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Towards a pedagogy for clinical education: beyond individual learning differences

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The development of teaching in higher education towards a more learner-orientated model has been supported by the literature on individual learning differences and on learning styles in particular. This has contributed to the evolution of university pedagogy away from a medieval transmission model than runs counter to contemporary understanding of learning. However, rather than solving problems of classroom practice, recognition of student learning differences has amplified a number of tensions within the system that have not been adequately resolved in practical terms for academic staff. Such tensions complicate the professional lives of university teachers and as a consequence may lead to cycles of non-learning as teachers retreat towards the familiar transmission of content. A reconceptualisation of university pedagogy towards an expertise model allows the variation between complementary chains of practice and networks of understanding to be exploited as a positive characteristic of the learning experience.

Keywords: university teaching; pedagogy; expertise; learning styles; threshold concepts; concept mapping

Introduction

The novice teacher often sees teaching as telling and learning as receiving (Van Leuven 1997). However, decades of research on student learning have shown such a naïve view to be at best unhelpful and at worst harmful to the education of students. Teaching has to support student access to the discipline (Northedge 2003), so that students are actively engaged in their learning rather than passive observers of the field. As the prior knowledge that students bring to their studies is the only starting place for their learning (Ausubel 2000), teachers are placed in an impossible position if they try to address the diverse learning needs of their students on an individual basis. Grouping of students to alleviate this pressure depends on tools that can adequately discriminate between the diversity of student needs, but even then it is not clear if student characteristics are fixed for any significant period of time or, indeed, if teaching strategies need to 'hit the moving target' of evolving student needs. Therefore a pedagogy is required that will address the needs of the discipline and will support the needs of students. It also has to be manageable for the teachers concerned and sit comfortably with their professional values. In this article we aim to support clinical educators in developing their understanding of teaching beyond a tacit knowledge of basic pedagogical principles (McLeod et al. 2004), towards a signature pedagogy for clinical education (Shulman 2005). Our focus on clinical education within this article reflects the environments in which our original observations have taken place – with five of the nine schools within King's College

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London engaged in clinical education. However, once armed with the model described below, observers of teaching in non-clinical disciplines will be able to recognise characteristics of the model described in this article.

The World Health Organization recently recommended that dental education should be problem based, socially and culturally relevant, and community oriented (Gerzina et al. 2003). In response, many dental schools around the world set about constructing new curricula that were more responsive to student learning and more sensitive to evaluation mechanisms. These new curricula moved towards learning strategies to promote critical thinking and increased problem-solving capabilities within undergraduate programmes that would prepare students to be lifelong learners (Hendricson and Cohen 1988). However, in the absence of an embedded pedagogy, the student-centred view of learning creates problems for clinical educators, particularly if they have difficulty in labeling themselves as teachers, rather than as clinicians or researchers. At a time when many dental schools are engaged in the task of changing their curricula (Plasschaert et al. 2006; Manogue and Brown 2007; Plasschaert et al. 2007), it is important to emphasise the need for a coordinated development of pedagogy – providing the backbone for any curriculum development.

In this article we propose an expertise-based pedagogy for clinical education that addresses inadequacies recognised in previous models that have led to calls for change (ADEA Commission on Change and Innovation in Dental Education 2006). This is seen as the next step in the evolution of university pedagogy from a content-transmission model of teaching via a student-centred model (Figure 1).

This simplified summary offers a focus on content, learning styles and expertise as key indicators (but not exclusive characteristics) of the three broad phases. We have found this offers sufficient resonance with the experiences of clinical educators to help them access the argument for an expertise-based pedagogy (Cabot and Kinchin 2007).

Methods

This article provides a synthesis of the authors' work, having employed complementary approaches within an interpretive paradigm. These have included:

1. Immersed participant observation of all aspects of clinical and non-clinical teaching and assessment within the King's College London (KCL) Dental Institute. This has culminated in the production of a reflective portfolio of practice over a two-year period, from which elements of this work have been extracted.
2. Structured teaching observations ($n=128$) over a three-year period in non-clinical and clinical settings (including medicine, dentistry and nursing) that involved direct observation of teaching activities, bounded by pre- and post-observation discussions. This has formed the basis of a narrative enquiry (Beattie 1995; Savin-Baden and Van Niekerk 2007), in which participants are invited to tell their own stories.
3. Workshops with academic staff that were designed to challenge teachers' assumptions about clinical teaching. These were backed up with informal discussions with several of the participants.
4. Focus group discussions with fourth- and fifth-year undergraduate students ($n=61$) on the nature of teaching and learning. Appropriate approval for this methodology was obtained from the College Research Ethics Committee.

