Conscientious, competent and caring: producing the junior doctor of the future

Abstract

This article is based on the Association for the Study of Medical Education Gold Medal Plenary for 2022, given by the first author. It outlines different ways in which medical training can be approached, based on his career and his work with colleagues. Among the attributes that it would be desirable to promote in future doctors are conscientiousness, competence and care for patients as individuals. This article explores each of these in separate sections. The first demonstrates that the trait of conscientiousness can be observed in first and second year medical students by their compliance in routine low level tasks such as attendance and submission of required work on time. A 'conscientiousness index' calculated on this basis is a statistically significant predictor of later events such as performance in exams, the prescribing safety assessment, and the UK situational judgement test in subsequent years, and also in postgraduate assessments such as Royal college exams and the annual reviews of competence progression. The second proposes that competence in tasks undertaken by junior doctors is better achieved by teaching on medical imaging, clinical skills and living anatomy than by cadaveric dissection. The final section argues that the incorporation of arts and humanities teaching into medical education is likely to lead to better understanding of the patient perspective in later practice.

Key words: Anatomy teaching; Conscientiousness; Medical education; Medical humanities

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Introduction

This article is based on the Association for the Study of Medical Education Gold Medal Plenary for 2022, given by the first author. It outlines different ways in which medical training can be approached, based on his career and his work with colleagues.

Among the attributes that it would be desirable to promote in future doctors are conscientiousness, competence and care for patients as individuals. These are each addressed in a separate section. The first draws on psychometric analyses, the second features anatomy teaching and the third relates to the use of arts and humanities in medical education. The authors propose that powerful ways to develop medical students for later practice are first to ensure that students are selected and monitored with regard to the trait of conscientiousness, second, that students are educated in ways which empower their practice as junior doctors, with particular regard to anatomy learning via medical imaging and living anatomy, and third, to promote the beneficial influence of arts and humanities teaching on students' understanding of themselves and others.

The role of conscientiousness in selecting and monitoring medical students

The authors have argued that conscientiousness is a key part of professionalism (McLachlan, 2010). Professionalism itself is hard to define, and therefore even harder to measure (McLachlan and Robertson, 2017). The difficulty in measurement arises from a number of observations: that professionalism is a cultural construct, that varies from place to place and time to time and is therefore a moving target; that many of the proposed measures are subjective and that there is therefore an issue of reliability; that many of the measures, such as review of written texts, for example portfolios, are very time consuming and hence expensive.

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Several previous studies seemed informative. The first was that failure to bring passport photographs on day 1 of joining the medicine programme proved to be a strong predictor of performance in the end of year 2 examinations (Wright and Tanner, 2002). The second was that failure to comply fully with immunisation requirements on joining the programme proved to be a predictor of review board problems (Stern et al, 2005). Most saliently, low early career exam scores predict later fitness to practise proceedings (Papadakis et al, 2008).

The authors reflected on why this might be the case. Fitness to practise sanctions are rarely simply a consequence of failures of knowledge or skill. On the contrary, 94% of fitness to practise cases in the study by Stern et al (2005) were a result of unprofessional behaviour such as fraud, negligence or substance abuse. Normally, knowledge or intelligence are not thought of as co-distributing with virtue. It is hypothesised that perhaps the trait of conscientiousness underpinned both high exam performance and later risk of fitness to practise sanctions, so it seemed natural to attempt to measure conscientiousness directly. The big five approach to personality was used in the analyses; the authors were aware that conscientiousness is frequently the strongest single predictor of later workplace (Hurtz and Donovan, 2000) and academic (Poropat, 2009) performance and could see no reason why medicine should be different.

The principles established during the development of a tool to monitor conscientiousness were that each component should be objective (eg 'did not attend') rather than subjective (eg 'did not participate'). Measures which were already being collected were sought, such as attendance, so that little work was involved, and the measures had high discrimination between individuals.

