The perception of anatomy teaching among UK medical students

How do teaching methods measure up with students' preferences for learning?

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Medical education is currently undergoing a series of changes to meet the demands of modern medical practice.[1] A paper analysing the anatomy curriculum in medical schools across the UK has suggested a reduction in the number of hours dedicated to the study of anatomy.[2] Some believe that such changes have resulted in a decline in the anatomical knowledge of medical students and young doctors.[3,4] More than half of the newly qualified doctors consider their knowledge to be inadequate for their job.[5] Senior medical staff believe that this is a potential threat to patient safety.[6] These concerns have been the focus of many discussions on effective anatomy teaching methods in UK medical schools.

For doctors in training, appreciation of the architecture of the human body is essential in the application and practice of medicine. It allows the clinician to understand the theory behind patient symptoms, perform a relevant physical examination, interpret clinical images, form differential diagnoses and communicate these findings with both the patient and other medical professionals. It is therefore critical that anatomy remains at the core of the medical curriculum to enable the 'modern doctor' to practise medicine safely.

Hands-on cadaveric dissection has played a fundamental role in anatomy teaching as it allows for a haptic, three-dimensional (3D) appreciation of human architecture,[7] and facilitates the link between structure and function. Dissection enables the students to appreciate the natural anatomical variability.[8] It also familiarises them with the concepts of death, confidentiality and respect, which is essential for doctors.[9]

Cadavers are becoming increasingly scarce and their preservation costs have continued to rise. Running a dissection laboratory with appropriately trained full-time staff can be a considerable financial challenge for any educational institution. In addition, the variability of cadaveric material and quality of dissections (dependent on student skill level) are among the reasons why prosections are becoming more popular in some medical schools. Prosections have all the important structures neatly exposed for the student to identify while retaining the spatial orientation of the original structure. This method also has the advantage of being time and cost effective, and it has been argued by some to be equally effective as gross dissection.[8,10,11]

There has been an explosion of interest in the innovative problem-based learning (PBL) teaching method. This method promotes student-centred learning and encourages autonomy of learning. It merges the acquisition

of knowledge with generic skills and attitudes such as teamwork, communication, planning and problem-solving. However, the value of PBL over traditional methods in acquiring and integrating core anatomical knowledge has been uncertain and ambigious.[12]

Anatomy teaching has also benefited from technological success and the market has seen a flood of computer assisted learning (CAL) packages, DVDs and other visuospatial learning tools. These are time- and cost-effective ways of delivering anatomy teaching to large student groups. CAL packages have been demonstrated to be superior to conventional textbooks with regard to long-term memory retention.[13] Despite this, most consider them mere learning adjuncts and they cannot therefore be viewed as a substitute for the dissection laboratory.[14] This concept is supported by research comparing the use of CAL packages in conjunction with gross dissection against dissection on its own; students who used CAL packages in addition to gross dissection scored much higher in their summative examinations than those who relied on dissection alone.[15]

In the wake of *Tomorrow's Doctors*,[16] the emphasis of teaching has been steered away from factual content learning and towards a varied 'core knowledge'. Currently, there is no definition of 'core minimum knowledge', and there is an apparent lack of consensus on what to teach and the level of clinical anatomical knowledge expected from a junior doctor.[17,18] Universities are encouraged to vary their curricula and this can lead to significant variability in the number of hours dedicated to anatomy teaching. With the varied practice of anatomy teaching across UK medical schools, this ultimately means that the acquisition of 'core minimum knowledge' is, at best, variable across UK medical schools.

In this study, the main and adjuvant methods of anatomy teaching across medical schools in the UK were compared against students' preferred methods of anatomy teaching. The students' perceived confidence in their anatomical knowledge was also investigated as well as whether the current

Table 1 The numbers of students receiving various teaching modalities as their main and adjunctive methods of anatomy teaching

	Main teaching method	Adjuncts to main teaching method
Cadaver dissection	96 (27%)	133 (37%)
Lectures	101 (28%)	181 (51%)
Problem-based learning	124 (35%)	99 (28%)
Prosections	49 (14%)	175 (49%)
Tutorials	29 (8%)	206 (58%)
Multimedia	25 (7%)	252 (71%)

anatomy summative assessment styles are in line with student preferences.

METHODS

This was a prospective study with data collection taking place between 2005 and 2010. A questionnaire developed by the Centre for Spinal Studies and Surgery at Queen's Medical Centre in Nottingham was handed out to all participants at the Professional Medical Education finals revision course. This course included students from all medical courses (both undergraduate and graduate) across the UK. There was no bias for sex, age or previous experience of anatomy. Participation in the study was voluntary. All incomplete questionnaires were excluded from analysis.

The questionnaire was divided into a number of discrete sections. The first part comprised the students' demographic details, the main and adjunctive methods of how their anatomy teaching was delivered, and the students' preferred methods of learning anatomy. The questionnaire also included a ten-point Likert scale to evaluate the students' perceived confidence in their own anatomical knowledge at the level of a F1 doctor and their perceived importance of anatomical knowledge to different medical specialties. Finally, students' preferred examination methods were compared against the actual examination practices at their medical schools.