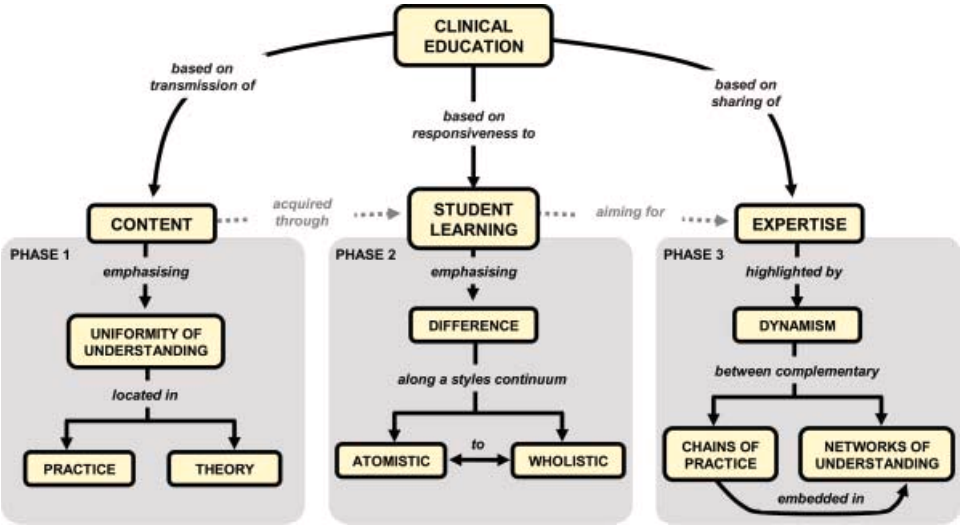

Figure 1. A summary of the evolution of clinical pedagogy in three broad steps, from: (Phase 1) a content-driven model that is characterised by a transmission mode of teaching, to (Phase 2) a learner-centred model in which the teacher responds to the individual learning demands of the students, to (Phase 3) an expertise model in which the complementary structures of understanding between the clinical and non-clinical contexts are used as a basis to develop a coherent view of the discipline that sees teachers and students as co-constructors of understanding. The arrows joining **CONTENT → STUDENT LEARNING → EXPERTISE** are greyed and dotted to indicate that this chain of progression (from Phase 1 to Phase 3) is only theoretical. In practice, teachers find such a direct linear progression difficult to achieve without a fundamental reconceptualisation of clinical education.

This work is considered in the context of a model of teaching and learning that has been developed for higher education, based on the examination of teachers' and students' evolving understanding as revealed through a decade of research on concept mapping, described in detail elsewhere (Kinchin and Hay 2007; Kinchin, Cabot, and Hay 2008a).

Learning styles and student knowledge

There are various ways of categorising individual student learning differences, the learning styles model (Kolb 1984) and the approaches to learning model (Entwistle and Ramsden 1983) probably being the most familiar to university teachers in the United Kingdom, especially those currently undertaking continuing professional development in this area. Both models are concerned with student learning, and it is not necessary to examine in detail here the differences between the two (usefully summarised by Cuthbert 2005). Our point is that the second phase of the evolution of university teaching (Figure 1) is focused on the student rather than the content of the subject. A brief examination of the learning styles model (currently topical in the clinical arena [Walsh 2007]) will serve this purpose.

Numerous dimensions have been used to describe student learning styles, and at least as many tools have been developed to measure their characteristics (Cassidy 2004). The apparent diversity of learning styles and instruments has been used as an argument for not engaging with the learning styles literature (Coffield et al. 2004a,b), whilst Ritter

(2007) has demonstrated how the uncritical use of learning styles inventories can subvert the discourses of student diversity and justify the tendency to promote commonality in student learning behaviours. The lack of clear evidence for a unifying theoretical underpinning for learning styles inventories has also been given as an argument for not using this literature to inform teaching in clinical education (Walsh 2007), though recent work is starting to develop a more integrated framework into which this work may sit (Kozhevnikov 2007). Whilst a proportion of the literature on the practical uses of learning styles fails to make explicit sound evidence regarding validity and reliability of the research (Coffield et al. 2004a,b), this does not invalidate the observation from practice that different students prefer to interact with learning materials in different ways and, therefore, a consideration of students' learning styles is sensible when developing materials to support learning (Rayner 2007). However, if learning styles exist, they constitute only a part of students' attitudes towards their study, and so only account for part of the story of student learning (Bloomer and Hodkinson 2000).