The measures chosen when the tool was first introduced in Durham University's medical programme, under the heading of the conscientiousness index, were in three categories. These were:

1. Induction behaviour on admission or moving to a new work or study environment, such as providing passport photographs, or immune and criminal records status
2. Routine matters affecting all students, such as attendance, submitting required work, completing course evaluations
3. Specific matters affecting individual students, such as failing to attend agreed meetings, failing to respond to e-mails or return material.

Subsequently, as the conscientiousness index was used in other environments, the authors introduced the idea of choices unique to that particular environment. For instance, GP trainers wished to add whether or not trainees submitted recorded patient interviews on time, paramedic trainers wished to record whether or not students brought their own stethoscopes to objective structured clinical examinations and dental school staff wished to record whether students attended formative sessions on filling teeth.

In practice, the conscientiousness index was found to be easy to administer, and administrative staff, who often suffer from dereliction by medical students, welcomed it. It did not require any justification, since all the elements were objective. There was no risk of the phenomenon of 'failure to fail'. It was also highly granular with generally over 100 data points per year.

The distribution of conscientiousness index scores was very consistent from year to year. Scores were normally distributed, quite leptokurtic and slightly negatively skewed, with a long tail. As expected, individual student scores tended to be quite stable from year to year (Chaytor et al, 2012).

Once the index was developed, the next step was to compare it with estimates of professionalism, which involved several approaches. First, medical school staff were asked to rate the professionalism of students they knew well. A good relationship was found between professionalism estimates and conscientiousness index scores, such that those who had a low conscientiousness index score were much more likely to be rated as lacking professionalism than high scorers (McLachlan et al, 2009). Students were then asked to confidentially rate the professionalism of their teachers. This would be a strong measure of professionalism, except that if it were used summatively, students would not report honestly. However, for research purposes, and knowing it was fully confidential, they were happy to participate, and again a strong relationship was found

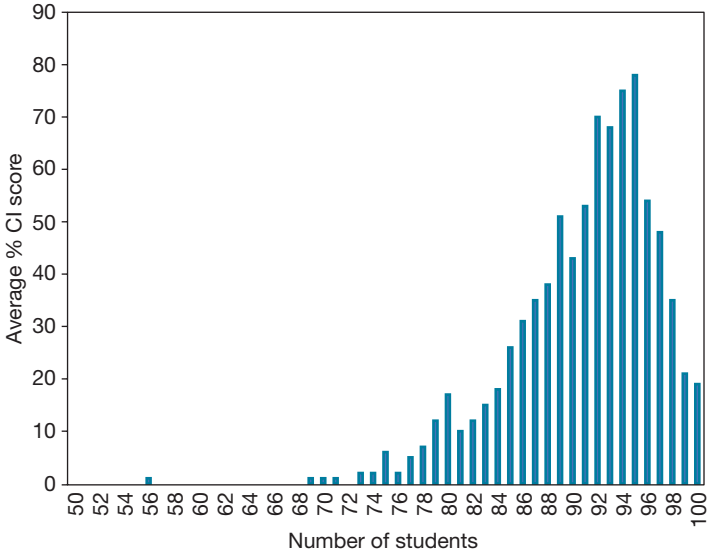

Figure 1. Distribution of conscientiousness index (CI) scores.

between ratings for the construct of professionalism and the trait of conscientiousness (Finn et al, 2009). Since initially the population being measured was students in the first 2 years of medical school only, the study was extended to clinical year students at a different medical school. The colleagues there established the same effect, that there was good relationship between low levels of conscientiousness and estimates of professionalism (Kelly et al, 2012). The conscientiousness index worked just as well with pharmacy and paramedic students.

