Medical education – beyond tomorrow?
The new doctor – Asclepiad or Logiatros?

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Summary
Against a background of the theoretical basis for the contextual approach to medical education, this paper examines and supports the changes that are occurring in undergraduate medical education throughout the world, before putting up for discussion the suggestion that the changes have not gone far enough.

Communication and contextual learning
Human communication is limited. We are essentially incapable of conveying the full meaning of our experiences to others. We are limited by verbal communication. We are limited by written communication. We have tended to forget that words and diagrams on a page reflect, not the form we would wish this knowledge to take within the brain, but our limited ability to communicate it.

These rather straightforward observations lead to an issue at the heart of traditional medical education. Early forms of human development are characterized by doing. Children don’t learn on which aisle in the supermarket the chocolate biscuits are stored by memorizing a map of the supermarket (or worse, a list of aisle numbers and their contents): they learn by wandering around. Children also learn quicker where to find the bread than they do the cinnamon, and in doing so learn that bread is purchased more often than cinnamon – a piece of factual information stored in a fundamentally different way from the sentence ‘bread is bought more often than cinnamon’. To appreciate this is to recognize something fundamental: book and desk learning is good for book and desk application.

The context sensitive nature of learning is something that has been appreciated for some time. One classic study showed that lists learned by Royal Navy divers on land were better recalled on land, whilst those learned underwater were better recalled underwater. Chess grand masters have a virtually photographic memory for possible playing positions laid out on a board, but do no better than novices if the same pieces are laid out in random formation. Other studies have consistently reflected the context sensitive nature of learning. One comparing ‘active’ teaching of chemistry with problem-based learning showed that, despite no difference in short-term recall, the students from the problem-based course scored 60% higher in long-term recall. Meta-analysis of outcomes data has also been shown to support the general superiority of context-based, problem-orientated medical courses over traditional approaches.

Traditional teaching in clinical medicine is confounded by the ‘you can’t miss it’ effect. Imagine one person giving directions to their home over the telephone. The explainer’s brain is filled with an image of the area to be described. Moreover, he knows about the bank because he does his banking there and he knows about the park because he walks his dog there. Not only is his map detailed and three dimensional, it is a functional map – each component evoking an image of...
itself and its significance. It is, in effect, a four-dimensional map.

Now think about the explainee. To her, the description is meaningless – a list of words on a page ‘turn right here, turn left there’. A true understanding of what it is like to be at that roundabout and take the correct turnoff cannot be gleaned from its verbal description. Witness the difficulty of most people in explaining to the newcomer. They don’t know how much detail to include and often underestimate the extent to which landmarks are apparent (‘you can’t miss it’). The explainer can, although not necessarily with ease, turn the four-dimensional map into words, but the explainee cannot possibly do the reverse, without having been there.

The medical relevance is compelling. Students are taught to learn lists of causes of common conditions and recite them on command – but with any sense of meaning? Sitting at a desk learning ‘lung carcinoma, pulmonary embolism, pneumonia, vasculitis’ gives no feel for the circumstances surrounding the presentation of haemoptysis. These lists are accurately compiled by clinicians. However, these are people for whom the mention of lung carcinoma triggers a series of images and memories, the mention of vasculitis a completely different set. For the beginning clinical students, this list evokes none of these. It is simply ‘words on a page’ which can be recited at will, but which action belies any real understanding. It is the explainee reciting the list of directions back to their host.

