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Capability for complex systems: beyond competence

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Capability for Complex Systems: Beyond Competence

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Abstract

One approach to ensuring project success in engineering is to focus on standards and their measurement (e.g., EIA/IS 632 published in 1994, EIA/IS 731 Systems Engineering Capability Model in 1998). In fact there is an almost global fascination with measuring competence and Taylorising modes of production and workplaces. The problem with measuring standards and competence is that it concerns past performance and is limited to knowledge and skills. However, complexity theory suggests that we live in a world that is not predictable. Managers, however, like to imagine that they can predict outcomes with some certainty. In this paper we describe a capability model that has a focus on the future, the unknown. We also propose heutagogical (Hase and Kenyon, 2000) approaches to developing capable people and workplaces. This holistic attribute enhances project success and serves as a feasible knowledge to be added to competency-based models.

Competency and Beyond

One of the dominant themes in human resource management practice over the past 15 years or more has been a preoccupation with the development and measurement of performance standards. These standards have had a profound effect on how we consider issues of quality, selection, promotion, performance evaluation, training and project management. In whatever way they are used, standards are quantitative, reductionist approaches that attempt to predict certain outcomes. Measurement might involve a checklist of either satisfactory or unsatisfactory achievement. In other cases levels of achievement of a standard are prescribed, based on identifiable criteria. In terms of measuring human performance and human resource development the term competence is often used, particularly in the United Kingdom, Australia and Singapore, to describe attainment of a skill or application of knowledge against specified criteria.

So pervasive is the competence and standards influence that whole systems of training and human resource development are based upon this linear thinking about performance. The assumption behind competence attainment or the attainment of a standard is that if a person, group or organisation can achieve a level of performance once then it can do it again. That somehow the environment in which this happens is as predictable as the outcome.

There is one other important point to make before examining another way of thinking about standards and competence for project success. What we are really talking about when we think of measuring standards, whether attainment of the standard is individual or organisational, is learning; a transformation whether it is the result of

human or social agency. Thus, this paper examines the idea of standards in terms of learning theory.

This paper suggests that standards and linear performance measures such as competence (much of the literature confuses competence and capability and tends to not define either) are only the beginning. Thus, we need to go further in our understanding of how performance can be construed. In particular, we argue that standards and competence measure only past performance and that we need to be thinking about fitness of purpose, a future orientation. Some recommendations about how to do this are proposed with a particular focus on a new concept called heutagogy (Hase and Kenyon 2000).

Complexity Theory

It is surprising how determinism and rationalism continue to dominate the way in which we think about performance management despite what we know about systems thinking, the sum of parts, and interrelatedness. In 1974 Fred Emery argued that there are two primary and competing paradigms related to learning. On the one hand, there is the view, based on the philosophies of Locke and Hume, that the world is a 'buzzing mass of confusion' for humans, that we cannot make sense of the world around us, and that we cannot make generalizations from specifics. In short we need to have someone codify our learning for us, wrap it up and present it in a digestible form. This philosophy underpins concepts such as standards and competency attainment. On the other hand, Heider's view which is quite the opposite and provides the basis for the idea that people in fact are quite efficient learners and it is we who do the learning on our own terms rather than in response to what we might be told. This is an important point that we will come back to later but, in short, we argue that there is a vast difference between knowledge and skills, and actual learning. We, particularly managers, like to think that learning can be predicted and outcomes but they can't. Only the learner has control over this. While this might appear to be obvious there is little application of the notion in the way we think about learning and, indeed, the world of work.

Supported by the rise and rise of Newtonian physics, what has become known as modernism has held sway for about three centuries in terms of how we look at learning and how we organize human resource development systems. The same competing paradigms, with the modernists again dominant, apply to the way we think about the world of work. The post-modernists have provided a significant challenge to the modernist view since the middle of the twentieth century, particularly in the social sciences. There is a healthy debate going, particularly in the academic and research literature, about which might be the right and which horses are for which courses. One of the weaknesses of this challenge to the modernist paradigm and consequent resistance to change has been the lack of a strong and coherent theory that can support this emerging and alternate view. Complexity theory provides an exciting and fascinating prospect as a candidate for questioning the rationality of modernism. In fact there is now a significant literature examining complexity theory in relation to many disciplines in both the physical and social sciences.

