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Moving from knowledge management to expertise management: a problem of contexts

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Abstract

This paper presents results from a project funded by the UK Arts and Humanities Research Council which has supported a philosopher in residence in three construction companies. The research addressed the philosophy of practice particularly focusing on expertise and extended other work in the construction industry about knowledge management with the objective of improving practice. Critical dialogue was used as a therapeutic tool to seek clarity in explanations of practice and thereby assign value to the actions of practitioners in both individual and team contexts. This dialogue was conducted with practitioners including trades-people, professionals and managers. Knowledge management which focuses upon the collection, storage and dissemination of knowledge in order to enhance company performance is critically analysed. Exploration of the philosophical roots of this approach to knowledge management indicates that it treats knowledge in a de-contextualised way and conceptualises it in terms of propositional knowledge. The project results demonstrated that expertise does not utilise this kind of knowledge and a new perspective was developed which was termed ‘expertise management’. The growth of expertise from novice to experienced practitioner and the implications of this for moving from knowledge management to expertise management are considered. The development of people and organisations requires an improved ability to respond effectively to contexts, thereby producing better performance.

Key words: expertise-in-context, knowledge management, practice

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Moving from knowledge management to expertise management: a problem of contexts

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Introduction

This paper presents results from the 'Philosopher in Residence in Construction Companies' project which was funded by an AHRC Knowledge Transfer Fellowship and ran from 2008-9. The research addressed the philosophy of practice particularly focusing on expertise and extended other work in the construction industry about knowledge management with the objective of improving practice. The project involved having a philosopher in residence in three construction companies to engage in critical discourse about practice so as to improve individual practitioner and company practice thus providing economic, social, and cultural benefits. The companies were Mouchel, Thomas Vale Construction and Rider Levett Bucknall. Mouchel is a civil engineering and public infrastructure management organisation employing nearly 11,000 people. Thomas Vale Construction is a medium-sized building contractor operating in the Midlands employing about 830 people. It has a strong record of partnership working in both the public and private sectors. Rider Levett Bucknall is a multi-disciplinary consultancy offering cost and project management services with 2000 people worldwide. Each of the companies sought to improve its economic performance in the short term and also to make itself sustainable in the longer term. They all identified a need to change but were baulked by the need to deliver business in tight timeframes and by past industrial practices. The companies agreed to allow groups of staff to participate in this research as an organisational development activity.

The project involved working in critical dialogue with 30 practitioners including trades-people, professionals and managers. It sought to explore the real nature of practice from a practitioner perspective. The inquiry centered around investigating the difference between the reality of professional practice and the representations of it, with the aim of gaining philosophical insight into the divergence between the two. The variance between representation of practice and practice itself was considered to be a barrier to improving it. The valuing of actual practice was regarded as fundamental to improving practice. Such concerns relate directly to questions about the nature of practice and expertise that are the focus of much attention in construction as well as academia. The philosophical concepts behind this involve 'expertise-in-context', which is everyday expertise understood broadly as covering various kinds of practical knowledge, attention based knowledge, skills, decision making and action planning (Dreyfus, 2005). This is contrasted with positivistic concepts which inform knowledge management in construction.

The research explored challenges to practitioner practice. The methodology employed semi-structured dialogues (Boyd and Xiao, 2006) which were coded using the grounded theory approach proposed by Strauss and Corbin (1997). This approach takes a social constructivist view of the world (Easterby-Smith *et al*., 1991) so objectivity and value neutrality are unavailable in both research and practice. Action research was involved since the planning and implementation of change in the real world was a critical part of the process (Susman and Evered, 1978). The research was also participatory in the sense that the subjects of the investigation were encouraged to direct the study for their benefit (Heron, 1988).

The project enabled companies to reflect on their approaches, thus providing ideas for improvement that could be embedded in their structure and processes. The activity has aided company staff in recognising their own expertise-in-context including diagnosing limitations to their knowledge and work context. In the longer term, staff were enabled to change company structures and processes so they were aligned with improvements in practice and to assist colleagues through therapeutic and diagnostic tools to engage with effective change. These processes facilitate sustainable evolutionary change from within. The staff enhanced their ability to understand, value, and communicate their expertise to a wider public thus presenting a better image of the construction industry whilst the companies have acquired an improved understanding of individual staff contributions.

