

The relationships between attitudes, course aims and teaching methods for the teaching of Gross Anatomy in the Medical Curriculum

Bernard J. Moxham¹ and Siân A. Moxham²

1- Cardiff School of Biosciences, Cardiff University, Cardiff CF10 3US, Wales, United Kingdom

2- Barts and The London, Queen Mary's School of Medicine and Dentistry, Queen Mary, University of London, Turner Street, London E1 2AD, United Kingdom

SUMMARY

Recent developments in medical curricula have led to marked changes in the teaching of gross (topographical) anatomy. This has resulted from the belief that anatomy is largely “content-driven” and not “skills-based”. This presentation describes and evaluates, primarily from the perspective of medical students, different methods of teaching anatomy and includes the “teaching” of such skills as: team skills, relating their dissecting room experience to the study of pathology and to the clinic, relating their experience to medical humanities issues such as their responses to death. The assessment of attitudes was conducted by employing Thurstone and Chave attitude analyses and also a matrix questionnaire that evaluated different methods of teaching anatomy in relation to an array of potential course aims/learning outcomes. Comparisons were made with the attitudes of professional anatomists working in Europe. The findings show that:

- Medical students and professional anatomists differ little in their evaluation of the importance of anatomy and of the relationships between teaching methods and course aims/learning outcomes;

- Medical students believe that anatomy is very important to clinical medicine (before entering their medical course, after completing their anatomy courses, and towards the end of their medical training at university);
- Medical students would prefer that anatomy is taught practically (via dissection, use of prosection, with living and radiological anatomy) than theoretically (via didactic teaching, models, CAL).

Because of anatomy's perceived clinical importance, because of the preference for practical teaching and learning, and because both professional anatomists and medical students do not believe that anatomy contributes greatly to other basic sciences, it is suggested that anatomy ought to be a “stand-alone” component in a medical curriculum.

Key words: Attitudes – Teaching Methods – Gross Anatomy – Professional Anatomists – Medical Students

INTRODUCTION

This paper briefly revisits three studies that we have recently conducted to assess medical students' and professional anatomists' attitudes

Correspondence to:
Prof. Bernard J. Moxham, Cardiff School of Biosciences, Cardiff University,
Cardiff CF10 3US, Wales, United Kingdom. Telephone: +44 (0)29 20874031;
Fax: +44 (0)29 20875964. E-mail: moxham@cardiff.ac.uk

towards gross (topographical) anatomy and their opinions as to how the subject is best taught/learned. The motivation for these studies came from a realisation that there were few quantitative investigations concerned with such important issues and that “data-based” studies were now required to deal with the perceived threats facing the subject. Indeed, much has been written under the guise of proclaiming that the subject of anatomy is under “threat” such that it is not appropriately valued in the medical curriculum. In truth, however, anatomists appear to remain enthusiastic about their discipline, regardless of the educational and political assaults inflicted in recent times. Nevertheless, there continues to be the feeling that anatomy courses are under pressure and so initially the question should be posed - why?

To the cynical, the answer might be that we live in a period of “change for change sake” and that the pressures on anatomy relate more to “whim and fashion” rather than to rational educational objectives (to quote the mantra: being fit for the 21st century!!). In addition, there has been much political activity in medical schools and it has served well the purposes of many Deans to control finances by merging basic science departments. Indeed, within the United Kingdom there are now very few departments of anatomy within universities. To risk injecting controversy, some anatomists have put the blame for this situation on weak and/or uncommitted heads of anatomy departments who have preferred “the quiet life”!! It would, however, be kinder (and perhaps more truthful) to suggest that the slow, and persistent, drip of too numerous initiatives and unremitting bureaucracy have made it difficult to pursue reasonable strategic objectives. More compelling is the argument that, nowadays, universities wish to be seen to be more research-led. For example, in the United Kingdom, the four/five year cycles of its Research Assessment Exercise (RAE) have dramatically shifted the balance between teaching and research. Other countries, even without RAEs, have shifted the balance towards research on the basis of increasing scientific and public esteem and improving grant winning capabilities. Educational issues, often driven by emerging departments of medical education, have probably also contributed to anatomy’s situation. It is indeed frequently believed that gross anatomy is largely “content-driven” and not “skills-based” and consequently many concerned with medical

education have seen anatomy as being “over-stuffed with facts” and therefore in need of being diminished in importance within a medical curriculum that has a reduced factual overload. Within the United Kingdom, during the 1990s and early 2000s, the General Medical Council (2003) issued guidelines to medical schools stating that “undue emphasis on detail was not required” (Utting and Willan, 1995), calling for a reduction in the “burden” of factual information within medical curricula. Accordingly, many medical schools decreased the number of hours allocated to all biomedical sciences in the United Kingdom, but especially for anatomy (Utting and Willan, 1995; Dangerfield et al., 2000). Similar reductions in teaching hours have occurred worldwide and have been extensively documented (Collins et al., 1994; Utting and Willan, 1995; Cottam, 1999; Fasel et al., 1999; Holla et al., 1999; Leong, 1999; Dangerfield et al., 2000). Concomitant with such changes has been a change in educational ideology. Increasingly, there is less reliance on academic-led teaching and student-led learning (e.g. PBL) has become more prevalent. At the same time, anatomy as an independent subject has “suffered” as a result of “integrated” courses of various types. Perhaps more prosaically, dissecting rooms have closed for financial and/or health and safety reasons and, perversely given the extent of regulation and legislation given to informed consent for the bequeathal of bodies for anatomical examination, some have argued that it is unethical for medical students to deal with cadavers in a health care profession (McLachlan et al., 2004). Cases have also been made for the cessation of dissection by students on the basis that anatomical dissection causes too much anxiety and stress (e.g. Evans and Fitzgibbon, 1992; Charlton et al., 1994; Druce and Jonson, 1994; Nnodim, 1996; Leong, 1999; Lempp, 2005). Finally, even where the above issues do not apply, and where the medical school is in favour of dissection by the students, courses are being compromised by the shortage of bodies bequeathed.

