.63	0.50	0.80
10	Most tutors have encouraged me to explore the ideas, theories, assumptions and procedures related to the subject area	3.47 (0.90)	0.50	0.45	0.80
11	Most tutors have not demonstrated how to think and express myself in a more reasonable, objective and evaluative way ‡	3.54 (0.91)	-0.54	0.48	0.80
12	Most assessments have not stretched my intellectual abilities ‡	3.80 (0.94)	-0.48	0.41	0.81
% variance explained by 1st factor					34.95
Cronbach's Alpha					0.82

<sup>\*</sup>SD – Standard Deviation

<sup>†</sup>for one component solution

<sup>‡</sup>Negative item; the score of the item-mean was reversed



Table 2 – Critical Thinking score by gender and academic and scientific performance

	N* (%)	Mean (SD <sup>†</sup> )	P – value
Total	544	3.93 (0.43)	
Gender			
Female	326 (63.9)	3.97 (0.41)	0.01
Male	184 (36.1)	3.87 (0.42)	
Another Graduation			
No	537 (98.7)	3.93 (0.43)	0.57
Yes	7 (1.3)	3.84 (0.56)	
Failed at least on year			
No	404 (89.4)	3.94 (0.43)	0.11
Yes	48 (10.6)	3.81 (0.55)	
Research group			
No	495 (91.7)	3.93 (0.41)	0.91
Yes	45 (8.3)	3.94 (0.54)	
Scientific paper published			
No	524 (97.4)	3.93 (0.42)	0.95
Yes	14 (2.6)	3.94 (0.63)	

