

# Teaching Human Anatomy to the Graduation Course in Health Sciences of the Lisbon University: Five Years of a New Educational Experience



## O Ensino de Anatomia Humana na Licenciatura em Ciências da Saúde da Universidade de Lisboa: Cinco Anos de Uma Nova Experiência Pedagógica

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### ABSTRACT

**Introduction/Objectives:** The authors make the balance of the first five years of teaching Anatomy to the Licensure in Health Sciences, of Lisbon University.

**Materials and Methods:** Were studied 408 students, enrolled in the Curricular Unit of Anatomy (mandatory subject of the 1st semester) and 29 in the Curricular Unit of Neuroanatomy (optional subject of the 6th semester). It was performed the statistical analysis by Anova and *t Student* test.

**Results and Discussion:** There was an annual growing influx of students enrolled in Curricular Unit of Anatomy, a stable number in Neuroanatomy and clear predominance of female students; ratio teacher / student variable between 1/9 and 1/17 in Anatomy and 1/8 in Neuroanatomy; high number of initial dropouts (15.69%) in Anatomy; approval levels of 95.93% in Anatomy and Neuroanatomy 100%; trend of improvement in the last two years, with statistical significance in the Curricular Unit of Anatomy ( $p = 0.0001$ ) and equal academic performance of students of both genders; satisfaction scores of students of Anatomy, Good = 71% and Very Good = 8%; in Neuroanatomy, unanimous classification by students = Very Good.

**Conclusions:** It was a very positive learning experience. The authors propose: the study of the causes and prevention of early dropout of incoming students, improving the ratio teacher / student, possible extension to a 2nd semester of the Curricular Unit of Anatomy and improving facilities that are already underway and includes the refurbishment and modernization of the anatomical theater of the Institute of Anatomy, Faculty of Medicine, University of Lisbon.

**Keywords:** Anatomy/education; Education, Medical, Graduate; Education, Medical, Undergraduate; Faculty, Medical.

### RESUMO

**Introdução/Objectivos:** Os autores fazem o balanço dos primeiros cinco anos de ensino de Anatomia da Licenciatura em Ciências da Saúde da Universidade de Lisboa.

**Material e Métodos:** Estudaram o desempenho de 408 alunos inscritos na Unidade Curricular de Anatomia (disciplina obrigatória do primeiro semestre) e 29 na Unidade Curricular de Neuroanatomia (disciplina opcional do sexto semestre). Realizaram a análise estatística pelos testes Anova e *t de Student*.

**Resultados e Discussão:** Houve um afluxo crescente anual de alunos inscritos na Unidade Curricular de Anatomia, um número estável em Neuroanatomia, predomínio claro de alunos do sexo feminino, ratio docente/aluno variável entre 1/9 e 1/17 na Unidade Curricular de Anatomia e 1/8 na Unidade Curricular de Neuroanatomia; elevado número de desistências iniciais (15,69%) em Anatomia; níveis de aprovação de 95,93% na Unidade Curricular de Anatomia e de 100% em Neuroanatomia; tendência de melhoria verificada nos últimos dois anos, com significado estatístico na Unidade Curricular de Anatomia ( $p = 0,0001$ ) e igual desempenho escolar de alunos de ambos os sexos; índices de satisfação dos alunos de Anatomia, Bom = 71% e Muito Bom = 8%; Neuroanatomia, classificação unânime pelos alunos = Muito Bom.

**Conclusões:** Foi uma experiência pedagógica muito positiva. Os autores propõem: o estudo e a prevenção das causas da desistência inicial dos alunos que acedem ao curso, melhoria do ratio docente/discente, possível extensão a um segundo semestre da Unidade Curricular de Anatomia e melhoria das instalações que já estão em curso e que inclui a remodelação e a modernização do teatro anatómico do Instituto de Anatomia da Faculdade de Medicina da Universidade de Lisboa.

**Palavras-chave:** Anatomia/ensino; Ensino Médico Graduado; Ensino Médico Pré-Graduado.

### INTRODUCTION

Health is considered one of the treasures of Humankind and the importance of its preservation and promotion through healthy lifestyle acquisition is recognized; relevant and good preparation in Anatomy for *Técnicos Superiores de Saúde* is therefore unavoidable and mandatory. These professionals effectively represent the information link and scientific development force in different strands of Health Sciences such as the laboratory and in teaching and research.