However, the authors also wished to follow up the conscientiousness index over longer time periods through the use of UKMED, the UK's medical education database*. These follow-up metrics included:

1. Predictors of later undergraduate events
   a. UK Foundation Programme Office educational performance measure (ranked in deciles within medical schools). An aggregated retrospective measure of academic performance within the candidates' medical schools, averaged over the full programme.
   b. UK Foundation Programme Office situational judgement test. A long situational judgement test with known predictive power for how candidates perform in the workplace after graduation (Cousans et al, 2017).
   c. Prescribing safety assessment. A national test of prescribing skills, which all graduating medical students undertake.
2. Predictors of postgraduate performance
   a. Annual review of competence progression. A measure provided at the end of each year of foundation training, made up of multisource feedback, ratings from clinical and educational supervisors, and other sources of information.
   b. Royal College of Physicians membership exam.
   c. Royal College of General Practitioners membership exam.

The Royal colleges selected were those for which early career data were available in UKMED. Looking at the structure of the data, the authors observed that the bottom decile of conscientiousness index appeared to be markedly different from the other deciles (Figure 2) and, indeed, this proved to be the case. It is almost as if there was a separate distribution at the bottom end of the scale. Subsequently, the authors analysed this lowest scoring decile vs all the other deciles grouped together. This, incidentally, makes statistical significance harder to make: if the lowest scoring decile vs the highest scoring decile was analysed, for example, then there would be a marked statistical difference in all the above factors. As it was, significant differences were found in the values shown in Table 1.

*The authors are grateful to UKMED for the use of these data. However, UKMED bears no responsibility for their analysis or interpretation

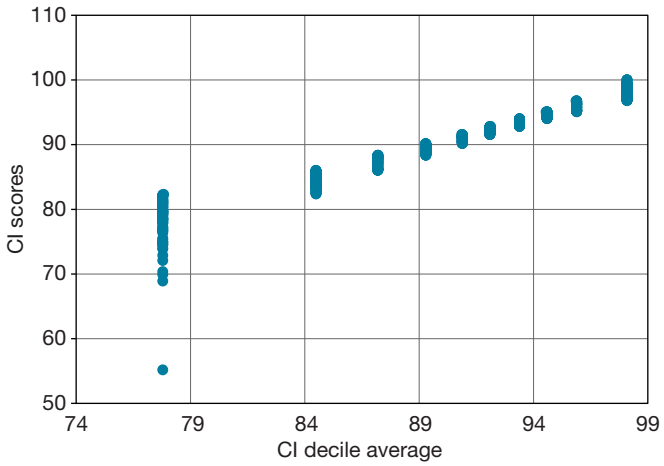

Figure 2. The spread of conscientiousness index (CI) scores in each decile (effect size 2.90, *P*<0.001, *n*=858).

Table 1. Relationship between the conscientiousness index and later measures of performance

Outcome measure	Effect size	*P*	*n*
Educational performance measure	0.39	0.003*	539
Situational judgement test	0.70	<0.001†	539
Prescribing safety assessment	0.59	<0.001†	463
Annual review of competence progression Y2	0.34	0.019*	517

**P<0.05; †P<0.01*

This indicates that a low level of conscientiousness is predictive of challenges in assessment performance later in medical school, and also of clinical performance in the workplace after graduation. The authors suspect that this could be related to behaviour patterns such as good note and record keeping, good handovers, following up patients and keeping up to date with developments. While these are all positive attributes, highly conscientious doctors would also be expected to avoid the kind of negative behaviours which lead to fitness to practise issues. In other words, the authors expect that low levels of conscientiousness lead to both low assessment scores and higher likelihood of disciplinary actions, explaining the paradox of why exam scores and fitness to practise sanctions are negatively correlated.

It would be desirable if conscientiousness could be quantified before recruitment to the profession. The authors have therefore also explored the relationship of conscientiousness performance with instruments designed to test such work, particularly the long test NEO-Personality Inventory Revised (Finn et al, 2012) and the short test Big Five Inventory 10 (BFI-10) (Rammstedt and John, 2007). Both confirm a correlation between conscientiousness as measured by these instruments and conscientiousness in actual performance, indicating that they could be used in selection processes.