\*N – Number of respondents

<sup>†</sup>SD – Standard Deviation

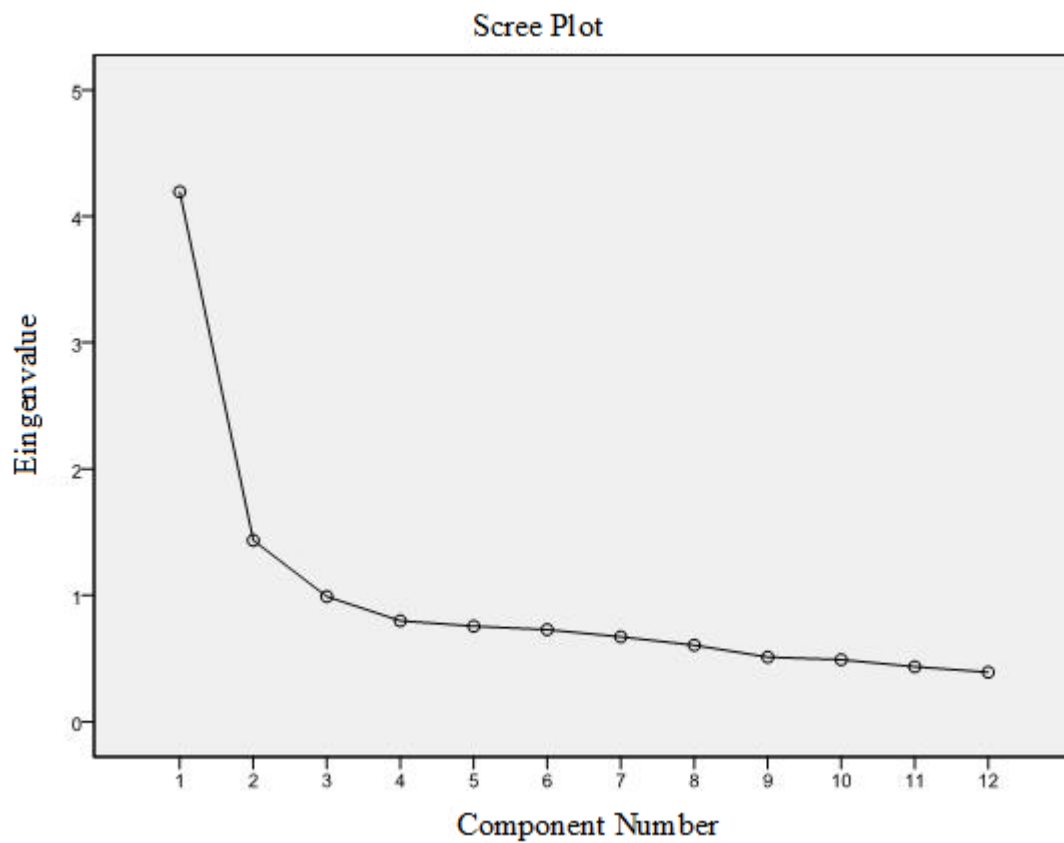


Figure 1 – Principal analysis components scree plot from critical thinking questionnaire

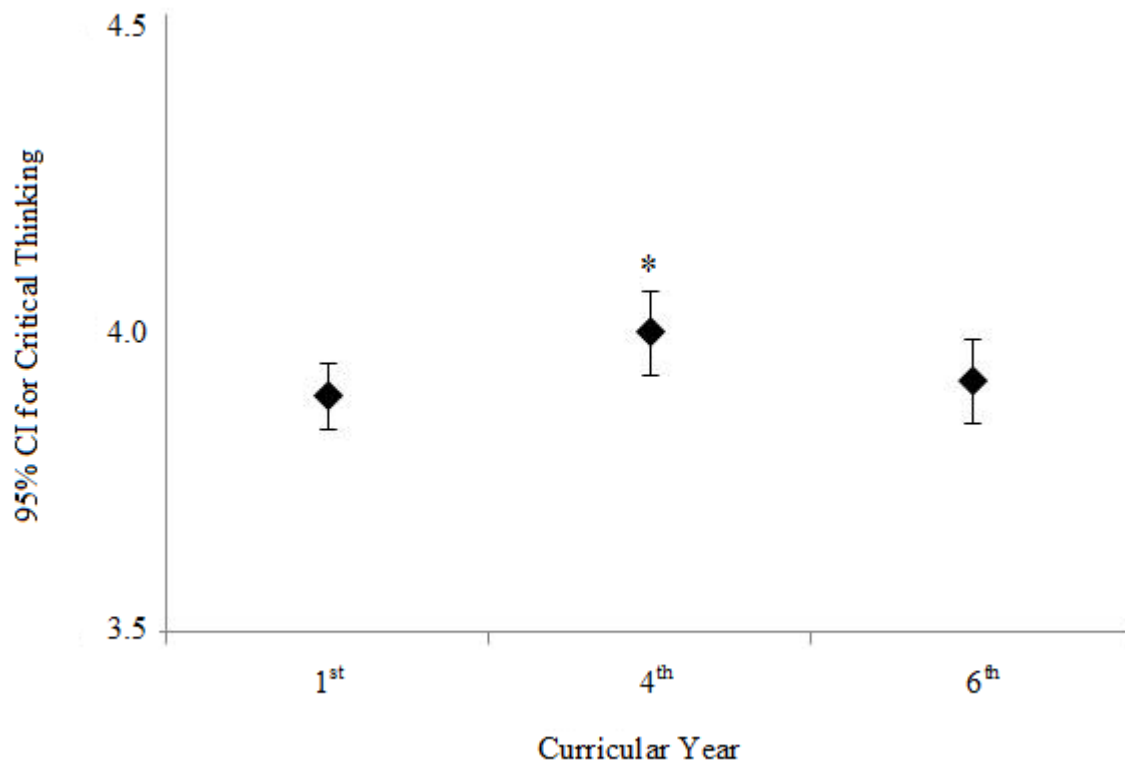


Figure 2 - Mean values and 95% confidence intervals for curricular year critical thinking adjusted for gender and self perceived critical thinking

\* p<0,05 (reference first year)

# Inquérito sobre Pensamento Crítico

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(A codificar pelo Investigador)

Este inquérito enquadra-se no âmbito da Unidade Curricular Dissertação/Monografia/Relatório de Estágio Profissionalizante e tem como objectivo avaliar o pensamento crítico dos estudantes da FMUP.

A confidencialidade dos dados é salvaguardada.