As we live in a world of globalization and economic constraints, synergies arise in the form of strategic development of added values and institutional fusions,<sup>1</sup> in order to meet the highest university goal of a better science production, embodied in a better research and in a high standard teaching, the latter's visibility translated in University ranking.

The Faculty of Medicine, University of Lisbon (*Faculdade de Medicina da Universidade de Lisboa - FMUL*), namely

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through the Normal Human Anatomy Institute (*Instituto de Anatomia Humana Normal*), is in a unique position to provide Health basic knowledge, in the field of: Human Body Anatomy.

A stronger investment in teaching in this area is essential as Health Sciences are a knowledge sector clearly expanding and with a predictable increase in social demand throughout this century, in turn due to intense ageing of population and an ever increasing intolerance towards life conditions and wellbeing degradation.<sup>2</sup>

The Health Sciences course extension allows the pre-university student to acquire a global vision of Anatomy, building the motivation and the aptitude for keeping up learning in subsequent studies. This model reflects, in our view, a first step towards the harmonization of curricula, Health Sciences university students' free movement in European Community and building of an European identity also extensive to the knowledge in the health area, in line with the Bologna Agreement.

The Health Sciences Bachelor (HSB) (*Licenciatura em Ciências da Saúde – LCS*) has been approved by the 106/2006 resolution, in the Scientific Committee of the Senate of the University of Lisbon (*Senado da Universidade de Lisboa*) meeting in 30th October 2006, following a proposal by the Scientific Councils of the Faculties of Science, Medicine, Pharmacy, Psychology and Educational Sciences and Dental Medicine.<sup>3</sup>

The Course leading to the Health Sciences Bachelor Degree includes six semesters of work comprising 180 ECTS credits.<sup>4</sup> The Course Unit of Human Anatomy is allocated with 6 ECTS and teaching is included in the first semester of the first year of the course. There is also an optional Course Unit of Neuroanatomy, with the same number of credits (6 ECTS), taught during the sixth semester of the course (second semester of the third year).

The authors were active participants in the course teaching from its inception, with Professor A J Gonçalves Ferreira in charge of the course during 2007 – 2010 and subsequently Professor Ivo Álvares Furtado.

Regarding the undergraduate education in the HSB of the University of Lisbon, the education method of the course units that we teach was one of our major concerns.

We worked to ensure that the Teaching-Learning process would represent both for us and for our students a continuing challenge, as we consider this as the key element for improvement and progression. In this new education experience, we regarded the change as fundamental, keeping the essential and taking advantage of the innovation benefits, with a view to obtain a better education. In the present work we draw an analysis of teaching methodology, of the results obtained and the evaluation of the teaching activity developed in the first five years of teaching Anatomy in the HSB of the University of Lisbon.

## MATERIAL AND METHODS

As the HSB course has already been designed to function according to the called Bologna Process, we analysed the

assumed commitments in this teaching model, aiming for practical applicability. Therefore, we designed the search of knowledge integration in modular teaching with shortening of the curricular subject in one semester, and a smooth processing of a multidisciplinary approach, encouraging the acquisition of a progressive autonomy by our students as skills improve as well as the student preparation for a continuous learning attitude.

We defined the educational objectives and the content for educational purposes of each course.

The Course program included two weekly theoretical one-hour lessons and two weekly two-hour practical lessons, in order to meet the learning plan included in the *Diário da República, 2ª série – nº 90 – of 9th May 2008*.

Figure 1 presents the numbers regarding the annual monitoring of Human Anatomy enrolment, called simply as Anatomy from 2010/2011 onwards.

