ASSESSMENT OF SIGNIFICANT LEARNING OUTCOMES: 3RD SEMINAR
How do we Represent Lifelong Professional Learning?¹

Michael Eraut, University of Sussex

INTRODUCTION

This paper is concerned with professional learning and hence with changes over time in what professionals understand and what they are capable of doing. Since many actions are not individual, it is also important to consider the understanding and capability of groups and organisations. These can be addressed first by examining those actions attributed to groups or organisations, rather than to individuals acting alone, then second by eliciting the significant understandings that influenced them. This paper seeks to address the challenging problem of how an individual’s understandings and capabilities may be represented and communicated in a social context by treating representations as mediating artefacts, whose meanings are clarified and to some extent reconstructed through the conversations they elicit.

As a strong advocate of ‘situated learning’, I argue that the meanings of all concepts and theories are shaped, both socially and individually, by the context(s) in which they are acquired and the context(s) in which they are used. Hence the personal meaning of a concept or theory is shaped by the series of contexts in which it has been used. In these days of rapid mobility, the sequence of such contexts is likely to be unique for each individual practitioner; so situated learning is unlikely to create the level of shared understanding predicted by the theory of ‘communities of practice’. This alternative interpretation of situated learning leads to an epistemology, which treats socio-cultural and individual theories of learning as complementary rather than competing, analogous to the Wave (social) and Particle (individual) theories of light.

The cultural perspective on knowledge focuses on knowledge creation as a social process, whose outcomes may take the form either of codified / reified knowledge or of shared meanings and understandings that have not been codified or translated into mediating artifacts. The individual perspective is captured by my definition of personal knowledge as “what individual persons bring to situations that enables them to think, interact and perform”. The distinctive feature of this definition is its focus on the use of personal knowledge, rather than its truth. This allows one to investigate the effects of personal knowledge without necessarily being able to represent that knowledge in codified form, thus incorporating aspects of personal expertise, practical wisdom and tacit knowledge. For example, it includes not only the personalised versions of codified knowledge that individuals use, but also their everyday knowledge of people and situations, know-how in the form of skills and practices, memories of cases and episodic events. It could also include various aspects of self-knowledge, attitudes and emotions. The evidence of personal knowledge comes mainly from observations of performance, and this implies a holistic rather than fragmented approach to knowledge; because, unless one stops to deliberate, the knowledge one uses is already available for action in an integrated form.

Most nations assign three major roles to higher education. One is the creation, evaluation and transmission of codified knowledge; the second is the development of students’ knowledge resources and skills; the third is the award of qualifications to those who pass the required assessments. All three roles contribute to professional formation; and I intend to address them all.

---

¹ Expanded version of paper given to EARLI SIG meeting, Heerlen, October 2006
DISCOURSES FOR REPRESENTING KNOWLEDGE IN HIGHER EDUCATION

There is a wide range of discourses for representing knowledge in the literature; and my review of them will seek to characterise them according to three criteria:

- Their portrayal of codified knowledge
- Their treatment of processes, skills and methods
- Their attention to the conditions and context of use

General higher education has traditionally focused on codified knowledge and given little attention to representations of how that knowledge might be understood or used. The typical syllabus contains lists of topics, whose items read like titles or chapters of books. Nearly all the information needed by learners is missing. Cue-seeking learners find out what they need to do by:

- Noting how much time is given to a topic
- Asking high-performing students who have recently taken the course
- Studying previous examination papers or assignments
- Picking up cues dropped by their lecturer(s) (Miller & Parlett 1971)

Serious attention to thinking processes was first given widespread attention by Bloom et al’s Taxonomy of Objectives, whose Cognitive Domain (1956) was published 50 years ago. The authors were university based psychologists, their target audience was college examiners and their purpose was to upgrade the quality of learning by raising the level of thinking required to pass them through constructing more challenging examinations. Its six main headings were as follows:

- Knowledge (their explanation and their examples indicated that this meant the recall and recognition of information)
- Comprehension (the interpretation and extrapolation of a communication)
- Application (the use of abstractions in concrete situations)
- Analysis (of elements, relationships and organisational principles)
- Synthesis (putting together elements to form a new pattern or structure)
- Evaluation (making judgments about ideas, works, methods, solutions, etc.)

One important advantage of this taxonomy was that, unlike most other taxonomies constructed at that time, it was comprehensible to academics without any knowledge of psychology. Another advantage was that its hierarchical nature was confirmed by Madaus et al (1973) with but one exception: Synthesis and Evaluation required a different set of skills from Analysis. There were, however, some weaknesses in the discourse of objectives. Teachers’ interpretations of the required level of work depended on their intended context of use, thus challenging the assumption that such objectives had some acontextual quality. A more serious practical problem was that even the most precise definitions did not prevent disagreements about the appropriate mark or grade for a script. This does not invalidate the taxonomy, but it challenges the notion that even an assessment based discourse cannot avoid the need for all representations to be accompanied by discussions of a sample of scripts before there is sufficient agreement to proceed.

