Chapter 2
Educational Ideas and Surgical Education

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2.1 Introduction

Chapter 1 gave an account of the evolution of the arrangements for medical and surgical training in the UK. It also discussed the environment in which surgical training and education occur, with a focus on the surgical elements, such as the 'arena' of the operating theatre and the highly skilled technical nature of the craft of surgery. These features create a distinct educational environment. It also touched on some of the differences between the social sciences and science. This chapter focuses on key elements of one social science which can be brought to bear in the surgical environment, education. It attempts to outline several central educational ideas and practices, mainly drawn from higher, professional, vocational, and adult education, which are important to surgical education. These ideas are of value in their own right to the practice and understanding of surgical education. They are also used, underpin or implied in later chapters in this book. This chapter does not touch on aspects of education that relate more exclusively to simulation or learning technology as these are considered in Chaps. 3 and 8. Assessment is considered in much greater detail in Chap. 5.

2.2 Changing Educational Imperatives and Preferences

It is not only in the UK that medical and surgical education has changed beyond recognition in the last 25 years. This is not just because the context and practice of surgery have changed, but also because education as a discipline has evolved, and so have the specialist medical and surgical branches of it. Change is to be expected

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in a 25-year period, but its extent may be unusual. The two rapidly changing areas (surgery and education) have interacted with each other. It is this interaction that is responsible for most of the features that distinguish medical and surgical education today.

To a layperson, educational theory (i.e., the concepts and ideas that underpin the practice of teaching and learning) is perhaps an alien concept or almost a contradiction in terms. Non-educationalists may think that learning and teaching are some form of 'natural process' – a process about which there is no evidence as to the efficacy of one method or another, and where there is no need to question, probe and discover what is actually happening during teaching and learning, or theorise about it. But this is not the perspective educationalists take. For educationalists, trying to understand what is happening, so that explanatory models and theory can be developed, is the way in which the discipline of education moves on, and the practice of (surgical) education progresses. The practice, the doing, can be informed by theory; it can also be the basis from which educational theory develops. In these ways, educational theory and educational practice may evolve. Teaching and learning can be 'tested' for efficacy by collecting evidence about impact and experience, but such 'evidence' will frequently not be generalisable or robust because of the variability of context, learner, and teacher (Chap. 4 expands on some of these themes). Kennedy (2009) has been among others who have pointed to the relationships between educational practice and theory and their implications for post-registration training.

It is essential to be aware of and understand at least some key educational ideas to be able to make rational and informed educational choices about behaviour and organisation. It is possible to be a good teacher without such understanding, but only within limits. Being a good teacher can involve little more than having a 'flair' and repeating experienced good practice. But this is rarely a sufficient condition for educational innovation, learning from and building on the teaching practices of others, guiding curriculum change, or the development of educational policy. Often, it will be an understanding of the theory, combined with understanding of the context, that will lead to innovation and effectiveness in surgical educational practice; Kneebone's own work described in Chap. 3 illustrates this point. Moreover, even the good but limited trainer described above will meet situations in which they fail (e.g., the trainee who reacts in an unusual or unexpected way). They will then usually be unable to analyse what went wrong or know what corrective changes might work.

Educational situations are often not as directly comparable or replicable as scientists are used to, either at the bench, or, for example, when calculating the correct dosage of a drug. They have too many interacting variables that cannot be controlled and which do not react in predictable ways. This is one of the reasons why randomised control trials are not frequently used in education. Even when they are used, the results from them cannot necessarily be universally 'applied' with the same effect (as context and people will differ). For example, among any group of seemingly similar trainees, there will be different levels of knowledge, experience, and skill and each one will likely respond in different ways to stress, competition, etc. (see also Chap. 4). Rational and insightful choice about variation

to enhance educational practice usually comes from the experience of teaching combined with understanding of learning and teaching theory, and usually also requires an appreciation of how to learn from and use relevant research.

Some examples may be useful to illustrate the points made above. Problem-based learning (PBL) is a method of teaching and learning which tries to put into practice a wide range of educational ideas tempered by contextual factors. But it can easily be less than optimally implemented due to a lack of understanding of the theory or the context of PBL, thus producing a mismatch between the two (a point returned to later in the chapter). Other fruitful examples that demonstrate a positive interaction between educational theory and practice include: ideas about coping with shorter trainer periods through using a more formal curriculum, and meeting demands from the lay person that trained doctors can be proved/guaranteed to be 'fit for practice' through more consistent and standardised assessment procedures.