Formal learning theories reinforce this point. Norman has been prominent in applying lessons from cognitive psychology to medical education.6,7 He has emphasized the need for embedding new information within relevant previously existing knowledge, to allow effective retrieval at a later point. Ausubel9 was probably the first to emphasize the need to take account of prior knowledge when structuring learning environments. More recently, Coles10 has produced an excellent synthesis of the evolution of these ideas, and suggests that the ‘concreteness’ of the context for learning should relate inversely to the prior knowledge of the student. For example, if the desired result is to produce a doctor who can do thyroid clinics, starting off by teaching abstract theory about feedback loops, binding globulins and the concentrating properties of follicular cells will be a waste of time. The student must first experience and understand the purpose in learning about the thyroid axis and its application (the treatment of patients). The clinical reasoning literature reinforces this approach, validated by the finding that expertise is associated with cognitive structures based on prototypical or actual patients (the ‘illness scripts’ of Schmidt6). Personal experience of clinicians adds further weight to the idea that the best way to learn medicine is to experience it. Inevitably, clinical practice prompts questions that provide a strong stimulus to find answers. The next time the problem is experienced, the answer will be retrieved and used in context. If this happens often enough, the response becomes automatic, thereby allowing a higher order of thought on the subject. This is the process of professional development within medicine as it happens today,8 and it is an approach often recommended to students.11 With its origins in the work of Ausubel, the principle has been advocated by Kolb.12 Significantly, his model is based around a repeating cycle of experience, reflection, theorizing and new actions. Effective learning occurs as one travels around the cycle. However, although this approach is accessible to doctors carrying out clinical management (the highest order of contextual learning available), undergraduate students in traditional curricula rarely have such opportunities.

**Solutions?**

The most influential answer to the question of how to provide such experience has been problem-based learning,13–16 an approach which puts students in the doctor’s role, solving clinical problems in the controlled environment of a tutorial. However, paper and pen cases are, at best, a substitute for actual doctor–patient interaction. Standardized patients, where the student has to use her knowledge in real time, and respond to the inevitably unpredictable nature of human interaction, can bridge this gap (a particular benefit of this technique is that it allows practice). However, even standardized patients can, at most, only substitute for the real thing. Only clinical practice allows students to experience the totality of the clinical senses.17 Whether we use our ears to detect dysarthria, our eyes to detect acromegaly, our nose to detect ketones or our fingers to detect an abdominal aneurysm, there is no simulation that can fully substitute. Slotnick18 has even suggested that giving medical students experience of real clinical cases in real clinical settings answers their basic psychological needs. He mentions security, self-esteem and affiliation, and suggests that security is particularly important because its compromise is an inevitable result of uncertainty in dealing with a clinical problem. This is reminiscent of Maslow19 and the hierarchy of ‘learning needs’. In fact, the most common complaint of clinical medical students in one study11 was that on clinical attachment, they were rarely made to feel ‘part of the team’.
Apprenticeship

Tell me and I will forget, show me, and I may not remember, involve me, and I will understand

One solution to these challenges may be found in the idea of ‘apprenticeship’. Here, a mentor is responsible for the learning of one student for an extended period of time and adopts the student into their working environment; first as an observer, then as a helper and, finally, as half of a two person clinical team. The student is present for on-call commitments and follows patients in the same way as the rest of the clinical team. The mentorship does not disqualify the student from gaining experience with any other member of the multidisciplinary team, nor does it imply that mentor and student should be together at all times. The key point is that for the major part of the time spent on attachment, the student’s learning takes place within the working environment of one doctor.

This approach has a number of strengths. Firstly, it facilitates ‘tailored training’. The mentor, acutely aware of the personal strengths and weaknesses of their student can, over an extended period of time, tailor learning according to those needs. Further, account can be taken of differences in speed of learning between students. In addition, if a student is struggling for personal or intellectual reasons, this can be quickly picked up and dealt with appropriately. Present systems often fail to pick up struggling students until it is too late and then are poor at dealing with them.11

Apprenticeship also provides an ideal setting in which to refine the motor skills of clinical examination. Research in skill acquisition has shown that humans learn best by watching and copying, with feedback,21 and while I would suggest that the best place to learn such skills is in the controlled environment of a standardized patient encounter, the place to refine them is in the setting of the ultimate working environment. Apprenticeship provides all of this, from observation to coaching to practice.