Teaching of Anatomy at the FMUL used Anatomy Institute Staff for added value and occasionally Guest Lecturers<sup>6,7</sup> were invited to collaborate in the theoretical teaching of the Course Unit. Synergies are therefore fully used as well as course harmony which, among other aspects, favoured the possibility of equivalences, whenever possible, in cases where similar contents and identical tuition times are followed. In this context, the Anatomy professors of the HSB have actively participated in theoretical and practical classes. Students were divided in five classes of practical lessons. The most adequate teaching material was provided to the students, including dissections when possible, atlas, videos<sup>8</sup> and human models, as well as artificial reproductions. Working with audiovisual equipment and the use of a dynamic image banks has proved very beneficial, as compared with the often inadequate time available from a simple dissection lesson.

Despite electronic access to bibliography and beyond this aspect, we kept providing reading orientations of anatomy textbooks<sup>9-13</sup> and complementary references<sup>14-20</sup> appropriate for the type of education required for the target students.

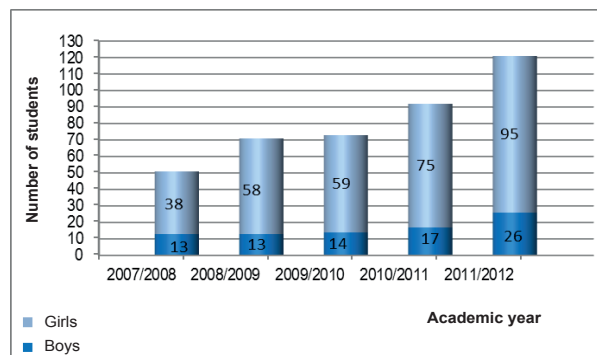


Figure 1 – Number of students annually enrolled in the Course Unit of Anatomy of the Health Sciences Bachelor of the University of Lisbon and their distribution by gender.

In anticipation of the educational method adopted we introduced to the students the extent and depth of an education directed towards defined objectives, including problem solving and skills acquisition (*Problems Based Learning*).

Therefore, we met the requirement of improving knowledge of the subject, covered during the hours of contact staff-student included in Bologna education, in order to obtain the maximal qualitative use of teaching hours: minimal teaching with maximum use, providing an option for the student regarding his scientific career.<sup>21,22</sup>

Our teaching tried to provide the technical and scientific knowledge with the communication and interaction with our students, supporting them in their learning. We established and maintained regular contact with the students, through the Course email.

The electronic access allowed for provision of Course Material, including the course program, its guidelines and lesson support, as well as the contents of theoretical and practical lessons. Anatomical demonstration sheets were also provided (for instance, a sheet indicating the structures to consider in heart dissection) and problem-solving sheets including the recommended solution.

In each practical lesson, a certain period of time was used to discuss anatomical problems and to answer any doubts or questions made by the students. During practical lessons, students also presented certain topics, including the use of anatomical models.

At the beginning of each academic year, the Anatomy Course Unit evaluation criteria were established, trying to focus on student continuing follow-up and using an effective continuous assessment.

Considering a brief first semester of students having just left high school and the need to build regular study habits, we obtained encouraging results by means of two preliminary tests, not only by the results, but also due to the information feedback regarding the implemented method. Therefore, these students studied the subjects using a stepwise method and obtained an adequate preparation for the final test at the end of the semester when the assessment of the acquired skills was performed. The practical evaluation counted for 20% for the final mark. The continuous evaluation made in practical lessons, including presentations and participation, counted for 10%. The two preliminary tests counted for 10% for the final mark. The access to the theoretical Final Exam, using a multiple choice test, was conditioned to obtaining a minimal classification of ten in the practical evaluation. The theoretical assessment was made using a multiple choice test with 75 questions covering all subjects of the Anatomy program, performed during a period of 90 minutes and counting with 80% for the final mark.

Teaching of the optional subject of Neuroanatomy started on the second semester of academic year of 2009/2010, a time when students of the initial course were entering the sixth semester, at a time when the course plan included the teaching of this optional subject.

The educational objectives of Neuroanatomy were previously defined.

The average number of students enrolled was ten.

Teaching methodology of Neuroanatomy Course Unit followed Human Anatomy general guidelines, obviously adapted to the subject specificity and to the progression level of the students, considering the knowledge integration level of a student in the sixth semester (the last course year). Human brain dissection was included in this subject, beyond the topics presentations made by students and the illustration support based on anatomical models.