Another variable is the conditions under which assessed “performances” take place. Formal examinations are subjected to strict time limits and usually, though not always, to the absence of notes or reference books. Ambitious candidates will have done most of their analysis before the examination; but that means preparing for a wide range of possible questions and hoping that a sufficient number of them will appear. Hence they need to invest in good intelligence work as well as academic preparation, an important preparation for life!. The
same issues are even more significant in workplace assessments for professional qualifications. Variations in time, level of support and access to resources are much greater, so assignments to particular placements or internships are likely to have an even greater effect on performance. The central problem is that the assessment process does not give examiners an adequate representation of a student’s knowledge.

Bloom et al recognised that the relationships between different pieces of knowledge were an important aspect of analysis and synthesis, but were not prepared to admit that a person’s cognitive structure cannot easily be represented by a taxonomy. Jonassen (1993) reviews a wide range of methods for representing this “structural knowledge”. These include network diagrams, concept maps or pattern notes, and methods for eliciting and using them. These forms of representation have three main purposes:

- To help learners to represent the structure of their own knowledge and then seek to extend it
- As mediating artifacts to trigger and sustain discussion and the sharing of meanings and understandings
- As advance organisers for texts and lectures.

Another mode of representation is the two dimensional matrix, which Bloom et al (1971) used to depict connections between the Content and Thinking Process dimensions of learning objectives. Eraut et al (2003) developed a similar matrix to represent connections between the academic and practice-based dimensions of professional knowledge. In order to represent the use of scientific knowledge by nurses and midwives, they mapped the titles of the topics taught for broad areas of knowledge like nutrition, pain or self-esteem against the activities used in daily practice. Whenever knowledge of the topic was used in the activity, the mode of use was entered in the relevant box of the matrix (see Figure1 below). Otherwise it was left blank. It was easy to see where any sub-topic was relevant, and whether its use was simply (1) remembering to use it, (2) decision-making based on prior experience once the situation had been recognised (Klein 1989), or (3) problem solving possibly requiring some external advice. Users were warned that those with less prior experience would require more time for deliberation or seeking advice. What these matrices offered was:

- An indication for learners (and their teachers and mentors) of where scientific knowledge was important
- Some hints as to how it might best be learned
- A mediating artifact for focusing on shared knowledge within one box at a time, while still recognising that it would need to be combined with the knowledge signalled by entries in other boxes, i.e. directly addressing the part-whole problem.

In order to more fully represent the knowledge involved in a single case, one would need all the matrices relevant to that case, and some indication of how the relevant knowledge was recognised, selected and used in a wide range of cases. Examples of this can be seen in case studies of surgical nursing investigated by Fessey (2002).

From a professional perspective, we are interested not only in the knowledge resources acquired during higher education, but also in professionals becoming knowledge workers. In particular, professionals are expected to find out what knowledge is most relevant for their current learning goals, track down the relevant knowledge and make appropriate notes for speedy retrieval at a later date. Information from several sources may be required and, if concept maps of the topic and/or notes on its evidence base are constructed as their investigations proceed, these will greatly enhance the usefulness of their inquiry. Managing one’s knowledge effectively adds value to the time spent acquiring and refining it, but is rarely found in practice. Hence it is important to develop a repertoire of approaches to knowledge representation.
**Figure 1: Knowledge of Acute Pain Used by Surgical Nurses: section on causes of pain**

<table>
<thead>
<tr>
<th>Areas of knowledge</th>
<th>Unrelated to surgery</th>
<th>Signs of infection</th>
<th>Haematoma</th>
<th>Retention of urine</th>
<th>Constipation</th>
<th>Wound assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nerve pathways</td>
<td>R2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission</td>
<td></td>
<td>U2</td>
<td>U2</td>
<td>U2</td>
<td>U3</td>
<td>U3</td>
</tr>
<tr>
<td>Perception of pain</td>
<td>U2</td>
<td>U2</td>
<td>U3</td>
<td>U3</td>
<td>U3</td>
<td>U3</td>
</tr>
<tr>
<td>Causes of pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effects of pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacteriology</td>
<td>R2</td>
<td>U3</td>
<td>R2</td>
<td>R2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmacology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anaesthesia</td>
<td>R2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wound healing</td>
<td></td>
<td>U3</td>
<td>U2</td>
<td>U3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barriers to</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>expression of pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre and Post</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>operative care</td>
<td>U3</td>
<td>U3</td>
<td>U3</td>
<td>U3</td>
<td>U3</td>
<td>U3</td>
</tr>
<tr>
<td>Alternative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>methods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R Appreciating the Relevance of the knowledge  
U Understanding and interpreting the knowledge  
1 Simple Application  2 Recognition-primed decision  3 Problem Solving