How could the conscientiousness index be used in practice, other than in selection? For existing candidates, it could be used in identifying candidates for remediation, although evidence suggests that conscientiousness is a stable trait (Cobb-Clark and Schurer, 2012) and that poorly performing candidates are refractory to remediation (Pell et al, 2012; Winston et al, 2014; Holland, 2016). After selection purposes, summative use of a conscientiousness index might therefore be best targeted to redirecting some candidates to careers other than medicine where their abilities might be put to better use.

These are ways in which psychometric or edumetric data might be used to improve the future performance of doctors. However, the authors would not wish to treat students as if they were all identical. They would also wish to encourage competence and relevance in the tasks that students are being trained in, and a full awareness of the humanity of the patients they will encounter. This leads to the next two sections of this article, also somewhat controversial.

Teaching clinical competence in anatomy without cadavers

For nearly half a millennium, anatomy has been taught via dissection of the human body. It has acquired both pedagogic and cultural significance in this time, often being described as a rite of passage, with the cadaver somewhat gruesomely described as the student's 'first patient'. It is true that cadaveric dissection may be essential to the training of surgeons, and there is a continuing place for this in postgraduate training. But the task of medical schools is to produce the undifferentiated junior doctor, and the anatomical knowledge required of the junior doctor is very different from that of the surgeon. The authors' job analysis when designing a new anatomy teaching programme at Peninsula Medical School indicated that junior doctors primarily encounter anatomy through the medium of living anatomy in clinical skills settings and medical imaging, and the controversial conclusion was that undergraduate anatomical education ought therefore to centre on these (McLachlan et al, 2004).

The radical programme at the then-new Peninsula Medical School (McLachlan and De Bere, 2004) integrated clinical skills teaching with anatomy teaching. A quarter of the anatomy teaching was delivered by radiologists and radiographers, and extensive use was made of computer three-dimensional reconstructions of the body, in which transverse sections proved particularly valuable in understanding computed tomography and magnetic resonance imaging scans. Living anatomy was taught through peer examination and through examination of 'clinical skills partners' – non-patients who were happy to be examined by students (Collett et al, 2009). A combination of three-dimensional technology and living anatomy was used to project three-dimensional images onto the body surface of students (Figure 3). This allowed students to 'see inside' a living body, with different organs being chosen for sequential display. The student could be invited to change position, and the projected internal structures rotated correspondingly, revealing anatomy from multiple different clinically relevant perspectives.

In a retrospective study of Peninsula medical students, over 75% agreed that the hands-on experiences helped them develop good professional attitudes in their subsequent encounters with patients (Chinnah et al, 2011). A debate and overview on this topic indicated that opinions on non-cadaveric approaches to anatomy teaching are capable of being modified (McMenamin et al, 2018).

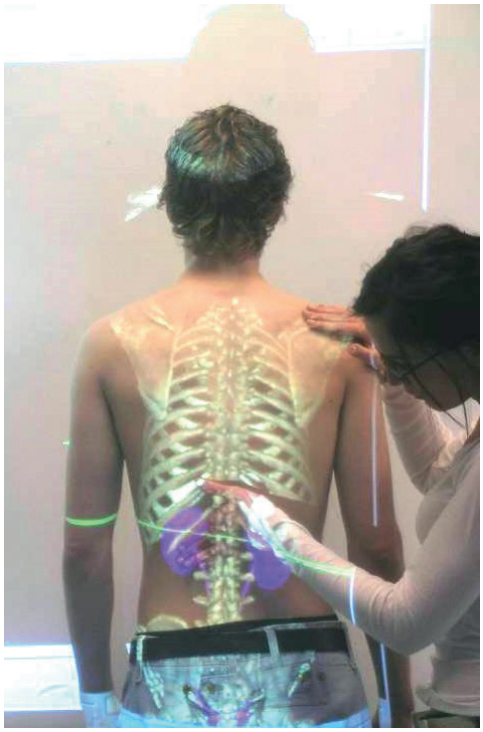

Figure 3. Image from the three-dimensional programme (VH Dissector) shown projected onto the body of a medical student.

Such approaches have been adopted in a number of medical schools in the UK and across the world. This had an unexpected benefit when the COVID-19 pandemic arrived, as the methodologies used were much easier to shift online than traditional cadaveric programmes.