The terms 'deep/holistic/meaningful' and 'surface/atomistic/rote' are used in combination within the literature. Deep/meaningful learning styles include a range of behaviours that help the student to understand and maintain the structure of a task by relating previous knowledge to the new, building up a bridge between theoretical ideas and everyday practice, and by organising the content into a coherent whole. Adoption of learning styles tending towards the atomistic involve the unreflective memorisation of information and focus on unrelated parts of the task. However, it should also be noted that 'deep' and 'surface' (whichever combination of terminology is adopted) is not a simple binary (e.g. Beattie, Collins, and McInnes, 1997). There are grey areas in between and a combination of styles may even occur simultaneously within a given task (Hay 2007). Students often see surface learning strategies as the requirement for academic success, even in the clinical environment (McManus et al. 1998).

Integration of science with clinical practice is a key objective of any healthcare curriculum, including the development of expertise in new and emerging treatment modalities (Wilson 2007). However, students often perceive that the mantra of survival is to pass the exams by rote learning and to discover the relevance of this material later in practice (Fang 2002). This is reflected in the learning styles employed by dental students that tend to be 'concrete' in their focus on correct answers, and 'sequential' in their linear acquisition of knowledge (Berlocher and Hendricson 1985). This may be linked to the dominant teaching style and presentation of materials in lectures (Kinchin and Cabot, 2007) and to the requirements of work in the clinical environment (Kinchin, Cabot, and Hay 2008a). Whilst it may be helpful to develop teacher sensitivity to students' individual learning differences (Rosenfeld and Rosenfeld 2004), this can have a disempowering effect upon university teachers who feel they cannot mobilise their greater appreciation of students' learning needs with the practical constraints that are placed upon their teaching by the institution. Indeed, the focus on simplistic binaries in higher education (such as student vs. teacher centredness) may have become a distraction from the main business of teaching and learning (Cousin 2008).

The effect of teaching strategies and techniques

The American Dental Association (ADA) recently reported that the culture of dental education has mainly been focused on teaching facts and techniques, rather

than on higher thought processes such as critical thinking (ADA 1998). At this point, the problem arises as to how to define, measure and improve students' ability to think critically and analytically. This is why the ADA proposes a global consensus from the recognised experts on key educational issues. These issues include learning styles, evaluation of teaching methods and establishing electronic information systems to share innovations and educational programmes (Falk-Nilsson et al. 2002). What this clearly states is that teaching faces new challenges. Clinical educators need to have a clear purpose, and must take account of differences in students' ability, and develop different teaching strategies related to the differing perceived circumstances. Critical reflection on practice is a major strategy for producing the evidence of progression. If we build up our professional knowledge and judgements related to student learning, and teaching styles, and provide a learning environment that encourages students to participate and actively learn, we can transform students so they become critical thinkers and problem solvers – the practitioners we want them to be.

The effects of assessments, evaluation, and monitoring

Many assessment methods fail to test understanding of the subject, with students adopting superficial learning styles and coping with course requirements by memorising facts and procedures. They tend to study without reflecting on the purpose or strategy and to see the course content as discrete items of information (Bloom et al. 1956). This makes it difficult to make sense of new ideas. In clinical schools, superficial learning is common and a popular strategy, as continuous assessment can drive students to seek quick solutions. The strategic, exam-focused students tend to favour superficial learning styles. Therefore, the main attention is on the examinations, and learning the correct answers that can easily be reproduced. These students value past exam papers, and do not usually think critically, nor do they have a holistic learning strategy. The outcome? Task-driven students succeed and pass their exams – certainly in the early years of the programme. If the superficial learning continues into the senior years of their programme, despite the fact that the students' learning style is maturing, we need to ask ourselves why it is that teaching/assessment continues to encourage the recall or application of apparent trivial knowledge. We also need to investigate further how these superficial learners face and cope with different types of clinical problems as clinical practitioners later on in their professional development (Shuler and Fincham 1998).