**THE DISCOURSE OF COMPETENCE AND COMPETENCIES**

Competence is another term, which has come to be used within both socio-cultural and personal perspectives. Eraut (1998) has argued that the socio-cultural definition of competence as “meeting other people’s expectations” has the longer provenance. In English the everyday meaning of ‘competent’ encompasses the following: being properly qualified, being able to perform on your own, being capable, adequate but not expert. The scope of such competence is rarely specified but is often implicit in the context. My own definition of competence is “being able to perform the tasks and roles required to the expected standard”. This expectation, being socially defined, will either be taken for granted or determined by the micro-politics of the particular context. Hence it is likely to vary across contexts and over time. Thus competence is a moving target. The expected standard will also vary with the experience, responsibility and reputation of the person concerned.

To avoid confusion I use the term ‘capability’ to describe the more recent individually situated definition of ‘competence’, and define it as “everything that a person can think or do.” Moreover, there are some important links between a person’s capability and their
competence. All their competence will be within their capability; but not all their capability will be needed on any one job. So they will also have additional capability, which provides a useful resource for changes in the job or changes of job. Such changes may not be fully covered by additional capability; so further learning may be needed. However, additional capability may be helpful both in enhancing one’s competence through learning; and in helping to transform one’s job through innovation. On the negative side, additional capability may atrophy through lack of further use.

Nor is it likely that an individual professional’s competence will remain static. Ideally, a professional’s competence is enhanced and expanded by further practice and new challenges. But this will depend on the affordances offered by their practice context and the disposition of individuals or groups to take advantage of them. At any one time, a professional’s competence is limited to the domain, within which their practice meets the expectations of significant others in their workplace and/or among their clients. Key aspects of this domain include:

- The contexts in which the performer will have to operate, including likely locations and their salient features
- The conditions under which the performer will have to work, e.g., degree of supervision, pressure of time, crowdedness, conflicting priorities, availability of resources
- The situations which the performer may encounter, covering such factors as client types and demands, tasks to be tackled, interpersonal events, emergencies, etc.

This complexity is incompatible with the common but simplistic assumption that competencies can be treated as binary variables, i.e. that workers are either competent or incompetent in each aspect of their performance. Moreover, there are several reasons why competence may not always be translated into performance:

- Personal disposition, which may be affected by both contextual norms and personal confidence in that particular context
- Lack of capacity due to too heavy a workload or lack of time (a common feature of many university examinations)
- The context and conditions in which the performance is situated (these may be too crowded, lack important facilities or fail to provide appropriate support).

Over time these factors can cause a person to settle for lower standards of performance, not a desirable outcome in professional work that serves the public.

Two other meanings of ‘competence’ are quite prominent in the discourse. The dominant meaning in management development derives from the work of McClelland (1976) and his co-workers, who defined a ‘competency’ as “an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation” (Spencer & Spencer, 1993). Their method for detecting these competences for a particular type of job was to identify two criterion samples, one of people deemed especially successful at the job and one of people deemed just good enough not to cause any concern. These groups were then engaged in Behavioural Event Interviews, in which they were asked to describe three successes and three failures and probed for details of their thoughts and actions. The transcripts of these interviews were then analysed to identify differences between the two samples. This yielded a competency model specific to a particular type of job, which comprised three to six clusters of two to five competencies, each with an associated rating scale (Boyatzis 1982). Several of these were common across quite a wide range of jobs.
The other significant form of competence discourse was developed in continental Europe to describe underlying features of high skills performance. This differed from McClelland by being socially situated and more concerned with learning for future employment needs than with selection. These competences were broad, but their looseness of definition and lack of standard modes of measurement has limited their impact to the conceptual rather than the operational level.

My research into the professions and into competency-based qualifications in the workplace indicates real difficulties in articulating and representing the nature of competence. These include:

- Finding the most appropriate level of detail: very broad representations of competence are too vague for any practical use; and very specific representations tend to become too numerous to handle, as lists of competencies approach the size of telephone directories
- There are similar problems with assessment to those found with even the most detailed learning objectives. Assessors rarely agree unless there is a past history of developing a consensus by discussing individual cases. Moreover, the half-life of such a consensus is usually very short, because personnel change and so do the expectations of significant others who influence the implicit social agreement on what counts as competence
- Capturing the essence of an area of expertise is both difficult and controversial
- Both listing important attributes of competence and describing their integration into performance is a part-whole problem, for which nearly all previous representations (including those in higher education) have focused only on the parts
- Covering all aspects of the job is rare, because many aspects remain tacit or get explained away by terms like “experience” or “personality” which tell us very little about how people learn to do them.
- Recognising the changing and conditional nature of what counts as competence: this changes over time and between contexts, an approach that works well with one group may not work so well with another group.