Arts and humanities in medical teaching

The first approach described above explored the psychometric properties of large numbers of students, and the second describes a style of teaching interventions delivered to groups of students. But the authors were also interested in students as individuals and wished to promote reflection on their own humanity and that of their future patients. Both Peninsula Medical School and the Durham University medical programme explored the use of arts and humanities in medical education. At Peninsula, a special study component in poetry writing was funded by a grant from the Higher Education Academy, in which students spent a reflective weekend writing poetry under the guidance of an established poet (Collett and McLachlan, 2006). The poems produced by the students were then voluntarily accessed almost 500 times by fellow students, showing that they had an impact well beyond the direct participants. One quote seems particularly salient. A participant wrote:

> **…Being a poet is all about being really observant, you know; you really have to look. And you look at everything around you and you try and define it; you have to pick up on what people talk about and how they talk about it. Poetry is about honing observation and listening skills— the key things that have come into my poems is phrases that have resonated with what people have said to me…**

and in this quotation, the words ‘doctor’ and ‘medicine’ could usefully be substituted for ‘poet’ and ‘poetry.’ Life drawing and sculpting classes were also offered as options for students (Collett and McLachlan, 2005).

A project with Professor Karen Fleming at Durham University, funded by the Wellcome Trust, featured ‘wearable art’ as one of its outcomes. The Incisions Gown (Figure 4) was used to show where incisions might be made on the body. It was used in small group teaching, with one student wearing the gown, and discussion being initiated by the tutor at three levels. The first was practical: how would you access a particular structure surgically? What might a scar in a particular area indicate? The second related to the experience of wearing the gown. At the back, it reflected a surgical gown: what might it feel like to be

Figure 4. The incisions gown.

Figure 5. The dermatome jeans.

wearing this and nothing else? The cowl neck could be pulled over the head, at which point the wearer could see out, but was anonymised for on-lookers: to what extent did this correspond to the patient experience? Third, there was a narrative element. When the incisions gown was taken into a public setting, such as science museums or fashion shows, it often evoked personal narratives of surgical experiences from members of the public. With their permission, these anonymised narratives were fed back to students, for their further reflection.

In a similar manner, the dermatome jeans represented the leg dermatomes (derived from Gray's Anatomy for Medical Students; Drake et al, 2004) transformed into trousers that students could wear (Figure 5). Again, there was a practical discussion around lower limb innervation, but vivid student humour led to memorable comments such as 'Does my S3 look big in this?' and the characterisation of S5 as 'the S5 Party Zone.'

An observation made during the making of the jeans is that the anterior and posterior views of the dermatomes shown in the textbook do not, in fact, meet along the seams. In other words, the illustrations in 'Gray's Anatomy' must be wrong, a fact only evident in three-dimensional reconstruction. Arts and humanities are sometimes thought of as merely explanatory, but this project showed that working with artists can add benefit to the science canon.

Conclusions

Selecting the right students, and monitoring and mentoring their progress with regard to conscientiousness, is posited to be likely to reduce the number of adverse events in later medical careers. Similarly, relevant anatomy training in medical imaging and living anatomy is predicted to improve the performance of junior doctors in the tasks they routinely encounter. It is at least plausible that exposure to arts and humanities in a reflective way during undergraduate careers is likely to encourage a more holistic approach to patients in later practice.

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Key points

- Conscientiousness, appropriate anatomical competence and caring are three invaluable attributes for junior doctors which can be promoted in medical school.
- Early measures of conscientiousness in medical students routinely predict later performance in assessments and clinical practice.
- Conscientiousness measures might therefore be useful in selection, progression and remediation in medical students.
- The focus of anatomy teaching for medical students should be on medical imaging and living anatomy.
- Imaginative arts and humanities approaches provide valuable insights to medical students which can help, not merely with promoting empathy, but also with knowledge acquisition.

Conflicts of interest
The authors declare that there are no conflicts of interest.

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