Two further explanations to account for the problems facing anatomy have not previously been considered. Firstly, too much controversy and criticism emanating from the community of professional anatomists itself can be counterproductive and the notion has been proposed that the community is divided into “modernists” and “traditionalists”. Secondly,

because a defence of the role of anatomy has too often depended upon anecdotal and/or qualitative evidence (frequently with a strong ideological bias), there has been too little quantitative and rigorous pedagogic investigation. The main purpose of this paper is to bring together ongoing research that we are undertaking to assess attitudes towards the importance of anatomy to clinical medicine and to evaluate different methods of teaching anatomy and how they relate to course aims/learning outcomes (including the acquisition of skills). Such work is presently being conducted primarily from the student perspective and takes a non-ideological position on the basis of quantitative evaluations. However, to accomplish this we have also evaluated the attitudes of professional anatomists since they provide a “control” group of individuals who are clearly committed to their discipline. The hypotheses we are currently assessing are:

1. that, although anatomy is highly valued in the medical curriculum by professional anatomists, it is much less valued by medical students;
2. that professional anatomists and medical students also differ markedly in their assessment of the best ways of teaching gross anatomy.

To date, three different studies have been undertaken to test these hypotheses.

Study 1. Professional anatomists’ perspective on the importance of Anatomy to Medicine and the relationship between course aims and teaching methods.

This work has been recently published by Patel and Moxham (2006).

This study assessed whether professional anatomists have preferred methods for teaching gross anatomy and was achieved by asking for an evaluation of how well six different teaching methods fit a variety of course aims that could be associated with an anatomy course. Using a structured questionnaire, our study compared anatomists with differing attitudes towards educational principles and the need to undertake curricular changes (i.e. “modernists” and “traditionalists”). The questionnaire was organised into four sections. The first section was an introductory questionnaire that focused upon the individuals’ personal details and previous experience, enabling

qualitative comparisons between groups of anatomists with differing experiences. The second part of the questionnaire assessed anatomists’ attitudes employing Thurstone and Chave questionnaires (Thurstone and Chave, 1951; Lemon, 1973; Rajecki, 1990). Figure 1 shows the questionnaire employed to assess anatomists’ attitudes towards the importance of anatomy in medicine. It consists of 20 statements covering a range of views and the anatomists involved in the survey were asked to tick *only* those statements with which they were in full agreement. Prior to distributing this questionnaire, scale values were allocated to each statement through a panel of fifty “judges” comprised of biomedical students and academics who did not participate further in the study (Thurstone and Chave, 1951; Lemon, 1973; Rajecki, 1990). The role of the judges was to indicate where, on a scale of one to eleven, they perceived each statement to lie. The judges were instructed to assign a value of 1 to statements that represent anatomy as being very important in medical curricula, a value of 11 to statements implying that anatomy is unnecessary in modern-day medicine. A value, for example, of 6 would represent a neutral statement. By calculating the median value from data supplied by the judges, an attitude value was allocated to each statement, thus giving each statement a location on the attitude scale. On completion of the questionnaire by a responding anatomist involved in the survey, the modal value of the statements that the individual marked could then be used as an attitude value for that individual (Thurstone and Chave, 1951). The final part of the questionnaire was a matrix questionnaire that consisted of a grid with anatomical course aims listed as row headings and teaching methods listed as column headings (Figure 2). Each recipient of the questionnaire was requested to enter a number from zero to five into each box, a value of five indicating an excellent “fit” between teaching method and course aim and a value of zero suggesting no “fit” between teaching method and course aim.

A total of 119 responses were received from professional anatomists. Analysis of anatomists’ attitudes revealed that the mean attitude score was 2.5 (± 0.82 SD), indicating that anatomy was perceived to be very important to clinical medicine. Furthermore, 98% of respondents regarded anatomy as being

Figure 1. Statements in a questionnaire used to assess attitudes towards the importance of anatomy in medicine according to the method devised by Thurstone and Chave (1951). Note that the “attitude values” deemed appropriate by a set of “judges” are included here but were not provided in the questionnaire distributed to potential respondents.

statements	Medians
Although anatomy is interesting, the subject needs selective understanding in the clinic.	7
Anatomical terminology is the vocabulary of medicine.	2
Anatomy is a useful tool for satisfactory medical practice.	3
Anatomy is a “necessary evil” in Medicine.	7
Anatomy is of some use in the clinic, but its importance may be exaggerated.	8
Anatomy is only of benefit in certain medical specialities.	7
Anatomy is so old fashioned that it has no importance in contemporary Medicine.	11
Anatomy is time wasted in the medical curriculum.	11
Anatomy needs to modernise if it is going to be really useful in Medicine.	6
Every doctor must have a good knowledge of Anatomy.	2
If alternative and Eastern Medicine can do without Anatomy, so can Western Medicine.	10
It is impossible to conceive of good medical training without a major Anatomy component.	2
It is not possible to make a reasonable medical diagnosis without Anatomy.	2
Medicine could not exist without Anatomy.	1
Most medical conditions do not require a great knowledge of Anatomy.	8
Of all the basic sciences, Anatomy is the most relevant	3
Only a limited anatomical knowledge is required for satisfactory medical practice.	7
Rather than learn Anatomy, medical students should concentrate on clinical sciences.	9
The principles of Medicine are not founded on anatomical knowledge.	9
Without a knowledge of Anatomy the doctor is of limited effectiveness.	3

Figure 2. The matrix questionnaire consisting of a grid with anatomical course aims listed as row headings and teaching methods listed as column headings. Each recipient of the questionnaire was requested to enter a number from 0 to 5 into each box, with a value of 5 indicating an excellent “fit” between teaching method and course aim and a value of 0 suggesting no “fit” between teaching method and course aim.

