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Education

Anatomy in medical education: Perceptions of undergraduate medical students

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ABSTRACT

Aim: The best method to teach anatomy is widely debated. A shift away from cadaveric dissection in UK medical schools towards newer approaches has taken place without adequate evaluation of their suitability. The impact of this on future anatomical and surgical competencies is unclear. We assessed student perceptions to different methods of anatomy teaching.
Methods: All 2nd year students at Leeds School of Medicine were invited to complete a matrix-grid questionnaire. Participants were asked to score six methods of anatomy teaching (dissection; prosection; lectures; models; PC software packages; living & radiological anatomy) using a 5-point Likert-type scale on the ability to achieve nine learning objectives. Kruskal–Wallis and Mann–Whitney analyses suitable for non-parametric data were used to evaluate differences in scores between teaching methods.
Results: 170 students (71%) responded to the survey. Overall, dissection was the single highest scored method, followed by prosection. Newer approaches such as models, computer software packages and living & radiological anatomy scored comparatively worse. The most suitable method for achieving individual learning objectives was variable with dissection perceived as most suitable for four out of nine objectives.
Conclusions: Cadaveric dissection is a favourable approach for achieving important learning objectives in the field of anatomy. Further evaluation of teaching methods is required prior to changes being made in the curricula of UK medical schools.

1. Introduction

Over the past decade, anatomy teaching in undergraduate medical education has undergone considerable change. Despite a long history, the role of cadaveric dissection as the primary mode of anatomical teaching has been reduced or replaced in many UK medical schools by more innovative approaches such as prosection, plastic models and multimedia-based learning packages (McLachlan et al., 2004; McLachlan and Patten, 2006; Sugand et al., 2010). The driving factors behind these changes have included pressures on limited resources, a shortage of cadaveric donation, reduced teaching time and the desire to optimise recall of anatomical knowledge (Yeager, 1996; Nnodim, 1997; Dinsmore et al., 1999; Miller et al., 2002; McLachlan and Patten, 2006; Collins, 2008; Mitchell and Batty, 2009). In addition, the appropriateness of undergraduate dissection has been called into question due to the implicated anxieties and stress which may be caused to students (Evans and Fitzgibbon, 1992; Charlton et al., 1994; Druce and Johnsons, 1994; Nnodim, 1996; Leong, 1999; Lempp, 2005). The debate over how best to teach undergraduate anatomy continues.

Authors have written at length to express concern over the ever-decreasing time dedicated to anatomy and changes to the way it is taught, with some suggesting it has already fallen below a safe level (Warner and Rizzolo, 2006; Turney, 2007). Relatively fewer studies have attempted to quantify the appropriateness of methods and to evaluate the potential consequences of curricula change. Those that have (Sinclair, 1965; Bernard, 1972; Willson et al., 1975; Jones et al., 1978; Peppler et al., 1980, 1985; Nnodim, 1990; Stanford et al., 1994; Yeager, 1996; Sandra and Ferguson, 1998; Jones et al., 2001; Johnson, 2002; McWhorter and Forester, 2004) are written by anatomists to compare cadaveric dissection to new institution-specific teaching approaches, but may be susceptible to bias according to a review by Winkelmann (2007).

The purpose of this study is to evaluate medical student perceptions of various teaching methods and the ability of these to achieve a set of learning objectives. A small number of recent studies have investigated the perceptions and attitudes of medical students but this area remains relatively underexplored (Moxham and Plaisant, 2007; Cahill and Ettarh, 2009; Kerby et al., 2011).

2. Methods and materials

2.1. Setting and population

All 2nd year students at Leeds School of Medicine were invited to participate in the survey between December 2011 and January

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2012. The school admits approximately 240 applicants per year to the standard five-year MBChB (Bachelor of Medicine, Bachelor of Surgery) programme. Those enrolled on the course are a mixture of undergraduates and postgraduates, with a typical female:male ratio of approximately 60:40.

Leeds is one of a small number of UK medical schools which continues to teach anatomy using "wet" cadaveric dissection. Anatomy is taught in the first two years of the course via an integrated systems-based approach (University of Leeds, 2010) with concurrent teaching in anatomy, radiology, physiology, pharmacology and clinical disciplines. Didactic lectures are delivered to introduce and develop knowledge of structure, function and clinical applications of each anatomical system. An associated online tutorial is linked to each lecture to reinforce key concepts via the institutional online "Virtual Learning Environment" (VLE). Focussed practical classes comprising of group dissection and anatomist-led prosection take place in dedicated dissection laboratories and are supplemented with a range of artificial and plastinated models. Practical classes are linked to online video tutorials and three-dimensional (3-D) anatomy software packages, available in library-based "viewing stations". Radiological and living anatomy is taught via small group sessions and clinical applications are explored via a series of clinician-led symposia. Table 1 outlines the methods and relative contributions of a typical systems-based module taught over a period of 8 weeks.