Data were coded and analysed with Excel® (Microsoft, Redmond, WA, US) using non-parametric tests.

RESULTS

Overall, 356 students (240 female, 67%; 116 male, 33%) fully completed the survey. One

hundred and eleven questionnaires were not included owing to incomplete responses. The age range of the respondents was 23–43 years. A third of the students (n=109, 30.6%) classified themselves as mature students.

Teaching methods

There are currently 32 registered medical schools in the UK. Nineteen medical schools in our survey offered cadaver dissection. However, only 12 (60%) offered it as their main teaching method.

The main methods of teaching anatomy in UK medical schools were PBL followed by lectures and cadaveric dissection. Prosections were offered less often with tutorials and multimedia being the least common methods of teaching anatomy (Table 1). Such methods were mostly used as adjuncts to the main teaching method.

Student preferences

When the students' preferred methods of anatomy teaching were examined, cadaveric dissection was the most favoured method (62.3%). This was followed by tutorials (57.5%), lectures (45.8%) and multimedia (41.7%), with PBL and prosection both being favoured the least at 34.8%.

Students' perceptions of their anatomical knowledge

More than 90% of the students believed that anatomy is an essential part of the medical curriculum and should be taught to all medical students: 85% felt anatomy was important for the F1 job, 92% for the physicians and 99% for the surgical specialties. In stark contrast, approximately

50% of students ranked their anatomical knowledge as inadequate to be a competent F1 doctor (Figure 1).

Examination styles and student preferences

Students were examined using a variety of methods: the objective structured clinical examination (OSCE) (69%), written exams (71%), *viva voce* exams (35%) and assessment of coursework (20%). Seventy-two per cent of students agreed that the OSCE style 'spotter' exam was the optimal form of examination (ie 72% scored it as 8/10 or above compared with written [57%] and *viva voce* exams [54%]). Coursework was the least popular assessment method with only 17% of students rating it 8/10 or above (Figure 2).

Discussion

Our study suggests that cadaver dissection was the most popular method of learning anatomy among UK medical students. In contrast, prosection-based learning was least popular, highlighting the perceived value of gross cadaveric dissection to the students' learning experience. Yeager found that students who 'learned by doing' (ie dissections) performed better than those taught using prosections.[19] Furthermore, it was suggested that formal cadaveric dissection enhanced integration of knowledge. These assertions were amplified by Winkelmann, who found greater acquisition of knowledge when anatomy was taught by gross dissection than by other methods.[20]

The strength and robustness of these findings can be implied from the declared bias of researchers towards introducing an alternative teaching method (CAL packages) and shrinking dissection laboratory time. While traditional dissection cannot be hailed categorically as the most superior teaching method, it would nevertheless be difficult to argue that reducing cadaveric dissection time would not have any detrimental effects.

In our study, nearly half (45%) of the students preferred lectures as their 'next best' teaching modality. Students' preference for lectures has been reported as low as 23% in a previous study.[21] It is possible that this difference is due to a higher proportion of 'non-mature' students in our study. This student group may prefer a more familiar, guided approach in the form of traditional didactic teaching.

PBL is currently most widely used as an anatomy teaching method. This practice appears to be well supported by research. There is sufficient evidence exploring the value of student-led groups to the acquisition of one's own learning objectives and in preparation for examinations.[22] However, our study suggests that only 28% of students prefer PBL, which is much smaller than the 60% reported previously.[22] We speculate that this could be a reflection of our students' characteristics as they appear to prefer a more directed form of teaching than independent methods. The discrepancy may also be due to the variability in the organisation and delivery of PBL classes. PBL is dependent on systematic and extensive preparatory work as well as relevant guidance from PBL group leaders. Without an appropriate infrastructure to support such an environment, this educational modality can be hijacked as 'an excuse for low staffing levels' and suboptimal educational standards.

Furthermore, our study suggests that only small numbers of students used methods such as colouring books, videos/DVDs and computer-based learning as their primary learning methods. Nevertheless, almost a third of students relied on these as secondary learning strategies, suggesting that such methods may not be suitable for grasping major anatomical concepts.[21,23]