Arguably, some of the major changes in medical and surgical education in recent years have been, especially at pre-registration level, a shift from a didactic approach based on subjects, teaching, and the teacher to more exploratory approaches that emphasise the learner and the nature of what is being learnt, or rather the nature of how that learning will need to be accessed and used in medical practice. Undergraduate curricula that are organised around body systems, link traditional disciplines together (e.g., learning about the cardiovascular system from a range of perspectives, including anatomy, biochemistry, etc.), introduce patients with relevant illnesses and symptoms, and bring in appropriate skills are characteristic of such approaches. They are designed to break down the old stereotype of the newly graduated doctor who may have a lot of knowledge but does not know how to use it. This shift has seen the virtual end of the separation of distinct underpinning sciences to their greater integration, relating them to clinical features, and the introduction of many new subjects borrowing from the social sciences, such as professionalism and communication (the latter of which is a theme in several chapters in this book, e.g., Chaps. 9–11).

Another shift has been the move from learning the practical skills of doctoring in the real world to learning them in the simulated world. At the same time, learning in the real world is happening earlier in training. In post-registration training, there has been a shift to more formal structures and a more obviously 'taught' period of training (see Chap. 1 for more detail). It is possible to see many of these changes as related to changes in the practice of medicine, and they are, but they equally relate to developing understanding and knowledge about learning and teaching. These changes are generally shifts in balance more towards one end of a spectrum than the other rather than complete revolutions.

2.3 Learning Theory and Surgical Education

Learning theory is a general term for many different concepts and ideas. Some theories are about the developmental stages of childhood (e.g., Piaget's work), others about learning in particular contexts. Six groups of widely used educational

ideas of particular influence and currency in surgical education are introduced here; some reoccur or are an assumed underpinning of ideas in subsequent chapters.

2.3.1 Constructivism

Most contemporary learning theories are constructivist. Constructivist learning theories are based on the idea that, in sum, the individual 'stores' knowledge and understanding in unique ways that will in turn influence their recall and understanding of that knowledge and their creation of new knowledge. How knowledge is stored will be influenced by a number of factors, including how an individual first encounters that knowledge. Knowledge is said to be stored in schemata that can be more or less complex and that interconnect with each other. The acquisition of new knowledge and understanding needs to add to and change (i.e., transform) existing schemata if it is to become absorbed and accessible.

Constructivism is important not least because it is influencing a wide range of medical/surgical educational activity. For example, it has had a strong influence in pre-registration medical education in the move away from traditional subjects and several years of basic science before knowledge is used in the clinical context. Constructivist theory lies behind ideas such as that knowledge will be better retained and accessed when it has been learnt in context and has been better linked together during learning. The 'joined up' schemata will have been formed early on. It has also influenced our understanding of clinical reasoning and retention of information. However, like much learning theory, it cannot show/dictate an optimum way of putting the theory into practice.

2.3.2 Approaches to Learning

Ference Marton is the most influential figure in the development of a theory known as 'approaches to learning' (also known as approaches to study) (Marton and Booth 1997; Marton et al. 1997). His early work with Säljö has been subsequently expanded upon, but in essence postulates that learners who have different intentions when they set out to learn something will have different types of outcomes. This is an idea that is therefore particularly pertinent in post-compulsory education where learners are learning out of choice, have experienced much formal education, and might be thought to have a repertoire of responses available to them. However, research has shown that not all learners have such a wide repertoire and not all use that repertoire appropriately (e.g., see Biggs and Tang 2007). How someone is taught may influence which approach they use, with some methods of teaching and assessing likely to limit the approaches learners will feel encouraged to take.

Those taking a surface approach to learning tend to be intent on memorising isolated facts and see the learning task as being one of meeting external, short-term goals. Those who take a deep approach to learning are seeking to understand the larger picture and fundamental ideas. Thus, those taking a deep approach to study are more likely to have developed, complex, and linked schemata in which to hold their knowledge, and therefore be able to call upon it with greater longevity and to use it in different ways, from the much more isolated, and therefore, usually, more shortly retained, surface approach. 'Approaches to learning' is a constructivist theory.

John Biggs (1987) was largely responsible for elaborating on this theory and suggesting that when approaching a learning task, especially if assessment is involved, learners who have both approaches available to them can decide which is likely to be most successful for the task in hand; they can take a strategic or achieving approach. Thus, if they face a multiple choice test, they may feel rote learning of information is best, but if they face extended matching questions in a test and they have only rote learnt without understanding underlying principles, they are unlikely to succeed; when asked a complex clinical question, those primarily using a surface approach may give/access some information that is somewhat relevant, but struggle to apply their knowledge or reach a satisfactory synthesis or resolution (Chap. 5 explains the difference between different types of test, such as those referred to here).