Appropriate methods of assessment can promote deep, reflective learning, meaning and understanding, with improved long-term recall (Gibbs and Simpson 2004/5). Unfortunately, there is also evidence that students' orientation to deeper styles of learning declines in some undergraduate courses (including dentistry), perhaps as a result of the overload of reproductive learning required for assessment (Harper and Kember 1989; Davis and Sales 1996).

The impact of professional knowledge and development on student learning

If students are expected to develop from lower- to higher-order thinking skills during undergraduate courses, they should be supported in making this transition, to grow and mature as individuals during their undergraduate training and develop as

professional practitioners. They then become competent and develop confidence to apply this acquired knowledge and skill appropriately to the best interest of the patients. Clinical educators must encourage undergraduate students to be lifelong learners, knowledge creators and leaders. Education is not just about the transmission of information, but should also include the transformation of the learner (Jessee, O'Neill, and Dosch 2006).

Practical components of undergraduate programmes play a critically important role. The use of clinical portfolios can help students enormously to improve through formative assessment. In this respect, portfolios have been reported to promote personal responsibility and relevance in learning to enhance motivation (Knowles 1975). Self-assessment of performance can encourage undergraduates to set goals and objectives, developing greater commitment and transforming themselves from being junior to mature and critical thinkers as the dental programme progresses. A key to unlocking the details of student learning in a manner that can be exploited for the development of university pedagogy has been the development of concept mapping as a tool for visualising learning in higher education (Hay, Kinchin, and Lygo-Baker 2008).

Focus on expertise

Expertise research can be traced back to the work of deGroot (1965) in the domain of chess. This has subsequently been developed into a research paradigm spanning a range of disciplines. A number of reviews of the field have been published (e.g. Chi, Glaser, and Farr 1988; Ericsson and Smith 1991). Amirault and Branson (2006) provide an overview related to education, whilst several authors have addressed the issue in relation to clinical practice, particularly related to nursing (e.g. Crook 2001; Bonner 2003; Ericsson, Whyte, and Ward 2007). The principle characteristics of experts in any domain is that they possess an extensive and highly integrated body of knowledge related to their discipline (Patel, Arocha, and Kaufman 1999). This is coupled with the ability to perceive patterns in large amounts of information and to process their responses quickly and efficiently. Uncovering the knowledge bases held by experts to gain insight into the nature of the structures that might be indicative of expert understanding (Bradley, Paul, and Seeman 2006) has led to the use of concept mapping as an exploratory tool.

Concept mapping

There is now a significant body of evidence to testify to the power of concept mapping as a tool to summarise information in a way that can support conceptual change and assess understanding (Nesbit and Adesope 2006). Whilst this represents important benefits for student learning, the potential of concept mapping goes far beyond this. Concept mapping provides a trigger for the development of a scholarly, student-engaged pedagogy (Kinchin, Lygo-Baker, and Hay 2008), based on the visualisation of the elements of expertise (Kinchin, Cabot, and Hay 2008a). It is this greater potential that we wish to explore here.

Concept mapping (Novak and Gowin 1984; Novak 1998, Novak and Cañas 2007) is a graphical method that requires the learner to consider his/her understanding of a topic and the way in which the elements of that understanding fit together. It is the concepts (indicated in boxes in a concept map) that indicate the