The evaluation model of this Course Unit was also defined and presented to the students from the beginning, overlapping evaluation of students attending the Integrated Masters Course of Medicine. The practical evaluation, which represented 40% of the final mark, had two components:

- Student presentations assessment, counting 20%.
- Oral assessment, counting 80%.

The theoretical assessment counted 60% for the final mark and was the result of a final written exam, with multiple choice questions.

We have followed a similar criterion to the Anatomy course, following the general educational guidelines of Neuroanatomy, namely in bibliography access, although taking into account the specificity of this subject.<sup>23-26</sup>

In the 2011/2012 academic year, we used our own staff synergies with the educational means of the Anatomy Institute at the FMUL in order to teach Neuroanatomy (theory and practice) to two non-medical students, enrolled in doctoral programs at the University of Lisbon. These students followed a normal attendance of the Health Sciences Neuroanatomy course as an optional subject, added with a tutorial follow-up oriented to the student's own research work.

Also in the 2011/2012 academic year, an anonymous satisfaction survey was been carried out online, applied to the students in the Course Units (Anatomy and Neuroanatomy), taking into account the different aspects of teaching this subject, including contents suitability, the staff and students relationship, autonomy acquisition and didactic technical and scientific support, among others.

Data statistical analysis was carried out using single-factor ANOVA test, for more than two groups comparison, and the Student t test for independent samples, considering statistical significance for values of  $p \leq 0.05$ .

## RESULTS

Monitoring of student inflow to the courses revealed that, from all enrolled students in each course unit (Anatomy = 408; Neuroanatomy = 29, there was an increase with two students from the Cognitive Sciences PhD:

– The Anatomy Course Unit from HSB of the University of Lisbon was attended by 344 students (2007/2008 = 47; 2008/2009 = 66; 2009/2010 = 59; 2010/ 2011 = 77; 2011/2012 = 95). There were a 15.69% dropout rate. Males (67) represented 19.48% of the course attendance.

– The optional Neuroanatomy Course Unit from HSB

of the University of Lisbon was attended by 22 students (2009/2010 = 8; 2010/ 2011 = 7; 2011/2012 = 7). Males (9) represented 40.91% of course attendance. In the 2011/2012 academic year, two non-medical students attended this Course Unit, included in a doctoral program from the Cognitive Sciences of the University of Lisbon.

The obtained classifications are presented in Figures 2 and 3 for Anatomy and Neuroanatomy subjects, respectively. To each of the two graduate students were attributed an 18/20 mark (Figures 2 and 3).

The classifications obtained were compared by gender. Figure 4 presents the most significant results, due to the highest number of assessed students in the Anatomy Course Unit.

Upon conversion to the European scale or comparability of classifications<sup>27</sup> (A = 18 to 20/20; B = 16-17/20; C = 14-15/20; D = 12-13/20; E = 10-11/20), the following results were obtained: Anatomy, A = 0.30%, B = 3.94%, C = 26.97%, D = 36.97% and E = 31.82%; Neuroanatomy, A = 27.27%, B = 9.09%, C = 31.82% and D = 31.82%.

The results obtained in the satisfaction survey regarding the teaching quality in the Anatomy subject are presented in Figure 5. Twenty-four students replied to the survey (corresponding to 25.26% of total number of those questioned). As added data, 75% of the students considered the required work load as adequate for educational objectives; 21% considered it as excessive and 4% as insufficient. When questioned about obtaining support, when necessary, 83% of the students answered affirmatively. Regarding the staff-students relationship, 79% replied this was Good. Eighty-three percent of the students answered affirmatively when questioned about staff support and autonomy acquisition. The suggestions given by the students were directed towards the improvement of learning facilities, a closer relationship between students and staff, readdressing the value attributed to practical lessons in subject's global evaluation, increase in time allocation, adding one extra semester and the possibility of a course

unit equivalence for students wishing to follow the Medicine Masters Course in the FMUL (Figure 5).