THE DISCOURSE ON EXPERTISE AND CASE KNOWLEDGE

These two further forms of discourse will be taken together, because expertise is commonly conceptualised in terms of the successful handling of individual cases. They also present a different approach to the representation of professional work. I have reviewed the literature on expertise elsewhere (Eraut 2005), but would like to draw attention to three developments in particular: the focus on representation itself as an important aspect of expertise, the recognition of the role of tacit knowledge, and the constraints which arise from treating expertise as only based on individual cognition. I will start with tacit knowledge, because it raises a different type of problem to that of complexity. People may be aware of some of their tacit knowledge, but they cannot express or explain it. So how can it be represented?

One early attempt to achieve this was the five stage Novice to Expert model proposed by Dreyfus and Dreyfus (1986) as an antidote to the cognitive scientists’ confidence in the design of expert systems. This model (Figure 2) was subsequently used by Benner (1984) to track the development of expertise by intensive care nurses. The early and middle stages of the model involve the development of situational recognition and understanding, and of standard routines that enable one to cope with crowded busy contexts. The explicit rules and guidelines so essential at the beginning are later abandoned as behaviour becomes more automatic; so the use of the deliberative mode of cognition (not usually very analytic) peaks at the competence stage. Progression beyond competence is then associated with the gradual replacement of deliberation by more tacit forms of cognition.
Figure 2: Summary of the Dreyfus Model of Progression

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Novice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 2</td>
<td>Advanced Beginner</td>
</tr>
<tr>
<td>Level 3</td>
<td>Competent</td>
</tr>
<tr>
<td>Level 4</td>
<td>Proficient</td>
</tr>
<tr>
<td>Level 5</td>
<td>Expert</td>
</tr>
</tbody>
</table>

Tacit knowledge appears in three different forms, confirming that it is not a single type of knowledge but an attribute of several types of knowledge:

- **Situational understanding** is developed through all five stages, based largely on experience and remaining mainly tacit
- Increasingly *intuitive decision-making*, involving pattern recognition and rapid responses to developing situations is based on the tacit application of tacit rules.
- *Routine procedures* are developed through to the competence stage for coping with the demands of work without suffering from information overload. Some of them are likely to have begun as explicit procedural knowledge and then become automatic and increasingly tacit through repetition, with concomitant increases in speed and productivity.

My main criticism of the Dreyfus analysis is that it is both individualistic and conservative. The ethical requirement to inform and consult clients and the growth of teamwork in complex multi-professional projects have increased the need to share one’s knowledge with others; and the Dreyfus Model acknowledges but gives scant attention to the increasing occurrence of novel and complex situations that require a problem solving approach involving an explicit search for relevant knowledge, the collection of further evidence and critical reasoning. I support the Dreyfus progression to Proficiency, because it helps to explain the benefits and constraints of tacit knowledge. In particular it enables us to better understand the difficulty of changing long established approaches to situational understanding, rapid decision making and
routine practices; because such changes involve unlearning as well as relearning, and a return to being a novice without the excuse of being a novice. Hence the need for time and support is an order of magnitude greater than that normally provided (Eraut 2003).

However, I see Proficiency as an end-point and treat progression to Expert as a parallel track in which critical analysis, the ability to develop multiple representations of complex problems and being able to work with users and other professionals with different types of expertise is prioritised (Eraut 2005). The cultivation of such expertise requires a very different learning context from that needed for the development of proficiency.

Figure 3 below (from Eraut 2004) shows the interaction between time and mode of cognition for four key aspects of professional practice in action:

- **Assessing clients and/or situations** (sometimes briefly, sometimes involving a long process of investigation) and continuing to monitor their condition
- **Deciding what, if any, action to take**, both immediately and over a longer period (either on one’s own or as a leader or member of a team)
- **Pursuing an agreed course of action**, modifying, consulting and reassessing as and when necessary
- **Meta-cognitive monitoring** of oneself, people needing attention and the general progress of the case, problem, project or situation.

These activities can take many different forms according to the speed and context and the types of technical and personal expertise being deployed. Although analytically distinct, they may be combined into an integrated performance that does not follow a simple sequence of assessment, decision and then action. For example, as suggested by research into naturalistic decision-making (Klein et al 1993), there may be several assessments, decisions and actions within a single period of performance. The chosen pathway may depend not only on the conditions and constraints on the performers, but also on what they have already learned to do, with or without stopping to think.