Approaches to learning are considered to be engendered by a mix of things, including past educational experiences and the way teaching and assessment are organised. This idea thus has many implications for teaching and training, especially in surgery, as surgeons need a lot of factual (and procedural) knowledge but also have to see the bigger picture.

When a deep approach to learning is taken, learners are likely to retain knowledge for longer, because it has been fitted together, are more likely to be able to call on that knowledge when needed, and link together things learned in different contexts. These findings have profound implications for the training of doctors and surgeons. They have been part of the underpinning theory that has influenced a move away from a very didactic teaching style, based on transmission of information, and from assessment forms based on pure rote learning, to the introduction of a wider range of teaching and assessment forms.

2.3.3 Clinical Reasoning and Decision Making

Our understanding of clinical reasoning and decision making has changed hugely over the last 20 years. There has been a shift from the belief, put crudely, that it is about teaching a lot of fact in traditional disciplines and about learning a near universal method or series of steps through which diagnosis and decisions can be achieved. Our understanding now is that clinical reasoning is much more about recognising significant patterns. When this is not efficacious or the patterns

cannot be discerned, it is about being able to go back to first principles and reason through what is happening. There are a handful of researchers who have worked in this area over many years and many of their ideas can be found in: Bordage (2007), Charlin et al. (2007), Norman et al. (2007) and Schmidt and Rikers (2007). The schemata of clinicians are often known as 'illness scripts', in which their knowledge about diseases and conditions are held and linked together. Swift, almost unconscious pattern recognition is often what distinguishes many expert clinicians. Better understanding of how clinical reasoning works has had an impact on curricula and methods of teaching (Bowen 2006; Del Mar et al. 2006). Chapter 10 takes readers through some of these arguments in more detail and from a particular perspective.

2.3.4 Social Theories of Learning

'Approaches to learning' and earlier ideas about clinical reasoning developed from the traditions of cognitive psychology with an emphasis on the individual and what and how they think and learn. However, over the last 20–30 years, *social* theories of learning have contributed as much or more that is of value to surgical education, as they do not take the individual as the centre of learning but focus more on the context, the impact of others on the processes and content of learning (Haggis 2009). Bandura (for example 1977) was a trail blazer in pointing to the way in which people learn from each other through a range of mechanisms that include imitation, observation, and modelling.

Social theories of learning have also interacted with and contributed to ideas about learning in and from the workplace (Eraut 1994, 2007; Evans et al. 2009; Lester and Costley 2010; Swanwick and Morris 2010). Ideas about workplace learning have developed in the UK not only in connection with the professions but also with the rise of a new type of vocational, associate degree (the foundation degree), which is intimately linked with the needs of employment and often incorporates large work-based elements – just as post-registration training for surgery does. Social theories are of particular interest in surgery where surgeons work in teams and within particular and very specialised cultures and contexts. Vygotsky and a number of his contemporaries who worked in Stalinist Russia are a main source of ideas for many variants of social learning theory. Their work is still being explored and developed in the contemporary era. These ideas are returned to in the next section and also figure prominently in Chap. 13.

Experiential learning (see later section) – simply put the idea that we can learn from and by doing things, that is, by 'having an experience' – started from a focus on the individual who reflects on and learns from that experience. But the development of these ideas, to consider, for example, feedback from others to aid reflection or the potential for a team to reflect collectively to learn about team activity, draws more on the social and cultural context and the roles of a social group in collective learning. An example from surgery (or anaesthesia) might be a reflection by a surgical team

in the form of preparation before surgery and debriefing afterwards. A subsequent section of this chapter considers these ideas in more detail and they also reoccur in several others, for example, Bleakley in Chap. 11.

2.3.5 *Activity Theory, Work-Based Learning, Situated Learning, and Communities of Practice*

Lev Vygotsky who died in 1934 is the best known of an eminent group of Soviet psychologists who initiated work on an important and influential social theory of learning that has become known as activity theory (Vygotsky 1978). For many years, their work was little known outside Russia. Vygotsky described the cultural mediation of actions, and although he still focussed on the individual he gave consideration to the surrounding culture in the development of learning.

