Conscientious, Competent and Caring:

Producing the junior doctor of the future

John C. McLachlan, Marina Sawdon, Gabrielle Finn, Karen Fleming

John C. McLachlan, School of Medicine, University of Central Lancashire, Fylde Rd, Preston PR1 2HE, United Kingdom. jcmclachlan1@uclan.ac.uk

Marina Sawdon, Hull York Medical School, York YO10 5DD, United Kingdom. marina.sawdon@hyms.ac.uk

Gabrielle Finn, United Kingdom, Faculty of Biology, Medicine and Health, University of Manchester, Manchester M13 9NT, United Kingdom. Gabrielle.finn@manchester.ac.uk.

Karen Fleming, Belfast School of Art, Ulster University, Belfast BT15 1ED, United Kingdom. K.fleming@ulaster.ac.uk.

Abstract

This invited article is based on the Association for the Study of Medical Education Gold Medal Plenary for 2022, given by JMcL. 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. We explore each of these in separate sections. In the first, we demonstrate 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, and that 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. In the second,

we propose that competence in tasks as junior doctor is better achieved by teaching on medical imaging, clinical skills and living anatomy than by cadaveric dissection. And in the final section, we argue 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.

Introduction

This invited article is based on the Association for the Study of Medical Education Gold Medal Plenary for 2022, given by JMcL. 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 will each be addressed in a separate section. The first will draw on psychometric analyses, the second will feature anatomy teaching and the third will relate to the use of arts and humanities in medical education. We propose that powerful ways to develop medical students for later practice are first to ensure that we select and monitor students with regard to the trait of conscientiousness, second, to educate them 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

We 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, 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.

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). And most saliently, low early career exam scores predict later fitness to practice proceedings (Papadakis et al. 2008).

We reflected on why this might be the case. Fitness to practice sanctions are rarely simply a consequence of failures of knowledge or skill. On the contrary, 94% of fitness practice in the study cited above (Stern et al. 2005) were a result of unprofessional behaviour such as fraud, negligence, or substance abuse. And normally, we do not think of knowledge or intelligence as co-distributing with virtue. We hypothesised that perhaps the trait of conscientiousness underpinned both high exam performance and later risk of fitness to practice sanctions. So it seemed natural to attempt to measure conscientiousness directly. We adopted the Big 5 approach to personality in our analyses and 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. Full details of each study and relevant ethical approvals are given in the citations.

The principles we established during the development of a tool to monitor conscientiousness were that each component should be objective (e.g., 'did not attend') rather than subjective (e.g. 'did not participate'). We also sought measures such as attendance which were already being collected, so that little work was involved, and were highly granular.

The measures we chose when the tool was first introduced in Durham University's medical programme, under the heading of the Conscientiousness Index or CI, were in three categories. These were

1. Induction behaviour on admission or moving to a new work/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 failing to attend agreed meetings, failing to respond to e-mails, return material, etc.

Subsequently, as the CI was employed in other environments, we 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 OSCEs. And

dental school staff wished to record whether students attended formative sessions on filling teeth.

In practice, we found the CI easy to administer, and administrative staff, who often suffer from dereliction by medical students, rather 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 CI scores was very consistent from year to year. Scores were normally distributed, quite leptokurtic and slightly negatively skewed, with a long tail. As expected, student scores tended to be quite stable from year to year (Chaytor et al. 2012).

(Figure 1 about here).

Once we had the index, the next step was to compare it with estimates of professionalism. We took several approaches to this. First, we asked medical school staff to rate students they knew well on the basis of their professionalism. We found a good relationship between professionalism estimates and CI scores, in such a manner that low CI scorers were much more likely to be rated as lacking professionalism than high scorers (McLachlan et al. 2009). Then we also asked students to rate their peers confidentially with regard to professionalism. This would be a strong measure of professionalism, except for the fact 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 we found a strong relationship between ratings for the construct of professionalism and the trait of conscientiousness (Finn et al. 2009). Since we were initially measuring a population of students in the first two years of medical school only, we extended the study to clinical year students at a different medical school, and with colleagues there established the same

effect, that there was good relationship between low levels of conscientiousness and estimates of professionalism (Kelly et al. 2012). We were also able to establish the CI worked just as well with pharmacy and paramedic students.