This paper critically analyses knowledge management which focuses upon the collection, storage and dissemination of knowledge in order to enhance company performance. Exploration of the philosophical roots of this approach to knowledge management indicates that it treats knowledge in a de-contextualised and propositionalised way. The project results demonstrated that expertise does not utilise this kind of knowledge and a new perspective was developed which was termed ‘expertise management’. The development of people and organisations requires an improved ability to respond effectively to contexts thereby producing better performance.

Problematic aspects of knowledge management

Construction is often presented as not operating effectively (Woudhuysen and Abley, 2004). Practitioners are continually being told to modify their knowledge and thinking in order to improve construction practice. The idea that this is possible through enhancing practitioner knowledge is at the foundation of most improvement initiatives in construction. The conventional conception of construction practice assumed a stable industry where superior technical knowledge held by an individual could ensure success; so solutions involved better objective identification, planning and implementation processes (Boyd and Wild, 1993). The industry uses technology at every level, and the reliance on it encourages the conceptualisation of problems in terms of propositional knowledge (Boyd, 2007). There has been much research into knowledge management for the construction industry (Anumba *et al.,* 2005) where the identification, extraction, storage and accessing of better knowledge is intended to enhance company performance. Within construction it is widely agreed that this approach is an oversimplified view of the problems and solutions but the prevailing rhetoric continues to espouse this position for a variety of reasons (Boyd, 2007).

The failure of knowledge management to bring about improvements in the industry (Boyd and Xiao, 2006) reflects the fact that unsatisfactory theoretical models can, and sometimes do, lead to inadequate recommendations about what good practice is or ought to be. The importance of handling complexity, uncertainty, ambiguity, value

conflict, crisis and change in construction practice challenges the importance of knowledge when this is conceptualised in terms of propositional knowledge and presented as lists of solutions. Project complexity means that no single individual can understand all of the technical details, with knowledge being held diffusely within the organisations handling the project and far away from sources of authority (Boyd and Wild, 1993). Multiple perceptions result in legitimate conflicts of values (Boyd and Wild, 1996), whilst uncertainties within the client and project organisations cause instability in projects (Boyd and Wild, 1999). Significant problems with the general notion of knowledge management are that knowledge management is separated from individuals, context, and action. Another difficulty is that knowledge management does not handle group expertise well. These are important limitations because successful professional practice involves integrating knowledge, the holders of that knowledge, the context in which the practice occurs, and the performance of appropriate action. This general critique might be summed up by claiming that managing knowledge means not managing what actually happens in practice but rather an abstraction from it.

The inadequacy of knowledge management which focuses upon the collection, storage and dissemination of knowledge in order to enhance company performance is demonstrated by a project interview with a senior surveyor. The surveyor demonstrated their exceptional expertise in handling a complex technical and political situation in a tight time frame. He had been asked to undertake an inspection of a medium-rise office building in a middle-eastern country before a major financial consultancy purchased it for about £7,500,000. He discovered that the building was not complete, there were family connections involved in the sale and purchase, that the client would want substantial modifications, and that the short time window was connected with desperation in finding a building. The different cultural situation meant that he was unable to obtain simple information such as drawings, and found resistance to questioning about technical aspects of the building. The fluid and rapid prioritisation of technical and situational factors allowed an intuitive response which enabled a significant job to be completed for the client:

> "The acid test to me was the skill to produce 5 or 6 Powerpoint slides that actually hit all the relevant issues … The final report was probably 40-50 pages long but to be able to pick out of that in the executive summary – (no client ever wants to read more than a page of A4) – to be able to summarise the nutmegs and filter what is relevant and superfluous is where the skill comes. I have this sense check if I was the client reading this what are the issues? … You have an instinct and you have a feel" (surveyor interviewee).

The expertise involved recognising that the job was just a confidence check for the client. The surveyor could not possibly understand all the national codes and building design standards or cultural idiosyncrasies. However, he could still confidently answer varied and wide-ranging questions posed by the client and bring significant issues to their attention by understanding what they needed to know. This display of expertise could not be explained by a codified and propositionalised approach to practice (where practitioners are deemed to stand outside the contexts they are involved in). Understanding such effective professional practice requires recognition of expertise-in-context.