Unlike approaches to learning, activity theory, as developed by, for example, Engeström (1990), emphasises action rather than cognition and the interaction between the individual, the community, and the object or outcomes. The social context and community might be those of the surgical team and operating theatre who share the same object/outcomes of a successful operation. Activity theory is concerned with theorising and explaining 'doing', both by the individual (within a community) and by collectives of individuals. 'Tools' are used to produce an outcome. Using activity theory, the elements of activities may be 'plotted' and analysed in relation to each other, usually represented diagrammatically in a triangular format within which relationships can be shown and around which additional elements can be added. The whole system will usually include rules (implicit and explicit) about how the community works and interacts and understandings about how the object is achieved by the collectivity of people/settings involved. These ideas challenge the notion that *teachers teach* what is learnt. Here, it is only through participating in a context that certain things can be learnt. The relevance for surgical education is clear.

Engeström has studied many organisational and work contexts, using and developing activity theory as he did so, to explain/understand learning in such settings. This has included a study in a Finnish hospital (2001) during which he expanded on his idea of 'expansive learning', that is, that work contexts can, and do, themselves generate new practices and learning transformations. This may seem an obvious point to surgeons, but it is quite different from long-held academic scientific assumptions that knowledge is generated through hypothesis testing. It is important in showing how working contexts and practices generate/give rise to ideas that are later worked up and developed and trialled.

This whole area is important in developing theoretical understanding of how learning at work occurs. An area that was not theorised in the past, usually occurred effectively only due to the long duration of apprenticeship, but even then could be 'hit and miss' depending upon the natural skill, patience, judgement, knowledge, and expertise of the 'master' (in surgery, the consultant or experienced registrar).

In surgery, in many parts of the world, service pressures have removed/reduced the apprenticeship element of training, while new structures and shorter training have been put in place, and more formal assessment introduced as patients and governments demand greater accountability. Such structures may draw more and less fully and more or less successfully on newer ideas such as these outlined here, but where they do so it is mainly in the absence of an understanding from the surgical profession of what is happening and what is intended.

Further work by other activity theorists is extending ideas about, for example, the difference between creative and routine activity. Activity theory assumes that any 'community' will have tacit knowledge embedded within it – for example, norms of behaviour or understood practices which are not written up – which new entrants have to learn. Several other chapters in this book also refer to this aspect of learning surgery.

This is a theory therefore that is especially relevant to learning in, from and for the workplace. The attractiveness and applicability of these ideas to the surgical setting are clear to see, with obvious parallels to be drawn; Chaps. 3 and 10–12 in particular draw on this area.

Situated learning is a theory that explores the understanding of knowledge in context, in the sense of the social context in which that learning occurs and to which it relates (Lave and Wenger 1991). Situated learning and activity theory link back to the same Vygotskyian roots. Situated learning is the type of learning that can only occur through an individual (or team) being immersed in a specific environment, with a specific group or type of people. It relates too to acquiring the professional identity and perspective of the profession to which one is seeking entry. Key ideas, as indicated above, are that learning is or can be a social practice and that practice can generate knowledge. Situated learning does not emphasise the role of a teacher or trainer, or necessarily of a formal curriculum. It privileges context and is about learning at and through work (work-based learning) and gradually moving, in terms of learning and practice, from the periphery of a profession to its centre stage. The importance of this idea for surgery is considerable. Situated learning is increasingly drawn upon to help understand and integrate better teamwork and inter-professional working. It also relates to the development of professionalism and other more intangible areas. Individuals are said to work in a 'community of practice' (Wenger 1998), which contains knowledge within it and generates knowledge and knowledge-based practice. Chapter 6 draws extensively on these perspectives.

Apprenticeship ideals, about a long immersion in a context and learning on the job, could be theorised as a form of situated learning. While contemporary circumstances have generally reduced the apprenticeship aspect of surgical education, many would argue that the value of participating in a community of practice – meaning in the case of surgery, a work context and ethos of shared values, common actions and aims, and the understood, but usually implicit, norms – has not diminished. Thus, more conscious efforts are now made to invoke the learning power of the community of practice, for example, through using scenario training where parameters are more controlled than in the real world, by emphasising

things such as the role and importance of team working and debriefing, and more consciously drawing on the power of role modelling (see Chaps. 3 and 10–13).

Although training time and real world exposure have typically diminished in surgical training, more conscious use of actions and practices which draw on this group of ideas, and which reinforce the opportunity for learning from and in the community of practice, can enhance learning. It can be suggested that their more conscious use to inspire compatible curriculum design and teaching and learning practices could make best use of scarce real world exposure and training time. As already mentioned, outside of surgical education the idea of work-based learning has been developing and growing in importance and there is still much to learn from drawing these strands together.