Figure 1 The students' perceived relevance of anatomy knowledge to various career paths and the students' perceived adequacy of their own anatomical knowledge at the F1 level
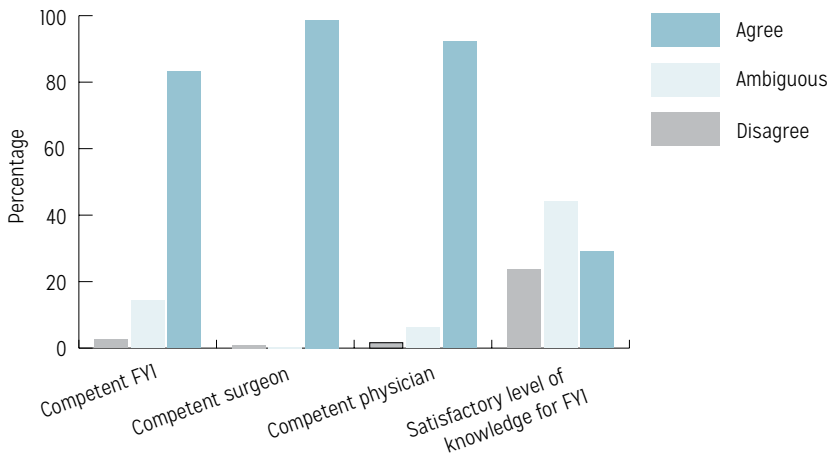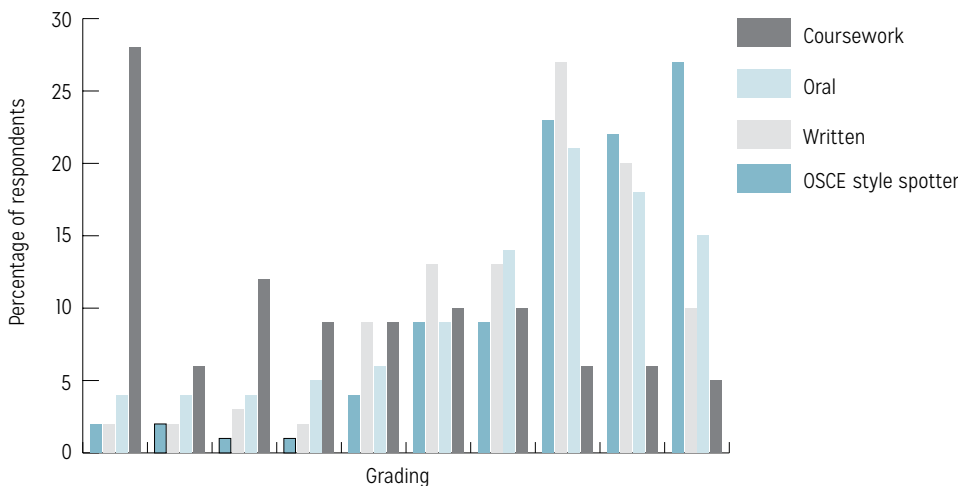

Figure 2 Students' perceived usefulness of examination techniques (1 = least useful, 10 = extremely useful)

In our study, students preferred to be examined by OSCE style spotter exams, which is consistent with UK medical schools' assessment practices. Learning that is acquired via gross dissection is likely to be easily retrieved by examination methods using a similar modality. The spatial relationship and 3D orientations in spotter exams are likely to act as retrieval cues from memory stores of dissection classes.[24,25] One may therefore argue that the mismatch between practically orientated assessments and the dwindling practices of teaching by gross dissection could lead to poor student achievement. However, this is not substantiated by previous research as medical students are a highly motivated group and are likely to compensate for such discrepancies.[26,27]

A disappointingly large proportion of students believed that their anatomical knowledge is insufficient for working as a foundation doctor. There are multiple potential explanations for this. It is possible that students may have underestimated their knowledge or they may have been unfamiliar with the level of knowledge required of a junior doctor and could be overestimating this. It is also possible that the recent reduction in cadaveric dissections and staffing cuts may have impacted adversely on the quality of teaching. The resultant perceived inadequacy of students' anatomical knowledge could therefore have been an accurate reflection of their competency.

These perceptions of inadequate anatomical knowledge have been echoed consistently in previous studies.[6,7,18] They may have resulted from the lack of uniformity in the anatomical curriculum[18] and inappropriate timing of anatomy education delivery. Most anatomy is taught in the pre-clinical phases, where students are forced to memorise facts without clinical experience. This may not be conducive to vertical integration of anatomical knowledge into clinical practice.[7]

In acquisition of core medical knowledge, the General Medical Council (GMC) has steered the emphasis away from learning by 'memorising facts' to learning by 'problem-solving'. However, it has still not defined what it means by core medical knowledge. The Anatomical Society has drawn up an anatomy syllabus specifically for undergraduate medical courses to guide anatomy teaching.[28] Such lack of clarity in the GMC's expectations may account for the broad variability in anatomical knowledge of students across the UK.

CONCLUSIONS

Our study suggests that medical students prefer to learn anatomy by means of gross dissection and, similarly, they prefer to be tested by methods using practical examination techniques. An eclectic approach employing a variety of methods, with gross dissection at its core, is likely to be perceived positively by the students.

The lack of student confidence in their anatomical knowledge is concerning. In an era of increasing patient expectations and rising complaints, it is important to produce confident doctors with anatomical knowledge that is adequate and consistent across all UK medical schools. This is an area that needs further guidance from the GMC.

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