Philosophical ideas about the nature of knowledge, its justification, and transmission inform aspects of knowledge management in construction. The perspective that knowledge is essentially propositional in character is dominant in contemporary philosophical thinking. There is good reason for holding that the idea that knowledge

is fundamentally propositional in character has been rather uncritically appropriated in knowledge management. For example, treatments of tacit knowledge could be thought of as a reflection of the idea that, if knowledge is not propositional, then it must be hidden in some way. The foregrounding of the notion of knowledge having a basically propositional character is the underlying cause of the problems with knowledge management and the reason why it cannot bring about the desired improvements in practice. Recognition of these difficulties highlights the benefit to be obtained from philosophical approach to understanding knowledge and practice.

The nature of knowledge has been a subject of philosophical study ever since Plato. In the seventeenth century, questions about knowledge assumed a central place in philosophical inquiry until the rise of analytic philosophy in the early twentieth century. However, interest in these questions continued and issues about knowledge are once again occupying a core position within the discipline. The standard ascription of propositional knowledge is of the form S knows that P. (There are also statements of the kind 'S knows when the Part P regulations about electrical installations were introduced'. This does not pick out a proposition that S knows, but it seems reasonable to claim that it is an indirect propositional knowledge ascription. Roughly speaking, there is some proposition which tells us when the Part P regulations were introduced and S knows that this proposition is true. Such indirect ascriptions permit the attribution of propositional knowledge without one actually knowing the proposition.)

Understanding expertise requires insight into the forms which knowledge can take. The idea brought into prominence by Gilbert Ryle (1946, 1949) and subsequently associated with him is that there are two types of knowledge. One is propositional knowledge expressed in the 'knowing that' construction and the other is practical knowledge ascribed in the 'knowing how' construction. The distinction between 'knowing how' and 'knowing that' is important for appreciating the difference between practical and theoretical knowledge. Intellectualism is a well-entrenched framework for the study of mind which claims that all practical knowledge is a species of propositional knowledge. Ryle's argument against intellectualism can be summarised as one which appeals to regress. If practical knowledge were a species of propositional knowledge, then, to engage in any action, one would have to contemplate a proposition. But the contemplation of a proposition is itself an action, which presumably would have to be accompanied by a distinct contemplation of a proposition. If the thesis that practical knowledge is a species of propositional knowledge required each manifestation of practical knowledge to be accompanied by a distinct action of contemplating a proposition, which was itself a manifestation of practical knowledge, then no practical knowledge could ever be manifested. Ryle claimed that practical knowledge is irreducible to propositional knowledge. For example, the ability to do carpentry does not consist in knowing that such and such is the case.

The idea that there is a difference between propositional and practical knowledge has been widely accepted ever since Ryle proposed it. Postulating a distinction between practical and propositional knowledge is not the same as insisting that the distinction can be drawn sharply. Indeed, it is doubtful that this is possible (Winch, 2009). A great deal of practical knowledge consists of the possession of propositional knowledge. For example, knowing how to get to a building site may consist, among other things, in knowing that one needs to go left at the junction. There are strong grounds to think that intellectualism is a methodologically inferior framework for analysis. In direct contrast to its stance there appears to be substantial plausibility in the idea that propositional knowledge may be grounded on

practical knowledge, and this will become evident when expertise-in-context is considered.

Expertise-in-context

Construction is a rich environment, displaying the use of expertise-in-context at a variety of levels in very intense and unique situations. The exploration of this is valuable for both individual practitioners and companies. The problems with the construction industry do not lie in the practices themselves, but in the conventional expression and analysis of what these difficulties are. Improving practice requires a different kind of expression, and analysis with expertise-in-context-based language and concepts provide this as they align with actual practice. The therapeutic and diagnostic application of these ideas in a Wittgensteinian fashion (Addis, 2006) can release practice from its self imposed conceptual problems. Excessively theoretically-based prescription (such as specifying particular kinds of causality) about the nature of practice should be avoided, as the goal is to free mental cramps when reflecting about practice and to engage with better thinking about practice. Practical knowledge is context dependent and therefore cannot be generalised in the same way as theoretical knowledge. Knowledge of practice is about how to do things where this is widely understood, and includes matters such as engaging in the right kind of deliberation in a particular context (Horvath *et al.,* 1999). It follows from this that how practice handles knowledge that is incomplete in some way requires research.