In the 2011/2012 academic year, regarding Neuroanatomy subject, five students answered the satisfaction surveys regarding education quality, representing 71.43% of the total number of those questioned (Figure 6). Answers were unanimous as regards the teaching of this Course Unit being considered as Very Good and adequate to the educational objectives. When questioned regarding staff support, when necessary, as well as the support towards autonomy acquisition, answers were also affirmatively unanimous. Regarding the relationship between students and staff, all students considered it as being Good. The suggestions given by students were directed towards improvement of learning facilities, through ensuring a study room within the Anatomy Institute facilities, with increased access to didactic material.

**DISCUSSION**

The first analysis considered the group of student characteristics, annually increasing in the Course Unit of Anatomy (Figure 1) and with a female predominance (79.66% of the enrolled students). From these, there were 15.69% dropouts (64 students). In the Course Unit of Neuroanatomy, being optional, the students number attending the subject remained constant each year with eight students. There was a decrease of seven students (24 % of the total number initially enrolled) and who changed their option at a later stage, and an increase of the Cognitive Sciences PhD students (two students in 2011/2012 academic year). There was a better gender balance in Neuroanatomy with a female predominance (64.52%), possibly comprising students who were linked to an improved formation objective, aiming for a possible transition towards the Masters Course in Medicine or towards the Neurosciences Masters from FMUL

The increasing student inflow, observed in the Course Unit of Anatomy included in the HSB of the University of Lisbon attendance, was not matched by a proportional

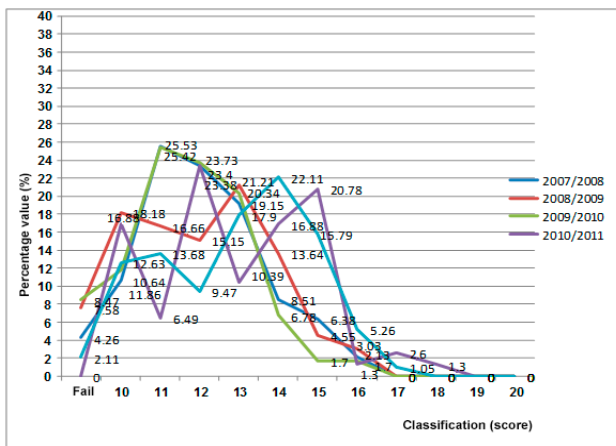


Figure 2 – Comparison of the school performance indicators of the assessed students in Anatomy in the different academic years, in the Health Sciences Bachelor of the University of Lisbon..

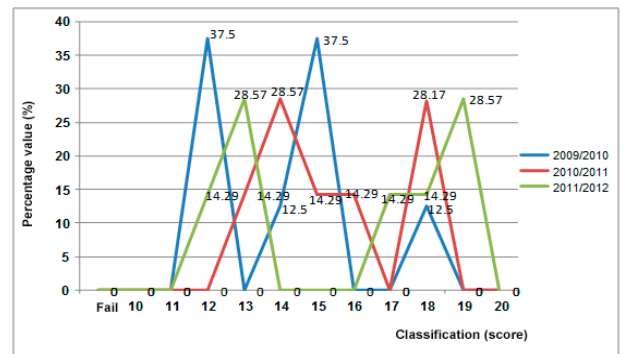


Figure 3 – Comparison of the school performance indicators of the assessed students in Neuroanatomy in the different academic years, in the Health Sciences Course of the University of Lisbon.

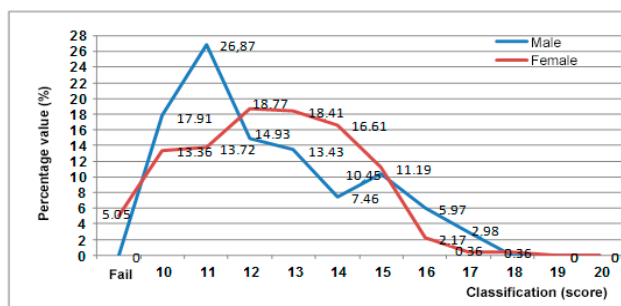


Figure 4 – Global comparison, by gender, of the school performance indicators of the students assessed in Anatomy in the Course of Health Sciences of the University of Lisbon.