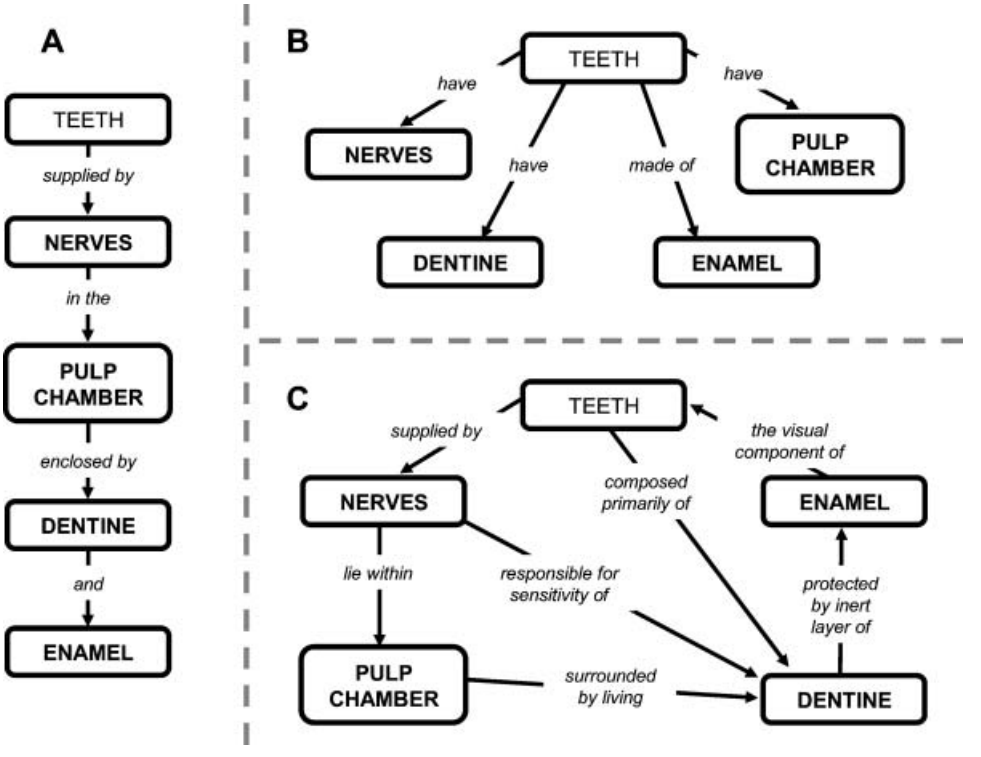

Figure 2. Morphological variation exhibited in concept maps illustrated in three maps showing the same content about the structure of teeth. Arranged as (A) Chain, (B) Spoke, and (C) Network, they show different levels of understanding.

scope of the student's awareness, while the quality of the links in a concept map convey depth of meaning. We have found that undergraduates are able to learn the mechanics of concept mapping in less than half an hour and are then ready to start producing their own concept maps.

The maps in Figure 2 show the universal characteristics of concept maps (concepts in boxes, linked by arrows that carry explanatory links) and the typical morphological variations that will be found among a group of students (described as chains [A], spokes [B] and networks [C]) (Kinchin, Hay, and Adams 2000). The significance of these morphological variations and the transformations from one to another are seen as having an impact upon the teaching and learning process, and form the basis of the model described below.

The expertise model of teaching

The model described here (visualised in Figure 3) has been derived from the qualitative examination of several thousand concept maps produced by students and their teachers over the past ten years (Kinchin and Hay 2007; Kinchin, Cabot, and Hay 2008a). These studies have indicated a great diversity in patterns of learning, such that a teacher could not hope to track the learning pathways of all the students in a cohort. But the maps have indicated the importance of knowledge

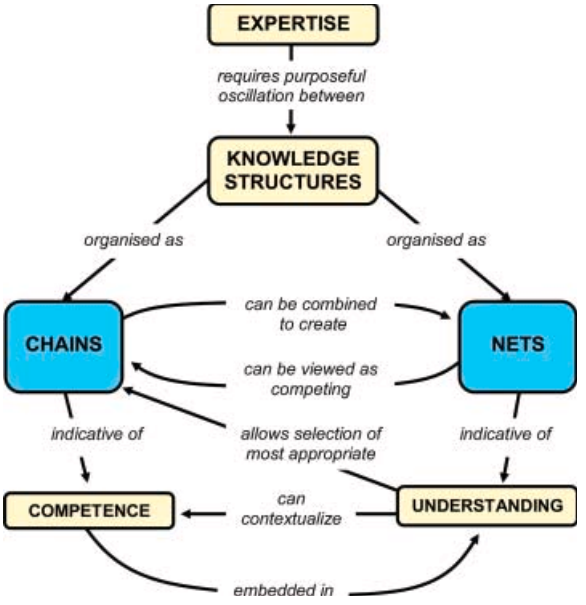

Figure 3. The relationship between chains of practice and networks of understanding. The active engagement in the links between these chains and nets is indicative of expertise (modified from Kinchin, Cabot, and Hay 2008a).

transformations and knowledge structures that are helpful in relating clinical and non-clinical settings.