The challenge now is to seek to further test and understand how this group of theories can support and provide insight about surgical training, and to better acquaint surgeons, trainers, and learners with them.

2.3.6 Experiential Learning, Reflective Practice, and Feedback

Experiential learning is the term used to describe a particular way of learning from practice (Kolb 1984). It seems an obvious idea, in line with the truism that 'practice makes perfect'. But experiential learning is the theory that describes how this happens and how such learning can be optimised. This theory has also played a part in correcting the balance within formal education that favoured the idea that education and learning happen in places like lecture theatres, not in operating theatres or other complex clinical settings. This again, now, seems a very obvious statement, but it was not one that underpinned medical pre-registration curricula until comparatively recent times.

Many people trace experiential learning back to Kurt Lewin in the 1930s. He worked in Germany and the USA and was a contemporary of the Russian social learning theorists whose ideas were still confined to the USSR. Lewin's ideas have been taken up by many others, most notably David Kolb, who developed them further (1984); they are now referred to by the general term experiential learning and have already been mentioned in a section above. Experiential learning theory rests on the idea and potential of a four-stage process or a learning cycle:

- Of doing something (e.g., closing a wound);
- Reflecting actively upon that thing, re-forming, and reshaping thoughts and understanding through analysis and synthesis, preferably with the help of feedback (from peers, patients, and surgical outcomes);
- Identification of areas for change/adjustment;
- And putting these into action or using to solve problems, this last step thus being the one that sets off a new cycle of learning from (a now altered) experience.

This process is often represented schematically as a cycle of which the best known version is Kolb's learning cycle. Many clinicians see this process as

comparable to an audit cycle. Thus, using experiential learning theory, one can hypothesise about learning from experience that is not about learning by accident, but about a process that will enhance/speed up learning if consciously used and incorporated into teaching and learning designs. Care is needed to remember, however, that in the real world learning is unlikely to progress smoothly or at an even pace – there will be reverses and jumps rather than smooth cyclical progression, a point also made in Chap. 6.

Experiential learning as a tool for consciously enhancing learning rests (as described above) on a very active, engaged, and consciously undertaken reflective step. This has given rise to the term reflective practice, that is, the idea that professionals enhance their expertise through actively considering it, often with input from others and from any available data, and acting upon the conclusions drawn (Boud et al. 1985). There are many variations and developments of this idea, from 'reflecting on practice' (i.e., after the event) to 'reflecting in action' – a form of simultaneous reflection and action (Schön 1987). The idea of reflective practice has been taken up in training, with efforts being made to teach learners how to reflect and consciously draw on it as a learning aid. This has often taken the form of encouraging reflective writing (De Cossart and Fish 2005), such as reflective elements in portfolios or log books. It remains to be seen how far written reflection engenders the 'habit' of reflection and whether it promotes a different type (e.g., more profound) of reflection from the well developed, if not always consciously named, reflective approach that many professionals have to developing their expertise.

Reflection and its role in learning are linked to contemporary ideas regarding the role of feedback in learning. Feedback is an important part of the reflective process and may give an insight beyond that of the learner. It is for this reason that many contemporary developments in assessment stress that feedback on performance, which also draws out the learner to assess their own performance, is crucial to the learning process (see the section below on assessment and also Chap. 5). Debriefing can also be considered to be a form of collective feedback and reflection. Chapters 7 and 10 among others draw on some of these ideas.

2.4 Curriculum Design and Learning Outcomes

Undergraduate (pre-registration) medicine has long had explicit curricula. Historically, these started much more as a syllabus (a list of content) linked with an examination schedule. Stenhouse's classic definition of curricula is that they are an 'attempt to communicate the essential principles and features of an educational proposal in such a form that it is open to critical scrutiny and capable of effective translation in practice' (Stenhouse 1975) Today, curricula are conceived and constructed as integrated wholes that consist of aims (what 'the course' – or work rotation – hopes to achieve in broad terms); statements about what 'students' – trainee surgeons – should learn (which are different from the content listing of traditional syllabi, as much content will be formulated as statements of what

students are expected to be able to do/know as a result of their learning), which are known as learning outcomes; the teaching and learning methods to be used for different parts of the course; and the methods of assessment. These are regarded as interlocking elements that have to be consistent with each other and compatible with the educational context. The development of better understanding of these elements and their relationship with each other has evolved over several decades. John Biggs coined the term constructive alignment (Biggs and Tang 2007) to describe the complex relationships between these elements of curricula. Below, three important aspects of the evolution of curricula are mentioned in more detail.