However, we also wished to follow the CI over longer time periods through the use of UKMED, the UK's Medical Education Database[1]. These follow-up metrics included:

1. Predictors of later undergraduate events
    a. UKFPO 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. UKFPO Situational Judgement Test (SJT). A long SJT with known predictive power for how candidates perform in the workplace after graduation (Cousans et al. 2017).
    c. Prescribing Safety Assessment (PSA). A national test of prescribing skills, which all graduating medical students undertake.
2. Predictors of postgraduate performance
    a. Annual Review of Competence Progression (ARCP). 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.

[1] We are grateful to UKMED for the use of these data. However, UKMED bears no responsibility for their analysis or interpretation

c. Royal College of General Practitioners Membership Exam.

The Royal Colleges selected were those for which early career data was available in UKMED. Looking at the structure of the data, we observed that the bottom decile of CI 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, we analysed this lowest scoring decile versus all the other deciles grouped together. This, incidentally, makes statistical significance harder to make: if we analysed, for instance, the lowest scoring decile versus the highest scoring decile, then there would be a marked statistical difference in all of the above factors. As it was, we found significant differences in the values shown in Table 1.

This indicates that low level conscientiousness is predictive of challenges in assessment performance later in medical school, and also of clinical performance in the workplace after graduation.

We suspect that this could be related to behaviour patterns such as good note and record keeping, good hand overs, following up patients, keeping up to date with developments, and so on. While these are all positive attributes, we would also expect highly conscientious doctors to avoid the kind of negative behaviours which lead to fitness to practice issues. In other words, we expect that low levels of conscientiousness lead both to low assessment scores and to higher likelihood of disciplinary actions, thereby explaining the paradox of why exam scores and fitness to practice sanctions are negatively correlated.

Obviously, it would be desirable if conscientiousness could be quantified prior to recruitment to the profession. We have therefore also explored the relationship of conscientiousness performance with instruments designed to test such work, particularly the long test NEO-P-IR (Finn et al. 2012), and the short test 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 CI be used in practice, other than in selection? For existing candidates, it could be used in identifying candidates for remediation, However, a number of lines of evidence seem to suggest 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 CI 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, we would not wish to treat students as if they were molecules of an ideal gas (all identical, with no interactions, are corresponding to predictable, if stochastic, rules). We would also wish to encourage competence and relevance in the tasks they 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 paper, 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 not merely pedagogic but also 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 it in their post graduate training. But the task of medical schools is to produce the undifferentiated junior doctor – the iatroblast, as it were- and the anatomical knowledge required of the junior doctor is very different from that of the surgeon. Our 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 of medical imaging, and our controversial conclusion was that undergraduate anatomical education ought therefore to centre on these (McLachlan et al. 2004). (Full details and ethical approvals are given in the following citations).

The radical programme at the then new Peninsula Medical School (McLachlan and Regan De Bere 2004) therefore 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 3D reconstructions of the body, in which transverse sections proved particularly valuable in understanding CT and MRI imagery. 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 useful combination of 3D technology and living anatomy was to project 3D 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 recent debate and overview on this topic indicated that opinions on non-cadaveric approaches to anatomy teaching are indeed capable of being modified (McMenamin et al. 2018).

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 pandemic arrived, in that the methodologies used were much easier to shift on-line 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 we were also interested in our students as individuals and wished to promote reflection on their own humanity and that of their future patients. In both Peninsula Medical School and the Durham University Medical Programme we 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 in poetry writing under the guidance of an established poet (Collett 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, funded by the Wellcome Trust, at Durham University 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 relating to the experience of wearing the gown. At the back, it reflected a surgical gown: what might it feel like to be 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? And thirdly, 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 vein, the dermatome jeans represented the leg dermatomes (derived from Gray's Anatomy for Medical Students; Drake et al. 2004) transformed into trousers that the students could wear (Figure 5). Again, there was a practical discussion around lower limb innervation, but vivid student humour led to (literally) memorable comments such as "Does my S3 look big in this?" and the characterisation of S5 as 'the S5 Party Zone'.

An observation made in the course of 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 3D reconstruction. Arts and humanities are sometimes thought of as explanatory only. On the contrary, 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. And 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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