To progress through the course, students are required to achieve a satisfactory standard in summative assessments for various subject focuses. Anatomy is examined via written and practical ("spot") tests comprising gross, radiological and living anatomy.

2.2. Questionnaire

Demographical data were collected including: age group, gender and attainment of previous anatomical degrees. Participants were asked to complete a questionnaire (Appendix 1) to investigate student perceptions of how well six teaching methods (cadaveric dissection; prosection; lectures; models; computer software packages; living & radiological anatomy) achieve the following learning objectives:

A To instil anatomical knowledge.
B To provide a background for other basic sciences.
C To provide a background for clinical disciplines.
D To obtain a three-dimensional (3-D) appreciation of the body.
E To appreciate anatomical variations.
F To relate anatomical structure to the development of pathology.
G To encourage self-directed learning.
H To encourage learning from experiences.
I To appreciate clinical anatomy.

Learning objectives were listed as row headings and teaching methods as column headings, arranged in a matrix-grid format. Participants entered a number between one and five in each box, where one indicated a "poor link" and five indicated an "excellent link" between method of teaching and fitness to achieve the corresponding learning objective. The matrix was similar to that used and validated by Patel and Moxham, where learning objectives were pre-determined by a panel of anatomical students and tutors (Patel and Moxham, 2006). Teaching methods were consistent with those used at Leeds School of Medicine and similar to categories described by Brenner et al. (2003).

Table 1
Summary of teaching methods for a typical systems-based module taught over a period of 8 weeks. Systems-based teaching consists of anatomy, radiology, physiology, pharmacology and clinical disciplines. LA/RA, living anatomy & radiology.

Methods	Total (hours)
Practical: dissection/prosection/models	16
Lectures	44
Online/computer software	27
LA/RA group work	8
Clinical symposia	27

2.3. Data presentation and analysis

Demographical data are expressed descriptively (%). Simple analysis of the questionnaire data is reported using median values. The Kruskal–Wallis H test, suitable for non-parametric data (Kruskal and Wallis, 1952), was used to investigate differences between teaching methods for each learning objective ($p < 0.05$ considered statistically significant). The test evaluates the difference in mean ranks across a whole dataset to assess a null hypothesis (N_O) that all medians are equal. The output is reported as H, a statistic approximately equal to chi-square (χ^2) with $k-1$ degrees of freedom (df) (Zar, 1985). The magnitude of H determines the difference between medians, with higher outputs indicating a larger difference. Individual mean ranks are reported where appropriate.

Independently, the Kruskal–Wallis test is unable to evaluate differences between individual pairs of groups, and requires further post hoc analysis using the Mann–Whitney U test (Mann and Whitney, 1947) to achieve this. Serial Mann–*Whitney U* tests were performed pair-wise on teaching methods for each learning objective and the results protected from Type I statistical errors (incorrect rejection of a true N_O) using Bonferroni correction (Dunn, 1961). This is calculated by dividing the a priori significance value ($p = 0.05$) by the number of tests performed on an individual dataset ($n = 15$). The output (U) was considered statistically significant if $p < 0.0033$ ($p = 0.05/15$). All statistical analysis was performed using SPSS 20.0 for Windows [SPSS; Chicago, IL]).

2.4. Ethical approval

Ethical clearance for this study was approved by the Medicine and Dentistry Educational Research Ethics Committee (EdREC) at University of Leeds. Informed consent for participation in the study was implied by each student upon submission of the completed questionnaire.

3. Results

70.8% ($n = 170/240$) of 2nd year students completed the questionnaire, comprising 69% females ($n = 117/170$) and 31% males ($n = 53/170$). The majority of participants ($n = 162$; 95%) were aged 18–23 and one participant described holding a previous degree in anatomy. There were no differences in median values between males and females. Median scores for all teaching methods and corresponding learning objectives are shown in Table 2 .

Table 3 demonstrates the outcome of Kruskal–Wallis analyses for each learning objective. There was a significant difference in how students rated teaching methods for each of the described learning objectives, with an H value of >11.07 considered statistically significant ($p < 0.05$). By combining data for all learning objectives, it is evident that a considerable difference exists between perceptions of teaching methods and their ability to fulfil all of the described learning objectives collectively.

Fig. 1A–I illustrates the outcome of pair-wise Mann–Whitney analyses for each learning objective. Dissection featured as the single highest-scored method for four out of nine learning objectives, significantly preferred for appreciating anatomical variation, 3D anatomy, encouraging self-directed learning and learning from experiences (D, E, G, H). In addition, dissection and prosection