1. Nº Mecanográfico: 

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2. Em que ano lectivo fez a sua inscrição na FMUP? 

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 / 

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 ex: 

0	5
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 / 

0	6
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3. Tem licenciatura noutra Curso?  Não  Sim 4. Género:  feminino  masculino

5. Já publicou artigos científicos?  Não  Sim

Se sim:

Quantos artigos publicou em revistas internacionais? 

--	--

 Destes, quantos artigos foi 1º autor? 

--	--

Quantos artigos publicou em revistas nacionais? 

--	--

 Destes, quantos artigos foi 1º autor? 

--	--

6. Está ou já esteve integrado em algum Grupo de Investigação?  Não  Sim Se sim, quantos? 

--	--

7. Como avalia a sua capacidade crítica?

Muito Má  Má  Razoável  Boa  Muito Boa

8. Conhecimento e capacidade crítica do estudante:

Por favor indique em que medida concorda ou discorda com as seguintes afirmações, preenchendo o respectivo círculo.

Enquanto estudante da FMUP:	Concordo fortemente	Concordo	Não tenho a certeza	Discordo	Discordo fortemente
Melhorei o meu conhecimento sobre como abordar assuntos complexos de diferentes maneiras	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<u>Quase nunca</u> me vi activamente envolvido no pensamento sobre assuntos complexos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Melhorei a minha capacidade para fazer julgamentos de valor sobre novas informações ou evidências que me são apresentadas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Melhorei a minha capacidade de analisar os assuntos chave do Curso de Medicina	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<u>Não</u> melhorei a minha capacidade de fundamentar devidamente as minhas crenças, opiniões e ideias	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Desenvolvi uma abordagem de maior abertura na interpretação, na análise e no julgamento de pontos de vista alternativos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Aumentou o meu interesse em assuntos e questões relacionados com o curso de Medicina	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Desenvolvi uma maneira de pensar mais focada e sistemática	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Melhorei o meu conhecimento sobre como justificar o motivo pelo qual são seguidos determinados procedimentos na área da Medicina	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Os professores encorajaram-me a explorar ideias, teorias, pressupostos e procedimentos relacionados com a área da Medicina	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Os professores <u>não</u> demonstraram como posso pensar e expressar-me de maneira mais razoável, objectiva e crítica	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As avaliações realizadas <u>não</u> aumentaram as minhas competências	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. De uma forma global, considera que a sua capacidade crítica aumentou enquanto estudante da FMUP?

Concordo fortemente  Concordo  Não tenho a certeza  Discordo  Discordo fortemente

29234

Agradecemos a colaboração!



# Critical Thinking Appreciation Questionnaire

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(Codified by the Investigator)

This investigation falls within the scope of the Master Thesis of Tiago Adrega Cardoso, 6th year medical student, and aims to assess FMUP students' critical thinking appreciation.

The anonymity of data is guaranteed.

1. Student's ID: 

--	--	--	--	--	--	--	--	--	--

2. When was your course enrollment in FMUP? 

--	--

 / 

--	--

 eg: 

0	5
---	---

 / 

0	6
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3. Do you have another graduation?  No  Yes

4. Gender:  female  male

5. Have you published any scientific paper?  No  Yes

In case of affirmative answer:

How many papers have you published in international journals?

--	--

How many were you the 1st author?

--	--

How many papers have you published in Portuguese journals?

--	--

How many were you the 1st author?

--	--

6. Are you or have you been actively enrolled in a Research Group?  No  Yes

If affirmative, how many?