**Figure 3: Interactions between Time, Mode of Cognition and Process**

<table>
<thead>
<tr>
<th>Type of Process</th>
<th>Mode of Cognition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Instant/Reflex</td>
</tr>
<tr>
<td><strong>Reading of the situation</strong></td>
<td>Pattern recognition</td>
</tr>
<tr>
<td><strong>Decision-making</strong></td>
<td>Instant response</td>
</tr>
<tr>
<td><strong>Overt activity</strong></td>
<td>Routinised action</td>
</tr>
<tr>
<td><strong>Metacognitive</strong></td>
<td>Situational awareness</td>
</tr>
</tbody>
</table>

The model assumes that time is the variable that most affects mode of cognition and divides the time-continuum into three sections, headed Instant, Rapid and Deliberative. These terms attempt to describe how the time-scale is perceived by the performer, and are interpreted differently according to the orientations of performers and the nature of their work. For
example, in one context rapid might refer to any period less than a minute, while in another context it might include periods of up to ten minutes or even half an hour. The critical feature is that the performer has limited time to think in an analytic mode. The instant/reflex column describes routinised behaviour that, at most, is semi-conscious. The rapid/intuitive column indicates greater awareness of what one is doing, and is often characterised by rapid decision-making within a period of continuous, semi-routinised action. Typically it involves recognition of situations by comparison with similar situations previously encountered; then responding to them with already learned procedures. The time available affects the degree of mismatch that is tolerated, because rejection of action based on precedent leads to deliberative, problem-solving and hence to a more time-consuming approach. The deliberative / analytic column is characterised by explicit thinking by individuals or groups, possibly accompanied by consultation with others. It involves the conscious use of prior knowledge and its application to new situations, sometimes in accustomed ways, sometimes in novel ways or in a more critical manner.

This leads us to Boshuizen’s (2003) excellent summary (Figure 4) of the changes in representation that accompany the development of expertise in doctors. Her interpretation of her own and other people’s research is that successive modes of representation are developed as a person’s expertise increases, and that the key advantages conferred by later modes of representation are their lower demand on the expert’s cognitive capacity, more rapid access to usable information and a reduced need for deliberation. The building block for this development is the accumulation of individual cases.

**Figure 4: Knowledge structure, learning and cognitive demand in problem-solving at subsequent stages of expertise development**

<table>
<thead>
<tr>
<th>Level of expertise</th>
<th>Knowledge structure</th>
<th>Learning</th>
<th>Problem solving</th>
<th>Control required in clinical reasoning</th>
<th>Demand on cognitive capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>novice</td>
<td>networks (incomplete and loosely linked)</td>
<td>knowledge accretion, integration and validation</td>
<td>long chains of detailed reasoning steps through networks</td>
<td>active monitoring of each reasoning step</td>
<td>high</td>
</tr>
<tr>
<td>intermediate</td>
<td>networks (closely linked)</td>
<td>encapsulation</td>
<td>Reasoning through encapsulated network</td>
<td>active monitoring of each reasoning step</td>
<td>medium</td>
</tr>
<tr>
<td>expert</td>
<td>illness scripts</td>
<td>illness script formation</td>
<td>illness script activation and instantiation</td>
<td>monitoring of level of script instantiation</td>
<td>low</td>
</tr>
<tr>
<td></td>
<td>memory traces</td>
<td>instantiated scripts</td>
<td>automatic reminding</td>
<td>check relevance</td>
<td>low</td>
</tr>
</tbody>
</table>

Novices start by learning large chunks of biomedical knowledge, which enables them to provide detailed descriptions of cases, but also requires lengthy multi-step reasoning. Placements offering engagement with large numbers of cases support the gradual development of broader, clinically based, more succinct frameworks for describing cases, which encapsulate the biomedical knowledge and slightly reduce their cognitive load. Then gradually they begin to develop condition specific illness scripts, which are best described as narratives of typical cases that remind them of the successive decisions they make for each patient. These make a significant reduction in their cognitive load. At this time they begin to give special attention to atypical cases, which they remember as separate one-off events. With more experience some of these become sufficiently familiar to form additional scripts or well-defined problems. The ill-defined cases continue to be very challenging and usually cause them to return to biomedical knowledge as a key resource.
Finally we come to the problems that arise from neglecting the role of other workers and the contexts in which professionals work. These are aptly summarised by Hakkareinen et al:

- It pays too much attention to mental processes and events rather than concrete activities taking place within socio-cultural contexts and situations.
- It focuses on mental representations rather than various external representations, tools and knowledge embedded in the environment that people are using to manage their limited cognitive resources.
- It assumes that intellectual processes follow a short timescale of almost instantaneous reasoning processes (i.e. processes taking place within one session of thinking) rather than extend across expanded periods of time.
- It assumes that intellectual activity takes place at the level of the individual agent, and is primarily dependent on his or her mental capacities, rather than distributed across several agents and dependent on characteristics of their social organisation (pp7-8).

Two key principles that emerged from their research were the relational nature of expertise, and the coordination of individual and social competencies. The relational nature of expertise means that, in order to make a valuable contribution to the community, an agent needs, “To develop their knowledge and skills in relation to their fellow actors in such a way as to allow them to complement each other’s strengths and weaknesses” (p206).