Bloom famously developed taxonomies of learning of particular types, starting with the cognitive domain (Bloom 1956), that is, pertaining to knowledge and understanding. He developed a hierarchy for the domain, starting at the simplest level, which he regarded as memorisation of the parroting type, and moving upwards as understanding and reasoning grow to a more analytical stage, to the highest levels of evaluation and synthesis (an example of which is diagnosis). He and others later developed taxonomies of the affective (values) and psychomotor (skills) domains. These domains are each typically represented as pyramids which reach a pinnacle at the most complex level. Although there have been changes made to the hierarchy of each area and although fewer people nowadays explicitly use these ideas about domains and levels, they remain the foundation of much thinking about designing, learning, and formulating learning outcomes, as they are helpful shorthand ways of referring in an abstract/generalised manner to areas of learning and levels of difficulty. In recent years, Biggs has elaborated on the work of Bloom (for example Biggs and Tang 2007) by seeking to express hierarchies of learning difficulty in a different way, showing how each level is a foundation for the next and also, in the cognitive domain, linking this to the approaches to learning theory, suggesting that taking a surface approach to learning will inhibit or prevent learning at higher levels.

Learning outcomes are statements about what learners should be able to do as a result of learning. That learning can be classroom or practice based, or indeed home based. It may take place with the help of trainers, or independent of them. Learning outcomes are intimately linked to assessment, because the statements of what students should have learnt should also be a guide to what is assessed. Learning outcomes will generally be formulated to start with verbs (what the learners should be able to *do* after some learning). They can be formulated at different levels of specificity and detail. For example, a rather inadequate learning outcome might simply state that after a given amount of training the learner should be able to close a wound. The tendency of the 1970s and 1980s to use behavioural objectives rather than today's idea of learning outcomes resulted in some overly specified, detailed, and complex curricula that amounted to hefty volumes of minutely specified statements, which were then all supposed to be accurately assessed, but rarely could be. Learning outcomes are thus conceived as more flexible with regard to suiting the level of specification to the tasks in hand. One might want to add some conditions to the earlier example, such as the type of wound, using a particular knot, or in a particular part of the body, or using specific instruments – or simply using appropriate techniques. The degree of specificity has to be judged against the

task, the possibility of assessment, and the importance of the skill or understanding concerned. It is also vital not to be so bound by overly specified learning outcomes that creativity and innovation are stifled, particularly if one is attempting to use them with (the learning of) senior practitioners.

Historically, post-registration education (in the UK) has not had a formal curriculum in Stenhouse's sense. It used an apprenticeship model where concepts such as a specified core of learning that had to be mastered or standardised levels of achievement that needed to be demonstrated were less formally construed, assessed, and regulated (see Chap. 1). The move to specify a curriculum at postgraduate levels is in part a reflection of standardisation, patient safety, and accountability, in part of shorter training, and in part a reflection of the evolution of education as a discipline and the use of understandings such as those indicated above about learning theory and curriculum design. It is worth noting that there is a long history in education of studies about the gap between the curriculum on paper, the curriculum as taught and experienced, and as assessed; ideas that have not yet been widely drawn on in relation to postgraduate surgical curricula.

2.5 The Role of Assessment and Psychometrics in Learning

Assessment is an important part of learning. Generally in this book, and always in the introductory four chapters, when assessment and evaluation are used in their specialist educational meaning, it is their UK usage that is adopted (rather than American English). In English educational terminology, the terms are clearly distinguished from each other. Assessment is concerned with judging the learner and evaluation with judging the teacher, course, or context in which that learning occurs.

Self-assessment is an important feature of surgical learning as it tends to be in many other professions. It frequently involves active reflection as to how well something was done, and thereby enhancement of performance (see earlier section and later chapters, especially Chap. 10). Self-assessment is less about external judgement and verification and more about self-regulation and continuous improvement. It has always been a feature of the professional practice of senior and expert surgeons who generally engage in it barely consciously. Self assessment should not be dismissed as a modern fad; its purposes and role in training and learning are quite different from 'big bang' assessment for the purpose of external regulation and verification.