--	--

7. How would you assess your critical thinking capacity?

Very bad  Bad  Reasonable  Good  Very good

8. Student's Critical Thinking appreciation of FMUP:

Please indicate to what extent you agree or disagree with the following statements by filling the respective circle:

As a FMUP's student:	Strongly agree	Agree	Neither	Disagree	Strongly disagree
I have learnt more about how to approach complex issues in a variety of ways	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have <u>seldom</u> found myself actively engaged in thinking about complex issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have improved my ability to judge the value of new information or evidence presented to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have learnt more about how to analyse the key issues related to Medicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have <u>not</u> improved my ability to give sound reasons for my beliefs, opinions and ideas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have developed a more open-minded approach in interpreting, analysing and judging alternative points of view	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My interest in issues and questions related to Medicine has increased	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have developed a more focussed and systematic way of thinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have learnt more about how to justify why certain procedures are undertaken in Medicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most tutors have encouraged me to explore the ideas, theories, assumptions and procedures related to Medicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most tutors have <u>not</u> demonstrated how to think and express myself in a more reasonable, objective and evaluative way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Most assessments have <u>not</u> stretched my intellectual abilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. In a global perspective, do your critical thinking capacity was enhanced as a FMUP's student?

Strongly agree  Agree  Neither  Disagree  Strongly disagree

Draft

Thank you for the precious collaboration!





tiago adrega <tiagoadregacardoso@gmail.com>

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## Tiago .:. Portugal | Masther thesis .:. Critical Thinking Questionnaire

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tiago adrega <tiagoadregacardoso@gmail.com>

22 de Março de 2011 17:14

Para: alan.castle@port.ac.uk

Cc: Maria Ferreira <mameliaferreira@gmail.com>

Dear Professor Alan Castle,

My name is Tiago Adrega and I am a 6th year medical student of the Faculty of Medicine of Porto's College (FMUP), Portugal.

Accordingly to the Bologna Process I need to present a Master Thesis at the end of the year. Since I am collaborating with the Medical Education Department of the Faculty, I had the challenge to work in Critical Thinking skills of medical students, as it is a area of my greatest interest.

Starting this project and after some literature review, I found your work "Assessment of the critical thinking skills of student radiographers", published in Radiography (2006) 12, 88-95, where you use the **Critical Thinking Questionnaire**. Since this instrument applies to the objectives of my work, **I am asking your permission to use it in my Master Thesis work.**

I am looking forward your cooperation, since this will be a great help to undergo this work.

I shall wait for your final reply.

Sincerely,

*Tiago Adrega*

[tiagoadregacardoso@gmail.com](mailto:tiagoadregacardoso@gmail.com)

00351 964528283

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tiago adrega <tiagoadregacardoso@gmail.com>

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## Critical Appraisal Questionnaire

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Alan Castle <Alan.Castle@port.ac.uk>

4 de Abril de 2011 11:20

Para: tiagoadregacardoso@gmail.com

Dear Tiago

I am happy for you to use my questionnaire in your research.

Good luck with the project.

Kind Regards

Alan

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## Medical Education

### GUIDELINES FOR AUTHORS

*Medical Education* is an international, peer-reviewed, journal with distribution to readers in more than 80 countries. The journal seeks to enhance its position as the pre-eminent journal in the field of education for health care professionals and aims to publish material of the highest quality reflecting world wide or provocative issues and perspectives. The contents will be of interest to learners, teachers and researchers. It aims to have a significant impact on scholarship in medical education and, ultimately, on the quality of health care by prioritising papers that offer a fundamental advance in understanding of educationally relevant issues. The journal welcomes papers on any aspect of health professional education.

#### 1. The journal's mission in education and research

Manuscripts and reviews submitted to *Medical Education* may be used for teaching and research purposes with potential authors and reviewers. Authors and reviewers may be asked from time to time to take part in surveys. Every effort will be made to protect confidentiality. Names will not be passed to third parties.

#### 2. Submission of manuscripts

Manuscripts should be prepared in accordance with the *Uniform Requirements for Manuscripts Submitted to Biomedical Journals* (see <http://www.icmje.org/>). All manuscripts are considered on the understanding that they have not been published previously in print or electronic format and that they are not under consideration by another publication or medium. *Medical Education* is committed to the Committee on Publication Ethics (COPE) Code of Conduct (<http://publicationethics.org/>). Authors should familiarise themselves with issues of publication ethics noted by COPE including duplicate publication/submission and 'salami slicing' as these behaviours will not be accepted.