The vertical dimension of the figure explains the characteristics and roles of each of the knowledge structures. Many students embark upon their undergraduate studies with firmly established chains of understanding that have developed during their secondary schooling. These are often incomplete or inappropriate for their new context. Such chains are resistant to development and so students are faced with the dilemma of either trying to abandon their existing beliefs or rote-learning the new material as an adjunct to their existing prior knowledge.

The chain of appropriate understanding is indicative of strategically successful learners (students and lecturers). Such goal orientation enables these learners to select the essential information from that which is available whilst selectively ignoring the rest. This may be seen by some as an efficient way of studying, whilst others could interpret this as a blinkered view of higher education. There is certainly a tension created within the university environment by attitudes towards this kind of strategic learning that may reflect disciplinary differences. For example, in the clinical environment, the development of chains of clinical reasoning is seen as one of the key aims (de Cossart and Fish 2005).

The demonstration of highly developed and integrated nets of understanding may be seen as the hallmark of the expert (Bradley, Paul, and Seeman 2006), for whom the demonstration of expertise is achieved by the accommodation of competing chains of understanding and the selection of appropriate chains to suit particular contexts. However, such expert structures need to be connected to chains of practice if they are to have any practical application. The simultaneous consideration of the same information in these two formats supports Norman's

contention that 'expertise lies in the availability of multiple representations of knowledge' (Norman 2005).

A horizontal reading of the model suggests a progression in the development of knowledge structures from chains to nets. Such a directional development has been observed (Kinchin, Hay, and Adams 2000), though the mechanisms of change are complex and have been discussed elsewhere (Hay 2007). The implication that the development of net structures among students may be the goal of higher education is one that may be contested, particularly where chains of practice seemingly have more immediate practical application than networks of understanding.

Application to teaching

Patel, Arocha, and Kaufman (1999, 89) have explained that 'an effective clinical teacher needs to be able to articulate knowledge that would normally be tacit for a practitioner not engaged in instruction'. It is precisely the articulation of this tacit knowledge that is facilitated by the model and by the concept-mapping tool, providing students with the key information they need to 'move up a notch or two on the road toward excellence' (Lovitts 2007, 50).

The tacit knowledge that needs to be placed in the public arena for teaching is found connecting the chains of practice that are manifest in the clinical teacher's actions and the underlying network of understanding that is usually held privately (Kinchin, Cabot, and Hay 2008a). The clinical student needs to gain experience in converting between complementary chains and networks (Figures 2 and 3). At its most simple, this can be signified to students in lectures by using carefully constructed supplementary materials (such as handouts) that emphasise the integrated nature of knowledge and the origins of the linear structures projected within the lecture. Such structural transformations can be modeled for the student, once the teacher has recognised them. Engagement in concept-mapping activities allows the teacher to recognise the existence of the structures and allows him/her to make them public to the students within the course of teaching. The concept-mapping tool also slows down the process (that is usually automated) to facilitate its examination. So, for example, the typical structure of a clinical procedure would be a chain of practice that would be communicated to the student. The student's competence would be assessed through his/her ability to reproduce that chain under varying conditions and with various patients. The student's expertise, however, must be assessed through his/her ability to relate the chain of practice to the underlying network of understanding, and explaining how the elements are linked, and how and why the chain of practice should be modified in response to changes of context.

Intuition and tacit knowledge

One of the difficulties in developing a pedagogy of expertise is the central position given to intuition and tacit knowledge in some of the models of expertise used within clinical education (e.g. Benner 1984; Dreyfus and Dreyfus 1986). Interpretation of Benner's work has been the focus of some debate, exemplified by the divergence of views aired by English (1993) and Darbyshire (1994), illustrating tensions between the 'art' or 'science' of clinical practice (Seymour, Kinn, and Sutherland 2003).

If intuition and tacit knowledge cannot be explained or modeled for students, they would not make a good basis for a pedagogy for clinical education. However,

we do not see tacit knowledge as a barrier to developing a pedagogy of expertise so long as it is viewed as knowledge that has not yet been revealed rather than knowledge that cannot be revealed (Eraut 2000). We see intuition based on tacit knowledge as simply the poorly articulated links between chains of practice and underlying networks of understanding, and agree with Welsh and Lyons (2000) that it would not be possible to use intuition in the clinical context unless it was linked to formal knowledge:

> The use of intuition without reference to a sound knowledge base would reduce it to the sort of thinking which might be expected of an uninformed lay person and has no place in professional practice.