Section D

Please enter a number from zero to five in each box, depending on how well the teaching aim is achieved - by using that particular teaching technique (with 5 being an excellent fit between teaching aim and technique, 0 being no ‘fit’ between teaching aim and technique).

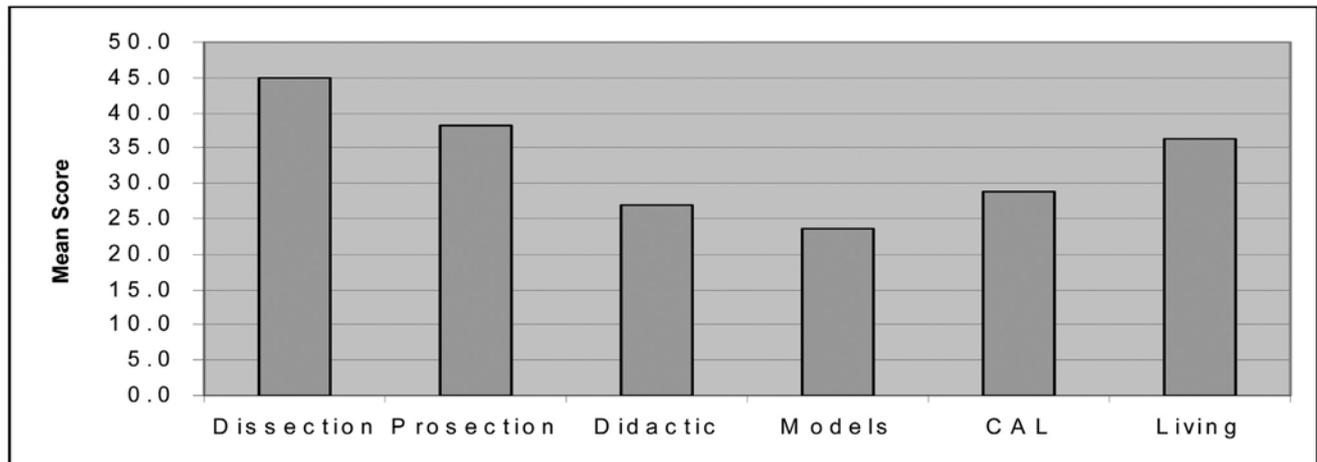
Teaching aim	Teaching technique	Dissection by Students	Prosection & Demo.	Didactic teaching only	Models	C.A.L. & Tape/slide	Living & Radiological
To impart anatomical information							
To provide background for other basic sciences							
To provide background for clinical disciplines							
To provide a medical vocabulary							
To obtain a 3-D appreciation of the body							
To appreciate anatomical/biological variation							
To relate structure to pathology							
To provide project-based and student directed learning							
To encourage learning from experience (not “authoritative texts”)							
To develop team skills							
To develop the skill of following complicated instructions							
To consider issues relating to Death							

important clinically, while only 2% were unsupportive of anatomy’s role in medicine.

Concerning the results from the matrix questionnaire, total scores for each teaching method within a respondent’s matrix questionnaire were calculated. For example, should an individual have allotted a score of 5 for every course aim for human cadaveric dissection, the total score would be 60 (the maximum). This total score represented the ability of each teaching method to achieve the various learning objectives of an anatomy course identified in the matrix questionnaire. The mean scores for each teaching method are displayed in Figure 3 and Table 1. The data clearly show that human cadaveric dissection by students is the professional anatomists’ preferred method of teaching to achieve course aims. Indeed, 69% of responding anatomists gave cadaveric dissection the highest score out of all the teaching options. Employing Kruskal-Wallis tests, a statistically significant difference in responding anatomists’ preferred teaching method was detected ($p < 0.001$). Further analysis of the data indicated that “modernist” and “traditionalist” views within the community of professional anatomists had not diverged such that the importance of gross anatomy in the medical curriculum is disputed and that cadaveric dissection by students is no longer the preferred method of teaching.

Table 1. Data (means and standard deviations) used to construct the histogram illustrated in Figure 3.

	DISSECTION	PROSECTION	DIDACTIC	MODELS	CAL	LIVING
Mean	45.0	38.1	27.0	23.5	28.7	36.2
SD	10.0	8.9	10.5	10.1	10.6	9.9

Figure 3. Mean scores of the six groups of teaching methods, as allocated by professional anatomists. Scores are based upon how well course aims are achieved by the various teaching methods, with higher scores indicating greater ability to achieve the learning outcomes in an anatomical course.

With the results of this study revealing a consensus within the professional anatomist community that human cadaveric dissection is the most efficient method to achieve anatomical course aims, the fact that many anatomists argue over different methods in journals (e.g. Newell, 1995; Shaw-Dunn, 1995; Skidmore, 1995; Dinsmore et al., 1999; Holla et al., 1999; de Barros et al., 2001; Fitzpatrick et al., 2001; Heidger et al., 2002; Johnson, 2002; Nieder and Nagy, 2002; Op Den Akker et al., 2002) seems inconsistent. It is conceivable that anatomists advocate the use of the specific teaching methods to which they are accustomed. Results from the introductory part of the questionnaire do not support this contention, it being clear that the majority of anatomists are familiar with the use of more than one teaching technique. Indeed, almost 20% of anatomists stated that they were experienced in using all six methods of teaching identified in this study. Another possible explanation for the inconsistency is that the population of anatomists questioned in this study is not representative of the anatomical community. However, a wide range of different individuals within the anatomical community answered the questionnaire. It is hoped that a similar study to ours (presently restricted to the

UK and Ireland and to Continental Europe) will be conducted by anatomists in other parts of the world (e.g. America and Japan).