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#### 3. Criteria for manuscripts

All manuscripts should meet the following criteria: the writing is clear and the information important and likely to be of interest to an international audience. For research papers, the study methods should be appropriate and the data valid; and for both discussion papers and research papers, the conclusions should be reasonable and supported by data or evidence. Papers are selected for peer review and publication on these criteria. We publish around 20% of manuscripts received each year. We welcome contributions from authors whose first language is not English, although it is recommended that before submitting your manuscript to the journal you ask a colleague familiar with written English to read it through. All authors are encouraged to review the peer review criteria (see *Med Educ* 2009;43:2-4) prior to submitting their manuscripts.

#### 4. Editorial and peer review process

All submitted manuscripts are read initially by the editor. One or more associate editors may also be involved in early decision making. Papers with insufficient priority for publication are rejected at this stage - sometimes with advice about resubmission in a different category. Other manuscripts are sent to experts in the field for peer review. The review process is usually double-blinded so that authors' and reviewers' identities are not disclosed to either party. However, we encourage reviewers to sign their reviews in the interest of providing responsible feedback. Guidelines for reviewers are available [www.mededuc.com](http://www.mededuc.com). We aim to give an initial decision within 12 weeks. All accepted manuscripts are edited according to the journal's style and returned to the author as page proofs for approval. Authors are responsible for all statements made in their work.

#### 5. Categories of manuscript

*Medical Education* publishes original research papers, review articles, special feature pieces, short reports of research in progress or of educational innovation, commentaries, and letters to the editor. Specific guidelines are shown below:



**Original Research:** Generally less than 3,000 words, but longer papers will be accepted if the context warrants the inclusion of more text. A structured abstract of no more than 300 words must be included and the paper should contain a maximum of five tables or figures with references included in the Vancouver style. The paper will usually be organised using the Introduction, Methods, Results, and Discussion (IMRAD) structure. The context of the work (i.e., findings from the existing literature) and your choice of methods must be made clear in the text. Qualitative and quantitative research approaches are equally welcome. All papers must make it clear how the findings advance understanding of the issue under study. Quality assurance papers that are predominantly of local interest or relevance do not meet this latter criterion. See *Med Educ* 2009;43:294-6.

**Review articles:** Generally less than 3,000 words, plus a structured abstract of no more than 300 words. Up to 2 tables or figures and references in Vancouver style. Systematic or critical reviews are welcome, but again, both types of reviews will be held to the criterion of needing to advance understanding beyond the current. See *Med Educ* 2008;42:852-3.

**Short Reports:** Generally less than 1,000 words plus abstract of no more than 300 words, with one table or figure and up to 5 references.

**The Cross-Cutting Edge** (commissioned papers only - please send a brief email to the editor at [med@mededuc.com](mailto:med@mededuc.com) if you would like to write for this section or have suggestions of other topics/authors who should be recruited): Generally less than 4000 words plus a structured abstract of no more than 300 words, with up to 2 tables or figures and references in Vancouver style. See *Med Educ* 42(10):950-1 for an overview of the intent of these papers.

**Really Good Stuff:** short structured reports of new ideas in medical education. 500 words plus structured sub-headings: the context and setting; why the idea or change was necessary; what was done; and evaluation of the results or impact. One reference only may be included but there should be no abstract, figures or tables. Detailed guidelines on this section are available on Manuscript Central and from [www.mededuc.com](http://www.mededuc.com).

**Commentaries:** up to 1,000 words and no more than 10 references; up to 5 short 'pull-out' quotations from the article of approximately 15 words should be supplied. An abstract is not required.

**Letters to the Editor:** up to 400 words, up to 6 references in the Vancouver style.

## 6. Preparation of manuscripts

The manuscript should be accompanied by a signed and completed copyright assignment form. An electronic copy of which should be uploaded during the submission process (alternatively this may be faxed and posted to the editorial office). A checklist to assist in the preparation of the manuscript for submission is also available. Copies of these documents may be obtained by clicking 'instructions and forms' on <http://mc.manuscriptcentral.com/medicaleducation>

### The anonymous manuscript

A full version of the manuscript as well as an fully anonymised version should be submitted. In the anonymised version, for review, authors should **NOT identify themselves or their institution**. This includes ensuring that neither the filename nor the footer/header contains the authors' names or initials. We encourage the use of the active voice, short sentences and clear sub headings in the text. *Chambers Guide to Grammar and Usage* (1996) can give advice on matters of style. The manuscript should be double-spaced with a wide margin (at least 3 cm) on either side. All pages should be numbered. Do not use abbreviations. All scientific units should be expressed in SI units. Before submission please remove fields from automatic referencing programs and switch off change tracking. Please supply a word count. Where figures, tables or illustrations from other publications have been used, appropriate permissions should be obtained prior to submission.