Phenomenology originating with Husserl provided a basis upon which important ideas about expertise-in-context were developed by Hubert and Stuart Dreyfus. Expertise-in-context seeks to understand everyday expertise, skills, decision making and action planning (Dreyfus and Dreyfus, 1986). It applies to refined (such as chess) and daily life (such as cooking) skills. Work on expertise-in-context involves investigations into the contextual interdependent nature of consciousness and action. Heidegger (1997) and Aristotle (2000) claimed that practical knowledge is a kind of expertise acquired as a second nature. Once one becomes sufficiently expert at something there is a sense in which it becomes natural. Expertise-in-context involves the idea of articulating smooth coping non-deliberative behaviour along with its non-conceptual and embodied character. It relies on a rich perceptual repertoire which consists of the capacity to respond to subtle differences in the appearance of a wide variety of situations, but it does not (primarily) require a repertoire of reasons at all. Given sufficient experience with a variety of situations requiring different decisions, the expert – unconsciously – gradually breaks these situations down into sub-groups, each of which elicits a particular response. Expertise is a matter of discriminating perception, which requires an appropriate response to the richness of the context. This permits the successful intuitive situational response that is the hallmark of expertise. One manifestation of this is the development of professional intuition, which instinctively senses quality and problems. Experts are able to effectively improvise in situations. The behavioural patterns of experts can be further subdivided, depending upon precisely the kind of expertise possessed. Some of kinds of experts, such as architects, display flexible expertise which could be thought of as the ability to deal with very diverse and unprecedented situations within their broad professional practice.

Heidegger (1997) and Merleau-Ponty (2002) claimed that one is always already in a world that is organised in terms of one's body and interests and thus permeated by relevance. In the case of an expert, features of a situation, although available to the perceptual system, need not be accessible to the mind. Phenomenology suggests

that a study of expertise shows that nameable features are irrelevant to the current state of mind of the expert when acting. Nothing about the situation need be nameable and thinkable as a reason for acting. In expertise-in-context there is a direct link between perception and action as opposed to the view that there is perception followed by cognition then action. The idea that understanding is required to perceive is consistent with this view of expertise. Thought and perception have equal weight. Expert perception in any skill area has an intentional or goal-directed content.

Formal instruction starts with rules, but they seem to give way to more flexible responses as one becomes skilled (Dreyfus, 2005). This suggests that the assumption that, as one becomes an expert rules become unconscious, should be questioned. Experience suggests that rules may be needed when learning, but one must eventually set them aside if one is to become an expert. To assume that the rules were consciously followed become unconscious is like assuming that the guidelines which were in place when learning must have become hidden. The phenomena suggest that to become experts one has to switch from detached rule following to a more involved and situation specific way of coping. Expert coping is not even implicitly rational in the sense of being responsive to reasons that have become habitual but which could be reconstructed if required. Hubert and Stuart Dreyfus (Dreyfus and Dreyfus, 1986) represented these ideas in a celebrated five-stage model of skill acquisition. This model has been extensively used, particularly in the study of nursing practice (Benner, 1984; Benner *et al.,* 1992). The model can be summarised as follows:

1. Novice: rigidly adheres to rules and has no discretionary judgment
2. Advanced beginner: has a very limited perception of situations and although the areas of knowledge have increased individual tasks are still treated separately and accorded equal importance
3. Competent: starts to cope with the complexity (scope and uncertainty) of situations in such a way that action involves integrated and longer term goals
4. Proficient: has a holistic view of situations rather than just seeing aspects and can identify what is most important in a situation.
5. Expert: has very little need for rules (although they can be articulated) as there is an intuitive appreciation of situations from which it can almost instantly be determined what it is possible to achieve.

The novice does not have the experience to appreciate contexts and find approaches for handling them effectively. The following examples, drawn from interviews, typify this:

> "The updated lighting plan showed some new proposed fittings, and some of the existing proposed fittings were to be relocated on the designer's request. This had time implications to both the electrical contractor and the decorators. The electricians had already put the new light fittings in place; therefore, to relocate them would require creating a new hole in the wall or ceiling for the new fitting and also filling and decorating the existing holes. The decorators and contracts manager reacted angrily to me announcing these changes. … This became an embarrassment."