Further analysis of the data (not undertaken as part of the initial report of Patel and Moxham (2006)) provides information concerning which teaching methods are best for specific course aims/learning outcomes. Figure 4 highlights, for each course aim, the number of excellent, good, moderate or poor measures of “fitness for purpose” for teaching methods according to criteria predetermined before collection of the data (Patel and Moxham, in preparation). Again, the findings indicate that cadaveric dissection by students is the most “fit for purpose” across the whole range of course aims, followed by prosection and demonstration and by living and radiological anatomy. The use of anatomical models and CAL and tape/slide is perceived as being the least “fit for purpose”. However, of greater importance pedagogically than assessing teaching methods across *all* possible course aims is evaluation of individual course aims. In this regard, little difference was discernible between teaching methods when considering learning outcomes related to the acquisition of anatomical knowledge. However, the use of human cadaveric dissection gained more

Figure 4. A table showing the “fitness for purpose” for various methods of teaching gross anatomy for a variety of course aims as obtained from data provided by professional anatomists.

Teaching aim	Excellent “Fit”	Good “Fit”	Moderate “Fit”	Poor “Fit”
To impart anatomical information	NONE	Dissection; Prosection; Living/Radiological	Didactic; Models; CAL	NONE
To provide background for other basic sciences	NONE	NONE	Dissection; Prosection; Didactic; CAL; Living/Radiological	Models
To provide background for clinical disciplines	Dissection	Prosection; Living/Radiological	Didactic; CAL; Models	NONE
To provide a medical vocabulary	NONE	Didactic	Dissection; Prosection; CAL; Living/Radiological	Models
To obtain a 3-D appreciation of the body	Dissection	Prosection; Living/Radiological	Models	Didactic; CAL
To appreciate anatomical/biological variation	NONE	Dissection; Prosection	CAL; Living/Radiological	Didactic; Models
To relate structure to pathology	NONE	Dissection; Prosection	Didactic; CAL; Living/Radiological	Models
To provide project-based and student directed learning	NONE	Dissection	Prosection; CAL; Living/Radiological	Didactic; Models
To encourage learning from experience (not “authoritative texts”)	Dissection	Living/Radiological	Prosection;	Didactic; Models; CAL
To develop team skills	NONE	Dissection	Living/Radiological	Prosection; Didactic; CAL; Models
To develop the skill of following complicated instructions	NONE	Dissection	NONE	Prosection; Didactic; CAL; Models; Living/Radio.
To consider issues relating to Death	NONE	Dissection	Prosection	Didactic; Models; CAL; Living/Radiological

approval when the skills-base was considered rather than just the content-base of an anatomical course. If, therefore, the major aim of an anatomy course (or component of a medical course) is to impart anatomical information (and for many this seems to be the *raison d’être* of anatomy) then, according to the respondents in this survey, the use of cadaveric dissection, prosection and demonstration or employing living anatomy and radiological materials can provide a good “fit”. Surprisingly, none of the methods of teaching anatomy were regarded as “fit for purpose” in relation to providing background information for other basic sciences. It is conceivable that this perception relates to the concerns sometimes felt about the way anatomy is “downgraded” in fully integrated/problem-based learning courses where anatomy might only feature as introductory material or where clinical case histories are not formulated to require much in the way of anatomical knowledge! Nevertheless, in terms of giving background information for clinical disciplines, cadaveric dissection by students was perceived as providing an excellent “fit”. Prosection and

demonstration and living/radiological anatomy seemed to provide a good “fit” for this course aim. However, despite the frequent expression of the view that anatomy provides an important vocabulary used at all levels of medicine, the perception is that this is better delivered by didactic teaching and not by the more “practical” methods of teaching the subject.

Concerning aspects of skills acquisition, professional anatomists were of the opinion that cadaveric dissection by the students fitted excellently with the aims of appreciating the 3-dimensionality of the human body and with strategies for experiential learning. In addition, cadaveric dissection produced good “fits” for the appreciation of anatomical variation, relating structure to pathology, project-based learning, developing team skills and following complicated instructions. Demonstrating anatomy using prosections produced good “fits” for appreciating the 3-dimensionality of the body and anatomical variation and for relating structure to pathology. Thus, it is the view of professional anatomists that the use of human cadavers within gross anatomy courses

confers many important skills. It is rather ironic, therefore, that many new courses that are being developed along supposedly “modernistic” lines with major cuts to factual content and with the belief that they are encouraging the development of a better “skills-base” are potentially doing the opposite if cadavers are not being fully used in the teaching and learning process. It should also be mentioned that the use of didactic teaching, models and CAL was also considered by professional anatomists to provide poor “fits” for course aims associated with skills acquisition. To the authors’ surprise, the use of living and radiological anatomy did not appear to gain much favour amongst anatomists in relation to skills acquisition. This method of teaching and learning only produced good “fits” for appreciating the 3-dimensionality of the human body and for learning experientially.

Concerning the aim of considering issues relating to death, cadaveric dissection by students produced a good “fit” and prosection and demonstration a moderate “fit”. Other teaching and learning methods produced poor “fits”. Consequently, it is appreciated that the experience of learning with human cadavers (either directly or indirectly) can impact upon this course aim. The extent to which gross anatomy courses in medicine make use of this course aim is unknown, although the potential for teaching in ethics and medical humanities is obvious. Furthermore, the very experience of handling human cadavers can lead to the students becoming more contemplative and concerned about issues of mortality.