As a result of the close integration of the student into the medical team (there is evidence that patients really do perceive the student and doctor as one team20) the apprenticeship model can facilitate experience of situations providing vast educational opportunity from which students are often excluded (personal observation). This opens the door for the student to be present when bad news is broken, when a patient has died, during resuscitation or in potentially sensitive situations such as when a complaint is expected.

Playing an integral part in real clinical situations as they arise leads to personal investment in the outcome – a particularly vivid and practical way to gain familiarity with ethical issues. By extension, what better way to ‘foster appropriate attitudes’22 than to spend a prolonged amount of time in the company of a good doctor – particularly when that doctor represents a good role model? It is known that the role models experienced during medical school play a large part in the choice of future career.23,24 The opportunity to form more in-depth and meaningful relationships with even a small number of good role models should be welcomed.

A challenge for the apprenticeship model is assessment. However, it is known that traditional clinical exams are limited in assessing the broad range of skills which students possess.25 How much better placed is the mentor to give not just an overall assessment, but to give structured and detailed feedback to the student? The assessment can be made after observing the student, and her progress, over a long time period in many different situations. Further, independent assessment could readily be achieved by swapping students for the last few days of an attachment allowing another mentor to work with the student. With appropriate standardization in the form of comprehensive Likert-type scales, I suggest that such a system would produce a more accurate and extensive picture of the student’s true ability than traditional assessment methods.

Another issue is that of time and monetary resource. In the UK at present, much of the centrally provided money does not closely follow individual students but is absorbed into the melting pot of those teaching hospitals which provide the largest part of the clinical tuition (this does not apply to primary care). The lack of any direct connection between those on behalf of whom education is ‘purchased’ and those who ‘provide’ leads inevitably to a lack of direct and personal responsibility for individual students’ teaching. It is likely that such a system, where resources do not directly follow the students, would struggle to sustain the apprenticeship model. Although it is probable that the role of mentor would be associated with kudos, an incentive and reward for what would be a considerable investment of time and energy, would undoubtedly be required.

Considering the choice of mentor, the most likely candidates would seem to be general medical hospital registrars and GPs. The clinical remit of these doctors would maximize the students’ experience of abnormal pathology – a difficult problem from within the narrower speciality mentor’s field. The primary issue is more one of numbers, because I submit that the ability to tailor educational needs to the individual (by, for
example, visits to specialist clinics) might result in better coverage than that currently achieved by traditional methods.16

Linked to the choice of mentor is the serious issue of standardization of delivery. Significantly, students report that in traditional clinical attachments, teaching differs widely in its quality and the extent of its coverage.11 The challenge for this model is to ensure that all students experience a consistently worthwhile apprenticeship. There is little doubt that this would require a whole new approach to the screening and training of educators. Instead of teaching being a distraction from clinical duty, the role of mentor would have to assume a central position in the everyday working of the hospital. It would no longer be acceptable for clinical tuition to be automatically relegated in the face of clinical responsibility. The funds would need to be made available to allow ‘protected time’ for the mentors to fulfil their responsibilities to their charges (perhaps paralleling the situation in academic medicine where time is protected for research). I believe these issues provide the central challenge to the apprenticeship model in undergraduate medical education, and I reflect that its implementation would require nothing less than a paradigm shift in the mechanism of delivery of clinical tuition today.

Conclusion

In this paper, I have considered the theoretical basis for the recent move back towards contextual learning within clinical medicine. The changes are welcome and long overdue, but I leave you with a question: are they radical enough? How much do students need to know and understand about myocardial infarction before they can learn from a patient experiencing it? The crucial point about Kolb’s theory of learning18 which, we have observed, underpins much of professional medical education in Britain, is that experience precedes reflection and theorizing. Even in these times of change, we should be bold and consider whether we have gone far enough. As I type these words into my proprietary software, my gaze wanders for a moment to my bookshelf, and to the seldom opened manuals therein, and I begin to wonder.

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