Complexity theory is concerned with complex systems and their behaviour over time (Rosenhead 1998 and Auyang 1998) and how coherent and purposeful wholes emerge

from the interactions of simple and sometimes non-purposive components (Lissack 1999). 'At its most humble, it attempts to explain the "big consequences of little things"' (Phelps and Hase 2002). Complexity is interested in dynamic systems which are seen to change in either in predictable, regular ways or in unstable, unpredictable ways (Rosenhead 1998). While there is nothing new about the idea of unstable and stable behaviour in science it is the notion of chaos, phenomenon that cannot be predicted, in complexity theory that is important. Some of the key postulates of complexity theory are (Phelps and Hase 2002, pp 209-510): the idea of open, non-linear systems; that change is emergent, self-organised, adaptive and dynamic, occurring through a process of bifurcation; cause and effect are not closely related in time and space; similar behaviours may not produce the same results; inherent unpredictability; and the importance of agent interaction.

That the future is essentially unknowable in complex systems and the notion of creative disorder have interesting implications for the way in which we might think about learning and work. Some of these are: the dynamic nature of learning in that people learn when they are ready not when the curriculum dictates; uncertainty about content and the importance of process; the need to access tacit learning; intuition; the difference between the acquisition of knowledge and skills, and actual learning; double loop learning to modify mental models; the importance of relationships and interaction; the ability to recognise and be open to serendipity, coincidence and accident; being open to knowing rather than emphasizing what we know; persuasion, argument and critical thinking; diversity and agility of thought; and the ability to cope with ambiguity and competing ideas.

Complexity theory then provides an ontological basis for challenging some of the more traditional approaches to learning and standards. Before moving on to look at some of these challenges in more detail we need to pose a complex issue without debating it to the depth it deserves. Instead of seeing modernism and post modernism as competing paradigms complexity could also open the door to recognizing that they can, despite the ontological differences, live side by side. There is a need for the rational, the certain and there is a need to recognise the unpredictability. In understanding learning, as we shall see, we need them to coexist. Thus far, however, the emphasis within industry has been on reductionist models.

Capability

The notion of capability, as it is defined here, was conceptualised in the UK in the mid 1980s as a response to the need to improve the capacity of British organisations to compete in a shrinking marketplace. It had been recognised that globalisation and all its sequelae were creating a different kind of workplace where people needed to be more than just competent in order for them and their organisations to survive in a very turbulent environment. The world has become no place for the inflexible, the unprepared, and the ostrich with head in sand, and this applies to organisations as well as individuals. Capable people are more likely to be able to deal effectively with the turbulent and complex environment in which they live by possessing an 'all round' capacity centred on the characteristics of: high self-efficacy, knowing how to learn, creativity, the ability to use competencies in novel as well as familiar situations, possessing appropriate values and working well with others.

Given the propositions of complexity theory developing competency is a minimum standard for dealing with the rational, the linear systems. But we need capable people to deal with the unpredictable nature of complex environments (e.g. Graves 1993; Hase 2002; Stephenson and Weil 1993; Stephenson 1994) and how to develop work environments that enable capable people to express their capability (e.g. Cairns and Hase 1996; Hase and Davis 1999; Hase 1998; Hase, Cairns and Malloch 1998).

The issue of enabling capability is important, and confronts the issues of power and control that is the dominant theory in action in organizations no matter what the espoused theory (Argyris and Schon 1996). Managers and supervisors in organisations need to be capable people themselves in order to facilitate the capability of others. Highly controlled managerial styles usually reflect high levels of anxiety or the need for power on the part of the manager. As a study of a number of Australian organisations has shown (Hase, Cairns and Malloch, 1998), a most important characteristic of a capable organisation is the capacity for managers to empower others, to share information, and develop capability. These are not new concepts of course and are endorsed by many contemporary management writers. Rosenhead (1998) provides an interesting reconceptualisation of management behaviour in the light of complexity theory that provides another line of support for capable people and organizations.

There is a heavy emphasis in our management schools and in organisations on the technical aspects of management and work and this is expressed through an emphasis on the attainment of competence. Similarly, the plethora of short management training programs attests to the simplistic approaches we take to developing our people despite there being little evidence to demonstrate behaviour really changes. We need to see more innovative approaches to fully enabling people to express their capability (and further develop it by doing so) such as that found recently in a major mining and construction company, for example, (Davis and Hase 1999) and in other Australian commercial and government organisations (e.g. Hase, Cairns and Malloch 1998) there are other excellent examples of course but space will not permit mentioning them here. The need for innovative approaches to education and training to develop capable people leads us to consider how we understand learning and it is to this that we now turn.