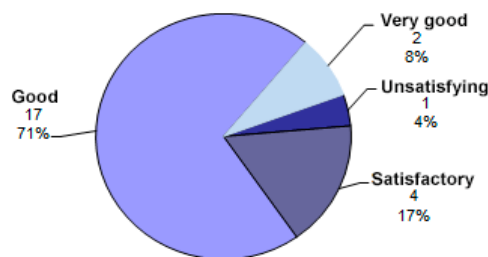


Figure 5 – Students' opinions in the 2011/2012 academic year, regarding the education provided in the Course Unit of Anatomy.

increase of staff, and therefore the staff/student ratio in practical lessons increased from 1/9 in the 2007/2008 academic year, to 1/17 in 2011/12. In Neuroanatomy, this ratio remained constant, of 1/8.

The annual evolution of the HSB Course Unit of Anatomy student achievement may be gauged by data presented in Figure 2, allowing to determine a satisfactory global result, reflected in a small number of failures that reached a maximum percent value of 8.47% in 2009/2010. Until 2008/2009, the classifications followed a trend towards bipolarization between a group of students of lower classification (10-11/20) and another group with medium classifications of 13/20. This trend was reversed in 2009/2010 and there was an upward trend in 2010/2011 and in 2011/2012, in which the highest student percentage, 20.78% and 22.11% respectively, obtained 15 and 14/20. This improvement observed in the last two years acquired a high statistical significance ( $p = 0.0001$ ). This improvement is due to the introduction of new technology supports in classes (didactic videos), as well as student motivation improvement due to the introduction of a PBL (problem-based learning) system education, based in predefined objectives and problem-solving, an initiative of the current professor in charge of the course. In 2010/2011 we achieved

100% approvals, which was obviously rewarding and, in 2011/2012 failures kept at a residual level of 2.11%. We have been able to partly counteract the effects of the high staff/student ratio. Only four students (1.16%) achieved a Very Good classification (17-20/20). We consider that this issue might be the consequence of the convergence of several factors. Firstly because the Anatomy subject is included in the first semester in which the students spend a great effort in their adaptation to university, full of multiple uncertainties yet to define, searching for an individual direction, in a semester that “quickly comes to an end. We tried to help our students to cope with these problems, encouraging them in a continuous form of study starting at the earliest possible stage. Several mini-tests were carried out in order to monitor study progression and these received considerable support by the students in the satisfaction survey that took place in the end of 2011/2012 academic year. The students further suggested an update of the percent value of its importance in the final mark, as well as an increase in teaching time dedicated to the subject in a future course update, with the inclusion of a second semester. The reasons of a high dropout number of students enrolled in the Course Unit of Anatomy are still not clear, although the first opinions point towards the fact of the HSB does not represent the first choice by a great number of students and in many cases this is the possible alternative for acquiring an improved education in order to gain future access to the Masters Course in Medicine.

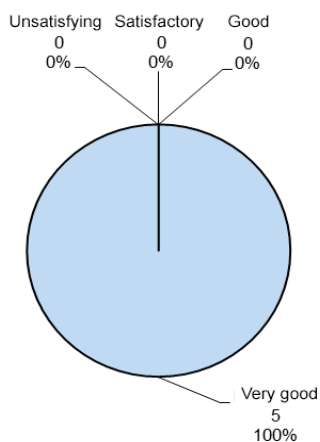


Figure 6 – Students' opinions in the 2011/2012 academic year, regarding the education provided in the Optional Subject of Neuroanatomy. Five students (71.43%) answered the survey.

The assessment of the classifications obtained in the Neuroanatomy subject of the HSB is presented in Figure 3, which shows a central group of 68.18% Good students, with classifications between 12 and 16/20 and a high percentage of Very Good students reaching 31.8%. There were no failures in the Course Unit of Neuroanatomy of the HSB. As it is the same staff, the reasons for success are mainly due to the maturity of the students who in this stage have chosen this subject as it represents added formative value. The suggestions made through the satisfaction survey asked for a new study facility specifically for the HSB Neuroanatomy students, within the facilities of the Anatomy Institute.

The school performance has been assessed by gender, in the Course Unit of Anatomy (Figure 4), and it shows

overlapping results ( $p = 0.34$ ), with the exception of a failure absence in male students. We may observe a higher homogeneity of medium classifications among female students, with the biggest group between 12 and 14/20 (18.77% and 18.41% of the female students, respectively). In the course unit of Neuroanatomy of the HSB, we also did not find any statistically significant differences between the classifications obtained by students of both genders ( $p = 0.12$ ).