**OTHER FEATURES OF COMPLEX PROFESSIONAL PRACTICES**

The highly analytic model of decision-making advocated in the immediate post-war literature has now been firmly reconstructed as evidence-based practice, with a strong emphasis on 5 star evidence from randomised control trials. However, such evidence is only available in a limited number of situations. In medicine, the home of evidence-based practice, no doctor has yet given me a figure above 20% for the proportion of decisions they make for which 5 star evidence is available; and since such trials exclude patients with multiple conditions, many elderly people lie outside the researched population (Eraut 2005). Policy makers are easily converted to hyper-rational approaches because, for understandable but not justifiable reasons they are aversive to complexity. Total reliance on evidence-based practice is an escape from the responsibilities of providing, or at least seeking, wise judgements.

Klein et al’s (1993) research into decision-making in practice showed that real life settings include many of the following characteristics:

- Problems are ill-structured
- Information is incomplete, ambiguous, or changing
- Goals are shifting, ill-defined or competing
- Decisions occur in multiple event-feedback loops
- Time constraints exist
- Stakes are high
- Many participants contribute to the decisions
- The decision-maker must balance personal choice with organisational norms and goals (Orasanu & Connelly 1993, pp19-20).
The findings of this research provide a much more complex different picture of the decision-making process and the nature of good performance in the field:

- Experts frequently generate and evaluate a single option rather than analyse multiple options concurrently
- Experts are distinguished from novices mainly by their situation assessment abilities, not their general reasoning skills
- Because most naturalistic decision problems are ill-structured, decision makers choose an option that is good enough, though not necessarily the best (ibid p20).
- Reasoning and acting are interleaved, rather than segregated (Weick 1983).
- Instead of analysing all facets of a situation, making a decision, and then acting, it appears that in complex realistic situations people think a little, act a little, and then evaluate the outcomes and think and act some more (Connelly & Wagner 1988) (ibid p19).

The research also demonstrates that reasoning is schema-driven rather than algorithmic; it uses processes to which the decision maker(s) have become accustomed:

“Even for problems with many novel elements, decision makers use their knowledge to organise the problem, to interpret the situation, and to define what information is valuable for solution. Some information may be selected or distorted to fit the existing schema, a potential source of error. But it also enables speedy assessment, search, selection, and interpretation of relevant information, a definite advantage when faced with information overload and time pressure. A critical feature of the schema-driven approach is that people create causal models of the situation. They try to understand the significance of events and information by inferring causal relations” (ibid p 18).

The implications for decision-making practice are that (1) the relationship between knowledge and decision-making is rarely simple, (2) good decision-making is critically dependent on how the decision is framed by the decision-makers in the light of their situational understanding and therefore (3) the balance is tilted more towards the personal knowledge of the decision-maker(s) and less towards any codified knowledge management system that might be available. If there is very little time, access to a knowledge management system would only be undertaken when there was a high expectation of getting a valuable pay-off very quickly.

My evaluation of High Level S/NVQs (Eraut et al 2001) revealed three major problems which have yet to be addressed: the effect of using qualifications for accrediting existing competence, the dangers of a fragmented approach to performance, and the limited development of expertise in assessment and learning support. We found that our sample of over 600 candidates spent, on average, only 28% of their time on developing new competence. Candidates who spent more time on development emerged with significantly higher ratings on two critical outcomes: taking the qualification helped their work and led to changes in their working practices. Moreover, spending more time on developing new competence did not increase the time it took candidates to qualify. A major reason for this last finding is that candidates seeking development embarked on fairly ambitious projects which, though time consuming, were both of value to their organisation and positive learning experiences; and these projects provided evidence of competence across large areas of the qualification, leaving only small pieces of units to be “picked up” towards the end. In contrast, candidates considered already competent spent a great deal of time searching for evidence of past accomplishments with relatively little learning gain. These candidates could equally well have chosen a more developmental pathway but were unaware that this could have been no less burdensome. This is but one illustration of the unintended effects of designing a qualification with no attention to learning.
The neglect of learning is even more apparent when one looks at the tendency for the pursuit of NVQs to be a fragmented learning process caused by a fragmented assessment process. Occupational Standards are the end-product of a functional analysis of competence, and NVQs are in effect a selection of units from those standards. Under present financial arrangements, the government pays for the development of the Standards and the Awarding Bodies organise the assessment; but no finance is available to develop a learning programme which is motivating, meaningful and effective, incorporates formative evaluation and progression, and concludes with holistic final assessments that are more valid measures of performance in the workplace than a portfolio of bits and pieces of evidence. People drift into the fragmented approach through lack of expertise, without recognising how frustrating and non-developmental it can be for candidates or its lack of workplace validity.

Two main causes of inauthentic assessment have now been discussed, the hyper-rationality of seeing knowledge as mainly evidence-based when lack of evidence is all around us, and the fragmentation of standards and assessments to make them appear comprehensive and escape complex judgements. I now have to add a third problem, the importance of tacit knowledge in professional performance.