Overall, therefore, it appears that, if the course aims are restricted to knowledge acquisition (which medical educationalists appear to decry) and assuming a reasonable quality of teaching, then professional anatomists seem to believe that all teaching methods could be “fit for purpose”. For skill acquisition, however, it is the clear belief that practically-based teaching and learning (particularly dissection by the students) is most “fit for purpose”. Consequently, in the design of anatomically-related courses in medicine, it is important to decide upon course aims and learning outcomes at the outset and to then choose the appropriate methods for delivering such aims and outcomes. Anecdotally, this appears to happen too infrequently. Indeed, it is not educational acceptable or desirable to decide first on the methods of teaching and learning (however compelling the political, theoretical, ideolog-

ical or financial grounds) and then to “shoe-horn” in the course aims and learning outcomes (e.g. Brenner et al., 2003).

Study 2. Medical students’ perspective on the importance of Anatomy to Medicine.

This work has been recently published by Moxham and Plaisant (2007).

To date, there have been no quantitative studies into the attitudes of medical students to the clinical relevance of gross anatomy. Our aim was to assess the attitudes of a sample of medical students in Wales and France who were about to begin the first year of their medical studies and, subsequently, as they are completing their final years of study. This was accomplished using the attitude analysis questionnaire devised according to the precepts of Thurstone and Chave (1951) that was employed previously to assess the opinions of professional anatomists (see Figure 1). The hypotheses that we tested were: firstly that students newly admitted to their medical studies have variable views concerning the relevance of anatomy to clinical practice and secondly that, as students progress through their medical courses, they become less positive in their attitudes towards the clinical relevance of gross anatomy.

Medical students at Cardiff University and at Paris V (Université René Descartes) were asked to complete a confidential questionnaire; once right at the start of their courses and before receiving tuition in gross anatomy, again after completing their courses and examinations in the subject, and lastly in the final year of undergraduate medical studies. The questionnaire was available in French and English versions (see Figure 1 for the English version).

For the results obtained during the early part of the medical course (when the students were newly-admitted to medicine), 89% and 87% of the students in classes at Paris V and Cardiff respectively correctly completed the questionnaire. Figure 5 provides a histogram showing the results of assessing the attitudes of medical students in Paris to anatomy and its clinical relevance. Given that “attitude scale values” below 7 are considered favourable to the view that anatomy is important for clinical medicine, the mode of 3 (both before and after the anatomy courses) indicates that the students are highly in favour of anatomy’s importance. Figure 6 provides a histogram

Figure 5. Histograms showing the attitudes of first year medical students at Paris V (Université René Descartes) to anatomy and its clinical relevance (data obtained using a Thurstone and Chave (1951) attitude analysis (see Figure 1)). Series 1 is data obtained before starting the anatomy course; series 2 is data obtained after the course and examinations/assessments.

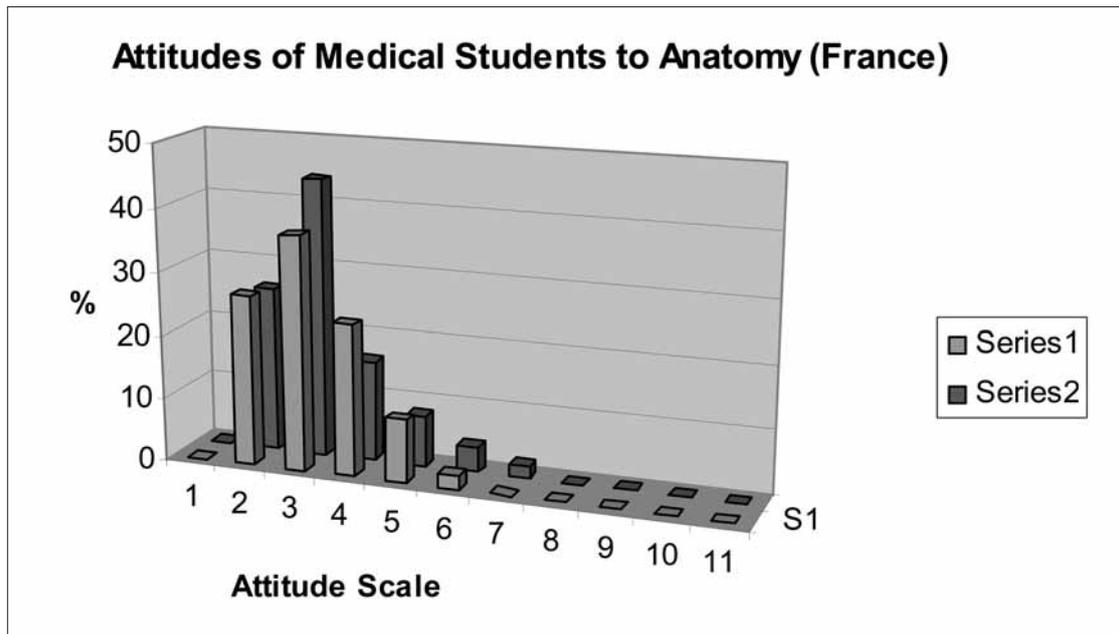
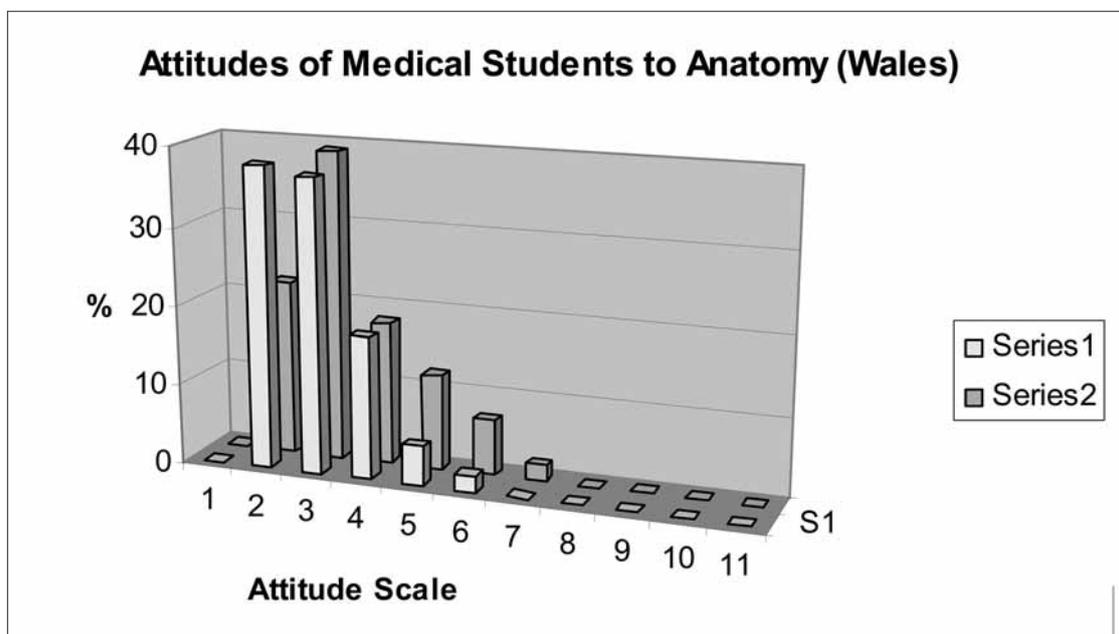