Referencing should be set out in double spacing in the Vancouver style. Authors are advised to consult the *Uniform Requirements for Manuscripts Submitted to Biomedical Journals* <http://www.icmje.org/> for details of the Vancouver reference style.

Authors should restrict *titles* to 15 words or fewer (90 characters including spaces), and the editor reserves the right to edit titles. The *main text* should start on a separate page and sections within the text should be appropriately sub-headed. Spelling should conform to the *New Shorter Oxford English Dictionary*. Both numbers and percentages should be given (not percentages alone) when relevant. Where *statistical methods* are used in analysis their use should be explained in the setting of the study and an appendix given if the method is particularly unusual or complex. For all research-oriented manuscripts a consideration of the strengths and weaknesses of the approach used should be included.

Keep a copy of the original manuscript for reference. An email acknowledgement of receipt will be sent by the journal. Any material sent to the Editorial Office will not be returned.

We reserve the right to copy edit papers to house style before final publication, but substantive changes will be the responsibility of the authors.

### **The identifying information**

A separate identifying document is no longer required. However, the submitting author should ensure that the following information is provided during the submission process:

- a) The full address, institution and contact details of all authors. It is the corresponding author's responsibility to ensure that each author holds a user account on the submission system and the details held are current.
- b) The individual contributions made by each author to the work described in the paper.
- c) Details of any funding
- d) Details of any acknowledgements
- e) A statement indicating whether ethical approval was sought for the research described. **All work involving research on human subjects** must comply with the Declaration of Helsinki (<http://www.wma.net/e/policy/b3.htm>) and authors must confirm, where appropriate, that informed consent was given. We expect ethical approval to have been sought from an appropriate body, such as an Institutional Review Board (IRB) or Independent Ethics Committee (IEC), where such bodies exist to review educational research. Both the manuscript itself and details concerning ethical approval input by the submitting author should indicate the outcome of the application, even when the decision was that no ethical approval was required. Where no formal framework for ethical approval is currently available, please provide a statement confirming if ethical considerations were made by a qualified person outside the group directly involved in work reported in this paper. There should also be a statement confirming the following points: That the work was carried out in accordance with the Declaration of Helsinki, including, but not limited to there being no potential harm to participants, the anonymity of participants is guaranteed, and the informed consent of participants was obtained. See *Med Educ* 2009;43:194-5.
- f) Details of any potential conflict of interest. A conflict of interest exists when professional judgement concerning a primary interest (such as patients' welfare or the validity of research) may be influenced by secondary interests (personal matters such as financial gain, personal relationships or professional rivalry).

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A copyright assignment form (available from 'instructions and forms' on <http://mc.manuscriptcentral.com/medicaleducation>) must be completed and signed by all contributing authors and uploaded as a separate file during the submission process; alternatively it may be emailed to [mededuc.com](mailto:mededuc.com) as a pdf file or sent by fax and post to the Editorial Office at the time of electronic submission. **We cannot accept submissions without this document.**

### **7. Proofs**

Proofs will be sent to the corresponding author via e-mail as an Acrobat PDF file. Your e-mail server must be able to accept attachments up to 4MB in size. Acrobat reader is required to read these proofs and it can be downloaded free of charge from [www.adobe.com/](http://www.adobe.com/). This will enable the proof to be opened, read on screen and printed out for any corrections to be made. Authors are required to provide corrections promptly; if you are going to be out of email contact for an extended period, please supply us with the contact details of someone who can attend to the proofs in your absence.

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