Heutagogy

Heutagogy, the study of self-determined learning, may be viewed as a natural progression from pedagogy and andragogy. It is learner-centred as opposed to teacher-centred learning. Teacher centred learning has to be organised by others who make the appropriate associations and generalisations on behalf of the learner. Thus, random individual experiences are taken to be inadequate as sources of knowledge, the educational process is seen to need disciplined students, and literacy is seen to precede knowledge acquisition. Success is based on attending to narrow stimuli presented by a teacher, an ability to remember that which is not understood, and repeated rehearsal. Self-determined learning assumes that people have the potential to learn continuously and in real time by interacting with their environment, they learn through their lifespan, can be lead to ideas rather than be force fed the wisdom of others, and thereby they enhance their creativity, and re-learn how to learn. Heutagogy recognizes that people learn when they are ready and that this is most

likely to occur quite randomly, chaotically and in the face of ambiguity and need. The challenge becomes how to maximise its potential.

The idea that, given the right environment, people can learn and be self-directed in the way learning is applied is not new and has been an important humanistic theme that can be followed through the philosopher Heider (Emery 1974), phenomenology (Rogers 1951), systems thinking (Emery and Trist 1965), double loop and organisational learning (Argyris and Schon 1996), andragogy (Knowles 1984), learner managed learning (Graves 1993; Long 1990), action learning (Revans 1980, 1982 & 1998; Kemmis and McTaggart 1998), action research (Dick 1997, 2000 & 2001; Flood 1999; Nita 1999), Capability (Stephenson 1992), work-based learning (Gattegno 1996; Hase 1998) and knowledge management (e.g., Davenport and Prusak, 1998). The thrust that underscores these approaches is a desire to go beyond the simple acquisition of skills and knowledge as a learning experience. They emphasise a more holistic development in the learner of an independent capability (Stephenson 1993), the capacity for questioning ones values and assumptions (Argyris and Schon 1996), and the critical role of the system-environment interface (Emery and Trist 1965).

Heutagogy emphasises human agency in what happens in projects, in workplaces and what will be learned at any particular time.

Implications

So, we turn to the implications of both capability and heutagogy for standards and their attainment. It is importance to recognise at this point that skill and knowledge (competency), whether it is organisational or individual, are essential. This is the baseline. What we are interested in here is how to go beyond this baseline to capability, the preparedness for applying standards and using competence in novel, complex situations rather than the familiar.

We suggest that the emphasis needs to be in the organisational processes that are used rather than outcomes. One approach to this is action learning (Revans 1980, 1982 & 1998) which can be built into the day-to-day activities of the organisation. Davis and Hase (1999), for example, studied the introduction of a new process introduced into a mine site aimed at reducing injuries. The process was called the Work Activity Briefing and involved meetings with all site workers (including engineers and other professional staff such as the mine manager) to talk about how to undertake difficult project tasks. Initially there was a lot of resistance to the process from almost everyone due to a range of reasons including anxiety, suspicion, the novelty of the experience and lack of expertise in speaking in meetings, for example. Initially the meetings had to be facilitated. However, as participants became familiar and more expert at being involved there were some interesting effects. As might be expected relationships between engineers and the site workers improved dramatically and solutions to problems were jointly determined and, therefore, implemented more effectively at the 'coal face'. However, the evaluation also revealed less absenteeism, less injuries, decreased time for completion of projects and less time lost for injuries that could have been expected. More interesting the site teams, without their bosses or any other intervention other than their own agency, implemented their own Work Activity Briefings, which they called Pre-Start Meetings. Each day the workers

arrived early and conducted a brief meeting to talk about what they had to do on that day and what would be the best way to go about it. This would be described as action learning. Most of these outcomes were totally unpredictable, variable and, therefore, impossible to include in a set of standards. These outcomes go beyond competence and involve all the elements of capability, which is only evident when it actually appears (such as the creativity involved in a great work of art such as the Mona Lisa, for example).

Another example of heutagogical approach is via the use of action research. Action research is a methodology that pursues action and research outcomes at the same time. (Dick 1997, 2000 & 2001; Flood 1999; Nita 1999). It is responsive and can be used for problem solving and systematic inquiry. In the work of Tay (2003), action research has been successfully applied to derive an inquiry and learning process for diagnostic modelling of armoured vehicles used by Singapore Armed Forces. It is also the inquiry process used to acquire the content for the Scenario-based Training System used by a Singapore railway service provider to train new trainees. In both applications, there was a lot of resistance to the process from almost everyone due to a range of reasons including lack of IT knowledge, the misinterpretation of terminologies used and lack of expertise in speaking and expressing in meetings. Initially the meetings had to be facilitated. However, as participants became familiar and more expert in the process, everyone enjoys the knowledge acquisition process. The expectation from this approach is that a content engineer should be able to appreciate the fact that knowledge acquisition is both an opportunity and a constructive modelling process that enables him/her to gain a better insight of a domain via the process of articulating, structuring and critically evaluating the model for that domain.