Figure 6. Histograms showing the attitudes of first year medical students at Cardiff University (Wales) to anatomy and its clinical relevance (data obtained using a Thurstone and Chave (1951) attitude analysis (see Figure 1)). Series 1 is data obtained before starting the anatomy course; series 2 is data obtained after the course and examinations/assessments.



showing the results of assessing the attitudes of medical students at Cardiff to anatomy and its clinical relevance. The mode “attitude scale value” is initially 2 and subsequently 3 at the end of the courses. Again, the students appear to be highly favourable to the view that anatomy is important to clinical medicine. Thus, students at both Paris and Cardiff showed very positive attitudes to the importance of gross

anatomy to clinical medicine and this attitude did not seem to be greatly diminished at the end of their courses and following examinations.

For the results obtained during the final year of the medical course, approximately 85% of the students who were available for “questioning” (and not out of the region/country for study leave) correctly completed the ques-

tionnaire. Figure 7 provides histograms showing the attitudes of the medical students at Paris and Cardiff who were then (as at April 2006) in their final year of study.

Despite their different educational experiences, students of medicine at both Paris and Cardiff showed very positive attitudes to the importance of gross anatomy to clinical medicine. In all cases, the range of attitude scores was between 2 and 7, with median values of 3. The findings thus indicate that students that are just entering medical school believe that anatomy is important for their training. This attitude corresponds with a very positive attitude shown towards anatomy by laypersons (Hennon and Moxham, unpublished data) and, unsurprisingly, by professional anatomists (Patel and Moxham, 2006). Subtle differences were discerned between the sets of data. Before entering an anatomy course, the medical students at Cardiff had a slightly more positive attitude to the subject than their counterparts at Paris. However, after the courses and the examinations, no differences could be discerned. Concerning the less positive attitude of Cardiff students after completion of their course and examinations, this shift is very slight (although statistically significant given the large numbers of students involved in the survey; $p < 0.05$). Indeed, if the modes had changed from 3 to 5 or 7 (or even greater) than this would have been not only statistically but also pedagogically very significant. It is possible that this shift is a reflection of the fact that, following the course and

the examinations, the Cardiff students may have a better (less idealistic) understanding of the subject and its clinical relevance. Alternatively, the difference could just be associated with *ennui* and the feelings students have after undertaking a difficult subject.

It could be argued that, since attitudes are “plastic”, there could be considerable changes to these attitudes as the students proceed through their medical training. The present data, however, shows that, despite the lack of formal teaching of anatomy beyond the earlier years of the medical course, students at both Cardiff and Paris maintain the positive attitudes towards the relevance of anatomy to clinical medicine up to their final years of study. Similar positive attitudes have been reported for medical residents in the USA, which would suggest that anatomy is still perceived to be important to them clinically long after they have finished their MD degrees (Cottam, 1999).

Thus, the present data does not support our original assumption and hypothesis that students newly admitted to their medical studies do not have clear views concerning the relevance of anatomy to clinical practice. Indeed, it seems that, whether or not they are daunted by the prospect of undertaking a difficult subject like anatomy, they are under no illusions at this stage about their views concerning its clinical relevance. Furthermore, the data does not support our original hypothesis that, as students progress through their medical courses, they become less positive in their atti-

Figure 7. Histograms showing the attitudes of final year medical students at Paris V (Université René Descartes) and at Cardiff University (Wales) to anatomy and its clinical relevance (data obtained using a Thurstone and Chave (1951) attitude analysis (see Figure 1)).