If colleagues are unable to verbalise their actions, it may simply be that they lack the appropriate tools to uncover what it is that they are doing, and/or the vocabulary or self-awareness to articulate it (Jarvis 1996). Hoffman and Lintern (2006) argue that there is no indication that tacit knowledge 'lies beyond the reach of science in some unscientific netherworld of intuitions and unobservables', and that appropriate tools can support colleagues in identifying and clearly describing their practice with the aim of improving teaching effectiveness (McLeod et al. 2004).

Rolfe (1996) comments that rather than considering intuition as a magical process of knowing, it should be considered as the unconscious workings of the prepared mind. By revealing these workings through the application of concept mapping, the tacit can be made explicit (Hoffman and Lintern 2006).

Conclusion

The clinical student has to juggle information between the clinical and the non-clinical teaching environments. Within a pedagogy of expertise, the linking of these two components of the curriculum is made explicit. This will help to avoid the situation, suggested by Fang (2002), where students feel (in the words of one of our fourth-year students) that:

> we have to learn everything twice. Once for the exam, and then again to understand what it was we were examined on. But we never have time for the understanding bit . . . maybe once we've qualified?

Our model is not prescriptive of teaching style, classroom management or delivery mode (i.e. face-to-face teaching or e-learning), and does not exclude any classroom strategy considered productive in a particular environment (Whipp et al. 2000). It simply requires the teaching to demonstrate the connection between chains of practice and underlying networks of understanding – in other words, making explicit the connections that are used intuitively by the expert.

The importance of developing assessment hand in hand with pedagogy cannot be overstated. If there is a mismatch in expectations of the curriculum between students and teachers, the likelihood is that teaching will revert to cycles of non-learning in which chains of practice are exchanged between student and teacher in the absence of understanding (Kinchin, Lygo-Baker, and Hay 2008).

Evaluation of teaching is also brought into focus by the expert model. Current student evaluations of teaching often tend to be led by an agenda of accountability and feature bland descriptors that will be interpreted inconsistently by a group of students. For example, whether or not presentations are well constructed, PowerPoint slides are clear and teachers appear well organised, it provides no

indication of the effectiveness of teaching. A determination of whether or not students can explicate the links between their lectures/clinics and the expert understanding from which they were drawn will give a direct indicator of the effectiveness of teaching and, crucially, one that is within the control of the teacher.

Such a view of expertise is transformative and integrative (Kinchin, Cabot, and Hay 2008b), and provides a strong link between what is known about the clinical teaching environment and the non-clinical teaching environment. Integrating theory and clinical practice has long been problematic for the students of dentistry, medicine and nursing (e.g. Rolfe 1996). Whilst university education is about developing creative, independent thinkers, this has to be reconciled with the need to ensure that a set of professional standards and competencies are met at some threshold level (Manley and Garbett 2000; Ashley et al. 2006). A dynamic pedagogy of expertise places such a link at its core and will support students through the 'metamorphic changes in clinical practice' that are predicted for the near future (GMC 2003; Wilson 2007).

By organising the way in which future practitioners are instructed in fundamental dimensions of professional work (to think, to perform and to act with integrity), the proposed model of teaching described in this article may be seen as the signature pedagogy for clinical education (Shulman 2005). However, Patel, Arocha, and Kaufman (1999, 76) have commented that 'the tension between . . . the tacit and the explicit is not unique to medicine, but rather characterizes all disciplines where theory is applied to practice'. For this reason, Cabot and Kinchin (2008) have proposed that an expertise-based pedagogy may be seen as a template for the development of general university pedagogy. Where practice within a discipline is interpreted more widely to include, for example, analysis of text in history or application of field study techniques in geography, the subtle relationship between chains of practice and networks of understanding can be revealed through direct observation of teaching (Kinchin, Cabot, and Hay 2008a). The importance of making explicit many of the implicit assumptions that have guided higher education in the past is starting to gain recognition. Lovitts (2007) has commented on the importance of making expectations explicit to enable students to excel rather than merely get by, whilst Northedge (2003) has commented on the importance of getting students to participate in the discourse of their chosen discipline, rather than act as passive observers on the sidelines. The application of the model proposed here provides a practical mechanism to enable that to happen.

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