Another important aspect of assessment and one that is closely linked to self assessment is the feedback of others – be they patients, senior surgeons, or other members of the surgical team. The main purpose of feedback is to provoke more learning through input from the perspective of someone other than the learner. Learning occurs both in reaction to positive feedback (the learner who is smart at picking up signals will think 'Ah, that's something that has worked that I should keep on doing and improve upon'), and to negative feedback, although in this

case the feedback will rarely be positively received unless it contains suggestions about how to improve or change. Reflection and giving and receiving feedback are skills vital to all professions and experts, and part of a culture of learning from and through work.

Self-assessment and feedback are types of formative assessment, that is, assessment whose primary purpose is to aid learning rather than provide external validation of fitness to practice. Such external validation may come through many different types of test and examination whose primary purpose is summative, that is, to arrive at an overall external judgement at a standardised or externally imposed point in time. Of course in practice, any given assessment may be designed to achieve both purposes, as is the case with a considerable amount of assessment in the current UK integrated surgical curriculum (referred to in Chap. 1).

In formal learning, assessment tends to take on a more regulated external element. In medicine, this external element particularly relates to 'being fit to practise'. Medical and surgical assessment has always been more tightly controlled than most other university-taught courses. It has thus a much more developed understanding and use of psychometrics than many other disciplines and has evolved many types of assessment specific to itself. Nowadays, this tighter regulation is increasingly a feature also of post-registration assessment. From an educational perspective, this could be thought of as having both good and bad effects.

Medical assessment 50 years ago was very different from that of today. Then, at elementary levels, assessment was often not very appropriate, in that it did not always match what was intended to be assessed to the format used for assessing it (e.g., using essays to test recall of factual nuggets or long or short cases to test procedural proficiency). Validity and fidelity were lacking and reliability was poorly understood or exercised. Such assessment was often 'high stakes,' but was not suitably controlled and constrained to provide confidence in the reliability of judgements nor was it firmly linked to assessing the key parts of the curriculum that need to be tested to reassure patients and to ensure a satisfactory standard has been reached.

Chapter 5 describes in detail the key concepts that underpin effective medical and surgical assessment and also the main types of assessment in use today. It points firmly to the way in which assessment design is an integral part of curriculum planning, as we have already seen above. Changes have been introduced to improve reliability, validity, and fidelity. With the move away from behavioural objectives as a universal panacea, there is now a degree of fluidity which is occurring alongside firmer understanding and use of psychometrics, and a return to recognising the place of judgement within an overall assessment regime. (However, an exclusive emphasis on reliability does still on occasion lead to poor validity and to trivialised assessments that fail to make best use of the opinion and experience of expert surgeons.) This increased fluidity mirrors the way in which our understanding of curriculum development and learning theory has developed to be more complex, better able to cope with less rigid contexts, etc. As Chap. 5 explains, some assessments have high validity and poor reliability while others have the reverse properties. The key is appropriate selection for purpose.

One noticeable change being introduced to surgical assessment in some countries is the use of more workplace-based assessment and the return to realising the importance of feedback in professional development, with this being 'designed in' and specified rather than happening through an apprenticeship model of education. The rationale for some of these changes stems in part from trying to use educational theory to enhance educational practices in changing contexts.

2.6 A Case Study: Problem-Based Learning as an Example of Using Educational Theory to Drive Educational Change

Problem-based learning (PBL) is an interesting method of teaching and learning that is quite widespread in undergraduate medical education and that some argue is what naturally happens' in clinical practice. It divides opinion. Where it has failed or been rejected it is possible to argue it has done so because it was used in a way that so compromised its underlying rationales, which are based on educational theory, that it had little hope of success. Such compromises have sometimes arisen from lack of educational understanding and at others from practical pressures. It has also had many successes. It provides a salutary lesson about the need to understand and evaluate carefully how to use educational theory successfully.

PBL is also an interesting case study for surgical education because many medical students all over the world study using this system, and come, arguably, into post-registration training with a very different background and expectation from students used to more traditional processes.

PBL was initially described and used by Howard Barrows (Barrows and Tamblyn 1980), but has subsequently developed with many recognised variations. It is an integrated system of learning and teaching.

PBL, in its ideal, is about creating learners who take a deep approach and develop integrated and accessible knowledge that they can use in various ways. To achieve this, curriculum and teaching are, in an ideal world, organised to limit the effectiveness of surface approaches. Another feature of PBL is the attempt to learn in a context that mirrors the real world of medicine and thus, it is argued, starts to create more naturally pattern recognition and schemata in which knowledge is sorted in useful ways for practising medicine. If PBL is viewed in these ways, the roles of teaching, assessment, the integration of knowledge, and practice fall into place. It draws on motivation theory and, in its use in medicine, on a desire to start developing 'clinical thinking and practice' at an early stage. It is argued it achieves the latter through approaching problems 'in the round', much more like a practising doctor than as a student learning separate disciplines, or even learning from information organised in systems.