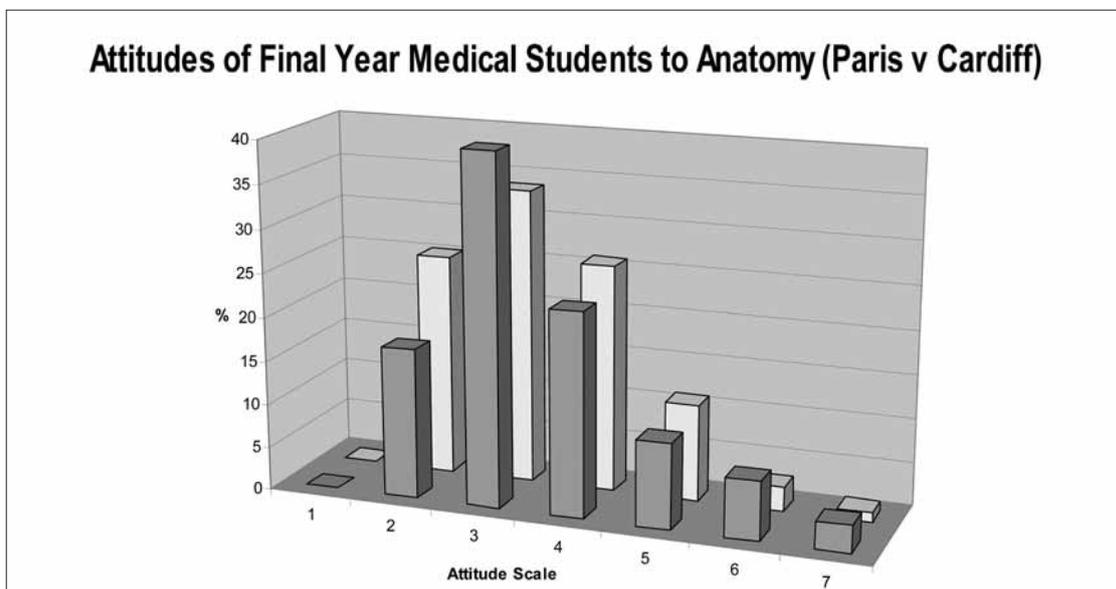


Figure 8. Histogram displaying measures of “fitness for purpose” for dissection-based teaching for a variety of course aims, as discerned by first year students at Paris V (Université René Descartes) and at Cardiff University (Wales) and using a matrix questionnaire similar to that shown in Figure 2. Course aim 1 = to impart anatomical information; course aim 2 = to provide background for other basic sciences; course aim 3 = to provide background for clinical disciplines; course aim 4 = to provide a medical vocabulary; course aim 5 = to encourage the development of manual skills; course aim 6 = to obtain a 3-D appreciation of the body; course aim 7 = to appreciate anatomical/biological variation; course aim 8 = to relate structure to pathology; course aim 9 = to provide project-based and student directed learning; course aim 10 = to encourage learning from experience (not “authoritative texts”); course aim 11 = to develop team skills; course aim 12 = to develop the skill of following complicated instructions; course aim 13 = to consider issues relating to death.

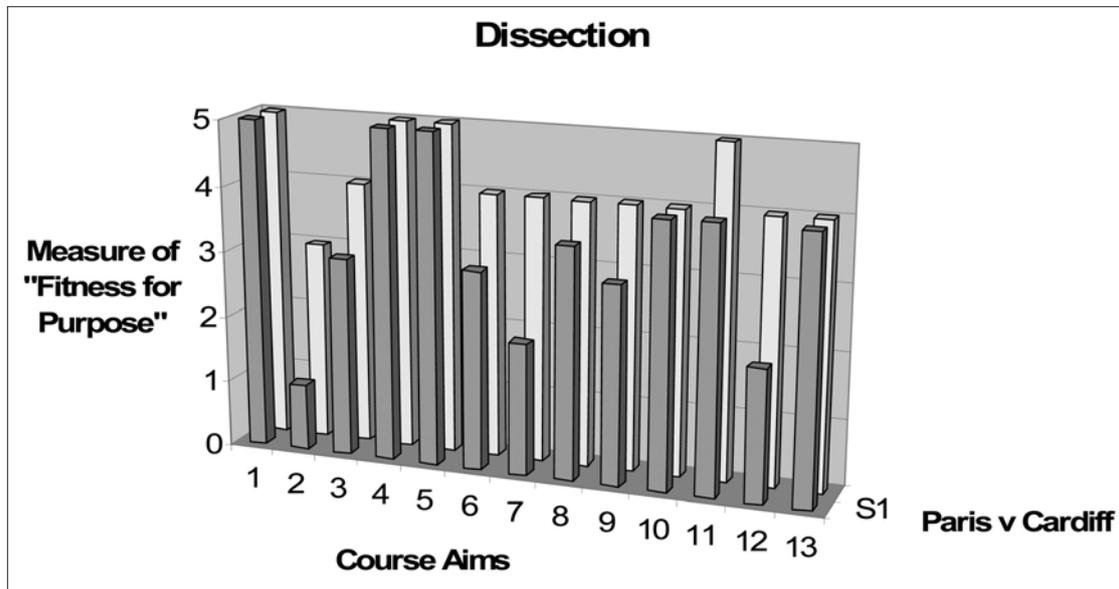
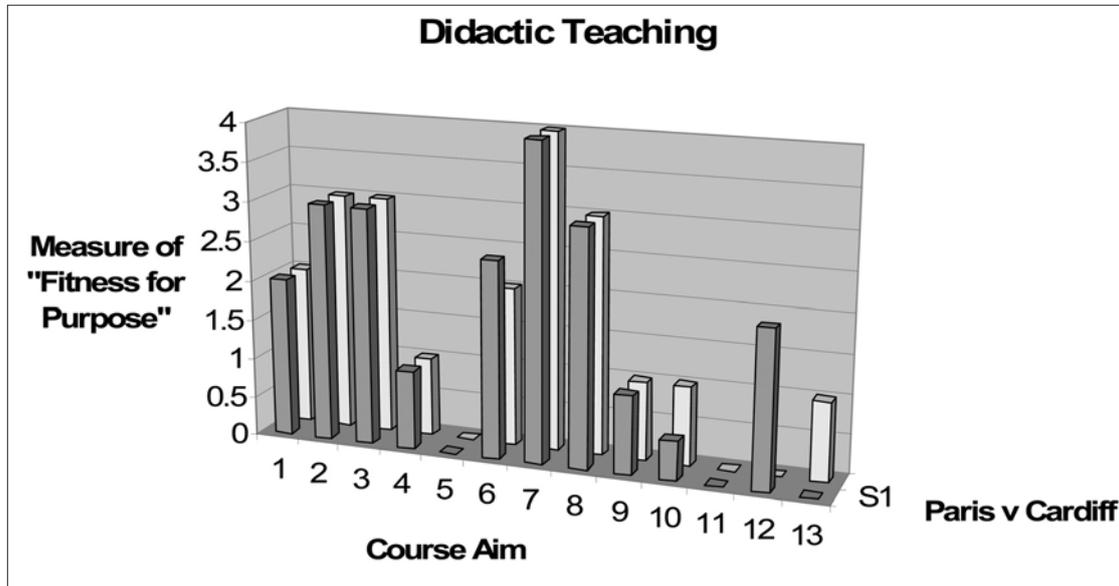