Diagrams depicting the transformation of tacit knowledge into explicit, codifiable knowledge have been commonplace from Kolb through expert systems and evidence-based practice to Nonaka & Takeuchi and the cult of knowledge management. Sometimes there are useful by-products, but the main outcome for those who look at the evidence and are not seduced by wishful thinking is greater awareness of the pervasive presence of tacit knowledge in the way we do our business and live our daily lives (Eraut 2000, 2004). Since many modes of learning rely on their ability to transfer tacit knowledge without making it explicit, this section has been added to explore how tacit knowledge contributes to the four elements of performance discussed in Figure 3 above: understanding situations, decision-making, skilful action and monitoring.

We start with the role of tacit knowledge in understanding people and situations, because people easily recognise this phenomenon. Getting to know other people typically involves the absorption of a great deal of incidental information, acquired by being a participant observer on occasions when we were both were present and partly by the normal conventions of politeness and sociability. While some of the knowledge gained may be explicit biodata, much will be gathered in the form of impressions of their character and behaviour or memories of episodes in which they participated. Secondary as well as primary data may also take the form of stories about a person as well as hard facts. Stories would normally be regarded as an explicit form of communication, but often they also carry implicit cultural and personal knowledge. Typically you learn more about the people you meet than you are able to explain, and some of that knowledge may be so provisional that you are reluctant to make it explicit. Yet you still take that knowledge into account when you interact with that person, because you are unlikely to stop and think unless there is something problematic about the occasion. What influences your behaviour is your aggregated knowledge of that person and that aggregation is usually a largely tacit process to which memories of incidents, encounters and episodes contribute in ways you cannot tell.

Another factor is the way you tend to organise your knowledge of people: this affects how you perceive their behaviour as well as how you structure your memories of them; and neither is a fully conscious process. There is evidence that people use particular personal constructs for categorising others, that early impressions affect later interactions and that you notice remember people’s actions in groups only when they play a significant part. Moreover, if you are a manager, your memories of occasions when you interacted with those you manage are bound to be an atypical sample just because you were present.
Many of the same factors contribute to the mixture of tacit and explicit knowledge which constitutes one’s knowledge of an organisation, context or situation. Many situations, for example, are largely characterised by the differing perspectives of the participants and of “significant others” off-stage; and knowledge of these perspectives depends not only on what people do and say but also on how it is interpreted by others in the context of what they already “know” about the people concerned. We also use terms like “acculturation” or “socialisation” to describe the often unconscious absorption of norms, values and other kinds of culturally embedded knowledge. Also significant is the amount of tacit generalisation which takes place from familiar people, situations and contexts which you think you know to those that are less familiar. All these processes are well documented in the psychological literature. Thus tacit understanding not only contributes to relationships and situational understandings within an organisation but to important transactions with external clients, customers, suppliers and stakeholders.

Skills are defined in terms of knowing how to do things; and nobody will accept evidence of a skill in the form of codified knowledge. For that reason, many skills are regarded as archetypal examples of tacit knowledge. For example, riding a bicycle or swimming are easily recognised skills which can be explicitly demonstrated; but nobody can explain to you how they do it, at least not in a way that would enable you to do it yourself. Skills of this kind cannot be disseminated by the use of a knowledge management system. Many important work processes involve a combination of propositional knowledge and skills of many kinds. These components are highly integrated and interdependent. Thus a person’s negotiating skill will affect the way in which they use their propositional knowledge and even the choice of that knowledge. The technician trouble-shooting a piece of electronic equipment will draw on propositional knowledge in a personal form which suggests something about the likely nature of the problem. Designing a knowledge management system which can cater for such individual needs regarding the type and form of information could be difficult. To learn to trouble-shoot a piece of equipment within a short period of time is probably best accomplished by going out with an expert with a varied caseload but enough time to talk, show what they are doing and try to explain it on-the-spot. Even this, however, may not always be successful because trouble-shooting is often an intuitive skill by which people recognise patterns without being fully aware of the cues which prompted that recognition. Another example would be interpreting what is going on beneath the surface of a business meeting. Simple well-defined situations might be analysed explicitly, but complex situations would be immensely difficult to portray or interpret.

In the previous section, we discussed the tacit nature of rapid intuitive decision-making in terms of situational recognition and prior experience. The research into naturalistic decision-making in less time-pressured situations, which allow at least some deliberation, suggests a pattern which relies more on the intuitive use of tacit knowledge when situations become more complex and uncertain. Our first three examples concern deciding what to say and how (1) when asked for advice, (2) when giving feedback and (3) when being cross-examined in a meeting. Your awareness of the interests and priorities of those being addressed, of the emotional dimension, and of the appropriate length of your response may guide any preparation; and you hope to reach a point where you feel that you have got it right, and when you need to adjust your plan because it does not seem to be having the desired effect.