PBL is initiated through 'scenarios' or triggers that start the learning process; these triggers can be selected to focus on commonly presenting conditions, diseases, and situations (Mr X comes to your clinic complaining of . . .). This is likely to be

important to the development of clinical reasoning and illness scripts (see above). A common misunderstanding of PBL is that it has no curriculum and no learning outcomes. Just the reverse is true; PBL has to be highly designed to work well. The main point is that learners are not (initially) told what the learning outcomes are; part of motivating them to learn and to take a deep approach is that they have to determine what they need to learn to unravel the 'mystery of Mr X'. Such an approach can sound artificial; appear to waste time and to be paradoxical. When PBL is well designed, the huge proportion of students will rapidly access their existing knowledge about the scenario presented and effectively determine what they need to learn to understand it better; they may do this in various ways including self study and accessing more traditional forms of teaching. This process is at the heart of the method, but to achieve it triggers have to be piloted for efficacy and need not only to be tweaked in use, but also changed from time to time to remove the potential for students to take shortcuts by 'borrowing' work from earlier years. At the report-back stage of PBL (after students have researched and thought about what Mr X's problem might be), poorly implemented PBL can become little more than students reading from notes without interaction, understanding, or probing tutor input.

PBL is not a universal panacea and to best achieve its educational payoff, it is usually expensive as it is time hungry in terms of planning, training, and tutoring. Attempts have been made with mixed success to reduce some of its intensive use of resource, but doing this effectively requires an in-depth understanding of the theory behind it and the characteristics of the particular students being taught using it. Some medical schools have moved away from PBL because of its costs, staff failures to use it correctly, inadequate and ill-suited assessment strategies, student incomprehension with learners wanting more spoon feeding, etc. Simply having a PBL curriculum will not ensure it 'works' if teaching staff are still approaching it from a non-PBL mindset and students are not inducted into its use – or prove able to subvert its practices to reduce the input it requires from them. Numerous studies of functional PBL implementation have shown that its effect on learning is usually to reduce the depth of detail that students learn in the short term but to intensify retention, understanding, and recall of information in clinical settings (e.g., Schmidt et al 1987; Alabanese and Mitchell 1993; Dolmans and Schmidt 2006). It is worth noting this in terms of what can be expected of graduates from good PBL curricula. (See Feather and Fry 2009 for a discussion at greater length.)

2.7 Implications of Educational Ideas for Surgical Training

The development of educational ideas and understanding should have had an impact on surgical training. The danger is that insufficient numbers of surgeons are sufficiently acquainted with these ideas to be able to operate effectively in a system using them, and even fewer are able to effectively participate in decision making about education and training from a theoretically informed viewpoint. And of course

educational ideas are only one of many factors that inform the development of training. Education as a discipline is so different from science-based disciplines that *how* its theories and ideas can be used is also misconstrued. There is thus much scope for misunderstanding and failure; a point we make repeatedly in these first four chapters and which can be seen in the PBL case study. It is also a misconception to see a lot of modern curricula for postgraduate training as overly influenced by educational theory. Shorter training times, fewer inpatient stays, public demands for practising doctors to be 'guaranteed' as reaching a satisfactory level of practice, etc. are nothing to do with education. But education does offer some ideas and hopefully some help about how to tackle these issues, from more formal and planned curricula that can maximise training time, through the use of simulation, to improved assessment practices.

Learners too need to grasp how they are expected to learn. Approaches that worked in school will not necessarily be effective in university education and strategies that worked at university may not be effective at post-registration level. Trainee doctors who can learn in different ways and from different circumstances are at an advantage over those who use a much more limited range of strategies. Doctors coming into clinical medicine who have not developed an 'independent learning' ethic will struggle. They will find they are no longer spoon fed, nor do they have many years in which they can demonstrate their ability to move to consultant level.

Designers of education – be they surgeons, educationalists, or policy makers – need to understand the overlapping worlds of surgical education. Educational designers need to take on board that not all educational practices work at all levels, or in all contexts.

Looking to the future, the contribution of educational ideas to surgical education will continue to be crucial. Surgical education in turn is well placed to contribute to the development of educational ideas, given its unique nature and practice-based training. One likely development is better understanding of how cognitive and social theories of learning fit together to explain learning.

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