The more ambiguous a situation in which novices and advanced beginners find themselves, the less that these codified skills are of any use at all. They therefore need to learn coping skills to handle their lack of knowledge, which moves them on to

being advanced beginners. In the first case, it is a matter of asking, in the second it is a matter of being honest about the value of the information.

> "After asking for advice with several queries regarding the electrical maintenance contract, it was highlighted to me technical knowledge comes with experience, and even those that are qualified may not have extensive knowledge in all areas of construction …. By consulting those that have the necessary knowledge and experience enabled me to overcome knowledge boundaries and progress with the necessary measurements and valuations."

> "Shortly after my boss had gone on leave, the client rang to say he needed the report as soon as possible. As I had never carried out such a report on my own, it was suggested I explain to my client that the report would be delayed and would have to wait until my boss had returned from holiday. However, to do nothing would not have been in the best interests of the client or my company's reputation. I felt it would be letting my boss down, having given me the responsibility to work on the report, and I should use my initiative in his absence. Therefore, as an interim measure I decided to provide the client with a preliminary report based on the information and advice that had been compiled so far. I explained a final draft would be available after my boss's return. Consequently, the preliminary report demonstrated to the client that we made every effort to meet his needs and provided him with sufficient information until my boss's return. An interim measure worked in our favour much more than providing nothing at all."

The latter interviewee went on to say, in a sophisticated appreciation of their developing skills demonstrating a move to a competent practitioner:

> "I realised that technical knowledge is not just black and white, that is it should not be assumed you have it or you don't. Learning is a gradient and that which you learn and absorb as you go along can be used for benefit in future experiences."

Expertise is clearly evident. It can be ably evinced when things go wrong, as this is when deeper skills and approaches to situations come into play. For example, when a problem occurred in a major complex mixed-use redevelopment project, a project manager with five years' experience described his actions in a way that indicated his high level of expertise. The project involved multiple partners including a property developer and a local authority, and raised with many issues relating to transport. Well into the design of the project, but before starting construction on site, it was realised that a bridge had been designed in such a way as to fall on to land not owned by the parties involved. The project was so complicated that the bridge itself actually involved four different ownerships. In a project earlier in his career the project manager revealed that, facing a similar very major problem, he had panicked and frozen. He had believed that solving the problem was all his responsibility which had the result that relationships broke down and a long-drawn-out mess ensued. However, now with expertise and suitable confidence, he facilitated a solution.

> "You've got to drill down and understand exactly what the problem is … what the issues are; understand why … not to blame but how to take it forward; be upfront with the client … not paint it in a negative way but in a positive pro-active way on how we are going to get through this. Then speak to the rest of the team saying WE have got a problem, let's work

on how we are going to sort it out. These are the constraints let's have a meeting soon."

He was proud of a successful meeting which exemplifies expertise-in-context. They came up with a solution which created a set of actions to take things forward and a timescale for these. The meeting ended in relief for everyone and strengthened the working of the team. The project manager facilitated this because he understood the context particularly the characters of the different individuals in the team and what could be achieved. This was undertaken without constant referral to a plan but with a deep intuitive response to what needed to be done in the here and now.

Discussion

The examples of expertise in practice demonstrate the relevance of the Dreyfus model of skill acquisition to construction. This is because it highlights the importance of coping skills in ambiguous and dynamic contexts along with the non-codifiable nature of expertise. We believe that there is a need for a fundamental shift in the academic support of practice in terms of how knowledge and expertise are handled. The application of expertise-in-context to improving practice requires moving from researching what knowledge is to researching what expertise is. Such a transition requires a conceptual and empirical understanding of how knowledge management and expertise management diverge. Appreciating the difference between the two is essential if practice is to be reshaped in a beneficial way. Figure 1 summarises this transition.