Figure 9. Histogram displaying measures of “fitness for purpose” for didactic teaching alone for a variety of course aims, as discerned by first year students at Paris V (Université René Descartes) and at Cardiff University (Wales) and using a matrix questionnaire similar to that shown in Figure 2. The course aims (1-13) are described in Figure 8.



tudes towards the clinical relevance of gross anatomy. Consequently, it could be argued that, given the findings of the present study, medical educationalists and politicians who favour drastic cuts in the teaching of anatomy in the undergraduate curriculum should take care not to upset or diminish the aspirations of medical students. This supports the beliefs of professional anatomists that (perhaps unsur-

prisingly) anatomy is critically important to clinical medicine (Patel and Moxham, 2006) and also the concerns that have been expressed about the effects on medicine of changing the teaching of anatomy without proper analysis of the consequences (e.g. Monkhouse, 1992; Older, 2004; Pryde and Black, 2005; Hinduja et al., 2005; Waterston and Stewart, 2005).

Table 2. “Fitness for purpose” of various teaching methods employed for gross anatomy as discerned by first year medical students (numbers without brackets) and professional anatomists (numbers in brackets). Thus, for example, for dissection by students, there are 3 course aims where the method has excellent “fit” as seen by both students and anatomists and there are 8 course aims deemed good by the students and seven deemed good by anatomists.

TEACHING TECHNIQUE	DISSECTION BY STUDENTS	PROSECTIONS & DEMO.	DIDACTIC TEACHING ONLY	MODELS	C.A.L. & TAPE/SLIDE	LIVING & RADIOLOGICAL
“Fitness”						
Excellent (mean >4.5)	3 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Good (mean 3.5 - 4.4)	8 (7)	5 (5)	1 (1)	0 (0)	0 (0)	4 (5)
Moderate (mean 2.5 - 3.4)	1 (2)	4 (5)	3 (4)	4 (3)	5 (7)	5 (5)
Poor (mean <2.5)	0 (0)	3 (2)	8 (7)	8 (9)	7 (5)	3 (2)

Study 3. Medical students’ perspective on the relationship between course aims and teaching methods (work in progress).

Using the matrix questionnaire previously employed to assess professional anatomists’ opinions (see Figure 2), 183 final year medical students at Cardiff and 161 final year medical students at Paris V, Université René Descartes were questioned to investigate the relationship between anatomical course aims and teaching methods. At the time of writing, this survey will be extended to students at London, Innsbruck, Madrid and Romania. For the present data, remarkably similar opinions were expressed by the final year medical students at both Cardiff and Paris as reported earlier for the professional anatomists. Thus, practical methods of teaching scored more highly than didactic teaching (see Figures 8 and 9) and there was greater “fitness for purpose” for teaching using cadaveric material (by dissection or by using prosections) and for living and radiological anatomy (see Table 2). Didactic teaching alone scored badly but the students believed that there was little or no “fitness for purpose” for teaching techniques employing models or e-learning (Table 2).

CONCLUSIONS

The three studies briefly reviewed here indicate that medical students believe that anatomy is very important to clinical medicine (before entering medicine, after an anatomy course, and towards the end of their medical training). Furthermore, professional anatomists and medical students differ little in their evaluation of the importance of anatomy and of the relationships between teaching

methods and course aims/learning outcomes. Indeed, medical students and professional anatomists would prefer that anatomy is taught practically (via dissection, use of prosection, with living and radiological anatomy) than theoretically (via didactic teaching, models, CAL/e-Learning). Thus, in relation to the initial two hypotheses proposed in the introduction to this paper, namely:

- that, although Anatomy is highly valued in the medical curriculum by professional anatomists, it is much less valued by medical students;
- that professional anatomists and medical students also differ markedly in their assessment of the best ways of teaching gross (topographical) Anatomy.

the findings/data collected are inconsistent with both these hypotheses.

Clearly, therefore, medical educationalists should ensure that anatomy forms a significant and important part of their clinical courses and that such courses should be based upon practical training with cadavers.

The findings also suggest that, because of anatomy’s perceived clinical importance, because of the preference for practical teaching and learning, and because both professional anatomists and medical students do not believe that anatomy necessarily contributes greatly to other basic sciences, anatomy ought to be a “stand-alone” *component* in a medical curriculum. Consequently, integrative biomedical science courses are potentially disadvantageous to clinical training if the teaching of anatomy merely forms background or introductory information or if taught not by subject specialists who are able to develop proper, and full, understanding of the discipline.

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