The assessment made through the European scale of comparability of classifications (ECTS) confirmed the different results obtained by students in Anatomy and Neuroanatomy. In Anatomy, 95% of the students were classified below level C and with a predominance of group D (36.97%). In Neuroanatomy, there was a homogeneous group included in levels C and D (63.64% of the students) and a group of Excellency of 27.27% of students included in group A. The reasons for these differences must be determined, aiming to improve the future performance of the Anatomy students.

Regarding the assessment of the results obtained in the satisfaction survey carried out in 2011/2012, there was a different participation which was proportionally higher in Neuroanatomy (Anatomy = 25.26% and Neuroanatomy = 71.46%), with obvious implications in the appreciation and measures to be adopted.

The education provided in both Course Units obtained a favourable opinion by all students questioned in the Course Unit of Anatomy as it was considered as Good by 71% and Very Good by 8%. It was considered Very Good by 100% of the Neuroanatomy students. We aim to improve our service and we will propose an improvement of the staff/student ratio in Anatomy, with the increase of one more practical class. The refurbishment of the anatomical theatre is underway, which will allow for cadaveric dissection adapted to a high Anatomy education standard in the next few years. In the Anatomy subject, an extra theoretical class will be included on next academic year, according to students suggestion and teaching time will be increased. Subject redistribution and unfolding will be made, regarding more condensed subjects, and imaging of anatomy themes will be added. We remain available to discuss the assessment methodology, aiming to improve the current model. We will try to improve aspects related with staff-student relationship, considered as good by 79% of the students questioned and to increase the favourable rate of 83% regarding staff support, improving communication using the course email, using direct contact with the staff, including the staff representative.

In the Course Unit of Neuroanatomy, which has been classified as Very Good in every considered item, the possibility of satisfying the students request will be considered, implementing a study Neuroanatomy room

in the refurbished Anatomy Institute facilities, as well as improving the didactic support to the students.

## CONCLUSIONS

Upon five years of teaching Anatomy in the HSB of the University of Lisbon, the following conclusions are drawn:

- 1 – This has been a very positive educational experience which has benefited the Anatomy formation of the *Técnicos Superiores de Saúde* (Superior Technician on Health).
- 2 – The observed high number of initial dropouts reaching 15.69% of the students enrolled in the course unit of Anatomy should be analysed and prevented in the future.
- 3 – An increasing inflow of students in the course unit of Anatomy, which has varied between 51 students (2007/2008) and 121 students (2011/2012) has not been matched by a proportional increase in the staff number, deteriorating the staff/student ratio, which has evolved from 1/9 to 1/17. This is different from the much more favourable situation in the course unit of Neuroanatomy, in which there was an average annual rate of 10 enrolled students and a staff/student ratio of 1/8.
- 4 – High medium approval levels (95.93% in the course unit of Anatomy and 100% in Neuroanatomy) have been achieved.
- 5 – According with the European scale of comparability of classifications (ECTS), we obtained different Excellency levels for Anatomy students (A = 0.30%; B = 3.94%) and Neuroanatomy (A = 27.3%, B = 9.09%), with a trend towards improvement in the last two years in both course units.
- 6 – Students achieved an equivalent performance between both genders (Anatomy,  $p = 0.34$  and Neuroanatomy,  $p = 0.12$ ).
- 7 – We obtained favourable satisfaction rates by students regarding the Anatomy subjects, Good = 71% and Very Good = 8%; the Neuroanatomy, unanimous classification = Very Good.
- 8 – It is possible to improve students school performance, specifically in the course unit of Anatomy, for which we propose the study and prevention of the initial dropouts causes, a better staff/student ratio, a possible extension to a second semester in the course unit of Anatomy and an improvement of the facilities which is underway, including the refurbishment of the anatomical theatre of the Anatomy Institute of the Faculty of Medicine, University of Lisbon.

## CONFLICT OF INTERESTS

The authors declare that there has been no conflict of interests in writing this manuscript.

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