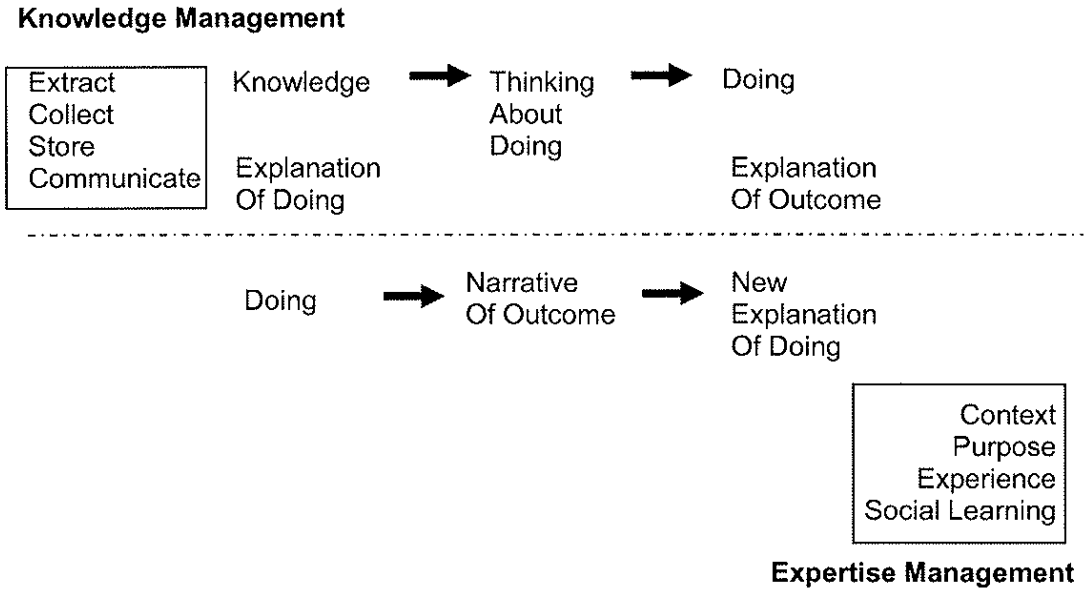

Figure 1. Diagram of the operation of knowledge and expertise management.

In knowledge management, the models of knowledge employed predominantly focus upon propositional knowledge and its relationship to action. It is commonly assumed that the sequence of action involves: knowing, thinking about acting and then acting. However, there is much evidence to suggest that acting may not involve this sequence. A post-event inquiry into an action may appear to show that this sequence was followed and the agent involved may also confirm this when

questioned. However, this does not *prove* that the sequence was followed as there are well-known problems with post-event rationalisation. On the contrary, empirical evidence (as shown in both the surveying case and problematic project) of the speed of the complex observation, appreciation and response of the expert suggest that this assumption about the sequence of action is false.

Knowledge management conceptions of practice tend to generalise and offer a totalising conception in that what is outside their scope is not deemed to be important. They also accord primacy to ideas about logical rationality, especially ones involving causation and control, with the consequence that anything which is not explicable in those terms is regarded as extraneous. Temporal stability is also accorded a central place which aligns with an emphasis on predictability and a diminished role for the management of uncertainty. Knowledge management conceptions of practice can be critiqued on three major grounds. One is that tendency towards generalisation results in de-contextualisation and appropriate appreciation of context is pivotal for the understanding of successful professional practice. Another is that the stress upon logical rationality leads to an approach to analysis in which identification of component parts is the central focus of attention. What this approach to analysis downgrades is how the various component elements are connected, and any parts which cannot be individually identified. Such conceptions of practice are prone to disregard the potential for according a key role to the performance of appropriate action in the explanation and justifications of action. Often some sort of post-event rationalisation of the action is the preferred approach.