A similar problem often occurs in recruitment, especially for one-off jobs, because:

- Some criteria are used for inclusion and some for exclusion, and an overemphasis on exclusion leads to “safe” but uninspiring choices
- The relative importance of the criteria is disputed
- The application of criteria involves a lot of distinct partial judgments, which never quite add up to a final decision.
Such judgments are essentially holistic. Hence, while the discussions about candidates meeting the criteria prepare the way, the final judgment in the absence of strong micro-politics will be based on tacit judgment and at least some mutual trust.

This is but one example of decisions in situations where there is no ‘right answer’, even after a considerable period of deliberation and analysis. The problem is rarely confined to analysing probable consequences, because there will often be conflicting interests and different timescales to be taken into account. The group of decision-makers explore and discuss the options, then eventually decide on one which seems to them to be “the best fit”. This final decision will often be largely intuitive, drawing on the tacit aggregation of knowledge which could only be analysed piecemeal. When there is less time or motivation to collect evidence and to construct and clarify arguments, such decisions will have an even greater tacit component. When there is less time still, they will be described as ‘backing a hunch’.

A great deal of monitoring also involves tacit knowledge. The first issue concerns finding space for monitoring: how do you give any attention to self-monitoring, when there are many apparently more urgent things demanding your attention; and how do you set up, or take advantage of, informal meetings to pursue your monitoring agenda with others. The second relates to what you notice during conversations or observations. Whether you rely on spotting problems or more systematically scanning your environment, you still have to notice any relevant evidence; and this is particularly difficult if it is not very salient and rarely appears. Then thirdly, you may also have to decide, often very quickly, whether or not to ignore, make a note for later consideration or make a rapid intervention. More explicit monitoring is only likely when based on previous mistakes, and even then it may have a short half-life.

LEARNING TRAJECTORIES

During two successive research projects on mid-career and early career professional learning in the business, engineering and healthcare sectors, we developed a typology (Figure 5) for classifying what was being learned. However, instead of calling our categories ‘competences’ we have called them learning trajectories and adopted a lifelong learning perspective (Eraut et al 2005a). Not only does the concept of learning trajectories fit our project’s data much more closely than of a set of competences (Steadman et al 2005), but it also takes into account discontinuities of learning so that at any one time:

- Explicit progress is being made on several of the trajectories that constitute lifelong learning
- Implicit progress can be inferred and later acknowledged on some other trajectories
- Progress on other trajectories is stalling or even regressing through lack of use or because new practices have not yet been adopted.

The most significant change in career terms is the award of a qualification, because this very public rite of passage symbolises generic competence in a profession, and is backed by the use of apparently clear and specific criteria for assessment. In practice, however, Professional qualifications in particular require both a specified amount of practical experience and the demonstration of competence in certain aspects of performance by successful candidates. The assessment process may require either that a particular level of competence is reached in each aspect or that the performance as a whole is satisfactory or both. Irrespective of the formal specification, assessors tend to use some combination of the two and to allow strength in one aspect to compensate for some weakness in another. Although the award of a qualification depends on achieving a minimum level of competence, who would want a candidate that achieved nothing above that level?
Trainees in most professions are allocated to a series of placements, through which they are expected, with suitable support, to acquire the specified level of competence. However, the learning affordances of each placement vary considerably according to the local context, and these differences will affect what each trainee learns and the profile of their competence at the point of qualification. The use of learning trajectories addresses both variations in competence and continuity of learning by tracking aspects of trainee performance before, during and after qualification.

A second advantage of using learning trajectories is that they can reduce the need to base qualification decisions on limited samples of performance under conditions of high anxiety. Mapping progress over time is measuring the ability to learn from experience, probably a better predictor of future performance than a final assessment.
Another advantage is the opportunity to include the context of performance in the learning record. What is learned is affected by the context and conditions for learning, and acquired competence does not usually transfer across contexts without significant further learning. Hence it is important to include information about the context and conditions in the performance record in order to indicate the domain of a professional’s current competence.

The implication of this need for amplification of the record is that ‘points’ on these learning trajectories are best considered as windows on episodes of practice, in which the aspect of learning portrayed by the trajectory played a significant part. Each window should include the following information about the performance:

- The setting in which it took place, and features of that setting that affected or might have affected the performance
- The conditions under which the performance took place, e.g., degree of supervision, pressure of time, crowdedness, conflicting priorities, availability of resources
- The antecedents to the performance and the situation that gave rise to the performance
- The other categories of expertise involved
- Any differences from previously recorded episodes
- Indicators of expertise in the domain of the trajectory having been maintained, widened or enhanced

This last point draws attention to the complexity of learning and performance in professional work. It is unusual for a performance to use knowledge from only one trajectory, and the seamless integration of personal knowledge from several trajectories may itself be an important learning challenge that goes beyond progress in several separate trajectories. The holistic nature of any complex performance should never be neglected. Within this overall framework it is still possible, indeed desirable, for different types of representation to be used for different trajectories and at different career stages.

REFERENCES