In contrast, expertise management could be characterised as being concerned with reflecting upon the idea of thinking in action. Central to the notion of expertise management is the notion that expertise is not explicit and articulatable, but rather is manifested in performing the right action at the right time in a given situation. Expertise involves the ability to handle ambiguity which requires the capacity to handle information in cases of uncertainty and to work effectively in particular contexts and with others. Improvement means one does things differently and this may well encompass making what others do and/or the context different. In expertise management the sequence of action involves: action, narrative of the outcome of action and then a new explanation of action. Investigation involved examining the language of practitioners to see how they think rather than simply determining what they know. A difficulty which the project encountered was that practitioners sometimes struggled to talk clearly about what they do and the interviews sought to obtain descriptions which were at an appropriate level. The analysis of practitioner language indicated that there was much confusion about both practice and the communication of practice. Scrutinising practitioner language helps to gain insight into how and why practitioners problematise situations in particular ways. Practitioners typically express their practice in narrative terms which often contain metaphorical language rather than fact stating discourse. Much of the meaning is context dependent, and a full appreciation of the narrative quite often requires a degree of insight into the situation being discussed. The narratives indicate that part of gaining expertise is acquiring the ability to say the appropriate thing in a particular situation. These narratives may simply describe a situation but they might well serve other purposes. A common instance of these purposes is post-event rationalisation (including justification). Part of considering post-event rationalisations involves reflecting on the function of these formal conceptualisations and the role which they are intended to have in explaining action and shaping future events.

The notion of context has a central role in expertise management. Recognition of context allows the successful intuitive situational response that is the hallmark of expertise. Crucially, improvements in practice require working on contexts rather

than systems. Improvement cannot be produced through de-contextualised models or theories of practice because the context characterises what improvement means and what can be achieved. It follows from this that contexts delineate the scope of meaningful models or theories by identifying the parameters required for them to be acceptable and workable. In terms of what is sought from models or theories of practice the objective is that their descriptive, therapeutic, and diagnostic aspects (as understood in a Wittgensteinian sense) are foregrounded. Many explanations of practice do not adequately describe what happens and may detract from improving practice. The valuing of actual practice facilitates the development of better models of it by thinking differently about knowledge and skills. (For example, in these models greater emphasis might be placed on flexible decision making that reflects individual expertise.) Such valuing of actual practice also aids improvement by articulating identifiable aspects of good practice and thereby supporting their propagation. The project worked with practitioners to develop an expertise-in-context based language and concepts to articulate knowledge, skills, and expertise in a way that values actual practice. The concept of purpose and experience are significant in expertise management due to the significant role which they have in the development of expertise. Expert perception in any skill area is purposeful in that it has an intentional or goal directed content. Expertise involves the ability to draw on previous experience and the appreciation of situated experience (Lave and Wenger,1991) where actions are negotiated from norms of knowledge, social and organisational positions (including status, power, and authority), perceptions of risk (including loss of face as well as technical unknowns), and personal friendships. This is related to the important issue of adequately accounting for group expertise or expertise in a team context. The perspective on expertise management developed suggests that group expertise is a matter of shared perceptions rather than knowledge of certain facts which the group as a whole somehow possesses.

Social learning is an essential element of expertise management. This is because the definition of expertise has a social element that encompasses the nature of the various construction professions, expected performance, and the characterisation of appropriate action. Social learning involves situated experience and this has implications for how expertise could be developed in companies. The novice has to become an independent learner with critical solution composition skills where the handling of incompleteness through an appreciation of context is acknowledged (Boyd, 2006). Mentoring either from within the company or the industry more widely could help novices to appreciate that expertise involves the ability to deploy increasingly flexible responses to situations. As part of this it is useful to investigate how expert practitioners can be assisted by the theorisation of expertise management to become better mentors to novices in a variety of ways (such as in the cultivation of appropriate kinds of discriminating perceptions).

Conclusion

Knowledge management in construction is problematic for both the specific and general problems which have been discussed. The fundamental difficulties stemming from its adoption of the perspective that knowledge is essentially propositional in character have been demonstrated in both practical and philosophical ways by the research carried out by the project. Philosophical studies of expertise-in-context indicate the context dependent nature of the physical and social aspects of practice. Expertise management is a far more realistic and practically useful concept for developing individuals and improving practice in construction. It aptly describes learning and skill development for both new practitioners and experienced ones seeking to extend the range of their abilities.

Expertise management assists practitioners in achieving recognition for their skills even if these capacities cannot easily be communicated and demonstrates why experience is fundamental for acquiring expertise. The importance of experience is well recognised in the construction industry but not in academic studies; so expertise management offers a way of redressing this deficiency**.** Expertise management can aid the development of innovation and change in practice that may be central to organisational sustainability. The embedding of expertise management in construction practice to improve performance may require changes to company structures and processes with the exercise of expertise-in-context being required to achieve this.

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