Thus, some of the work-based learning possibilities that are heutagogical in nature are action learning, action research, coaching and mentoring, and their associated techniques. These approaches emphasise processes that provide the opportunity to access learning 'moments', tacit learning, and develop the notion of a learning organisation. A more recent conceptualization of this notion that has been provided a practical base is that of knowledge management and communities of practice.

The difficulty is overcoming the need we seem to have to want to measure things, to predict. We can't predict higher order abilities such as capability any more than we can predict creativity. We can obtain the skills and knowledge to be a painter but a 'work of art' is another issue. The challenge is to implement processes designed to create optimum conditions for making decisions in the face of new, unforeseen problems. This can be described as fitness of purpose rather than fitness for purpose (Stephenson 1994). Documenting the process so we can learn from it might be the best we can hope for.

Another challenge for workplaces is to not be frightened of conflict and ambiguity but see these states as an opportunity for learning. Perhaps even the creation of instability provides the atmosphere for learning to occur. It is when we are confused and anxious that we ask the questions that lead to learning. However, a good deal of management practice is based on control rather than harnessing the creativity inherent in ambiguity. There are many capable people in organisations. The question is how to create an optimum environment for their capability to become manifest.

Conclusion

Complexity theory suggests that there is an ontological basis for thinking about dynamic approaches to thinking about successful projects. Clearly defined and measurable standards should be considered the baseline. Beyond that we need to be thinking about how to develop conditions to develop human (and hence organisational) capability. The emphasis needs to be on the process rather than outcomes and preparedness for the unpredictable. Furthermore we need to think carefully how we create environments that recognise complexity and fully engage with enabling capability.

References

Argyris, C & Schon, D. (1996) *Organisational learning II*, Addison-Wesley, Reading.

Autang, S. Y. (1998) *Foundations of Complex-system Theories in Economics, Evolutionary Biology, and Statistical Physics*, Cambridge University Press, Cambridge.

Cairns, L. G. & Hase, S. (1996, August) *Capability and re-engineering in educational change*. Paper presented at the Second ACEID – UNESCO International Conference, Re-engineering for Change: Educational Innovation for Development, Bangkok.

Davenport, T.H. & Prusak, L. 1998, *Working Knowledge: How Organisations Manage What They Know*, Boston: Harvard Business School Press.

Davis, L. & Hase, S. (1999) Developing capable employees: The work activity briefing, *Journal of Workplace Learning*, 8, 35-42.

Dick, B. (1997), *Choosing action research*, [online]. Available at <http://www.scu.edu.au/schools/gcm/ar/arp/choice.html>.

Dick, B. (2000), *Cycles within cycles*, [online]. Available at <http://www.scu.edu.au/schools/gcm/ar/arp/cycles.html>.

Dick, B. (2001), *Action Research: Action and Research*, Effective Change Management Using Action Learning and Action Research, 21-28, eds. Sankaran, S., Dick, B., Passfield, R. and Swepson, P., Lismore: Southern Cross University Press.

Doolittle, P. E. (2000) *Complex constructivism: a theoretical model of complexity and cognition: draft*. Available at <http://www.tandl.vt.edu/doolittle/research/complex1.html>.

Emery, F. (1974) 'Educational paradigms', Unpublished Paper.

Emery, F. and Trist, E. (1965) The causal texture of organisations, *Human Relations*, 18, 21-32.

Flood, R. L. (1999), *Rethinking The Fifth Discipline: Learning within the unknowable*, London: Routledge.

Hase, S. and Davis, L. (1999) *From competence to capability: the implications for human resource development and management*. Paper presented at the Association of International Management, 17th Annual Conference, San Diego, California.

Graves, N. (ed) (1993) *Learner managed learning: practice, theory and policy*, Leeds: WEF and HEC.

Hase, S. (2002) *Simplicity in complexity: capable people and capable organisations need each other*. Paper presented at the Australian Vocational Education and Training Association conference, Melbourne, April.

Hase, S. (1998) Work-based learning for learning organizations. In J. Stephenson, & M. Yorke, (eds) *Capability and Quality in Higher Education*, London: Kogan Page.

Hase, S., Cairns, L. G. and Malloch, M. (1998) *Capable Organisations: The Implications for Vocational Education and Training*, Adelaide: ANTA.

Kemmis, S. and McTaggart, R. (1988) *The action research planner*, Geelong: Deakin University Press.

Knowles, M. (1970) *The modern practice of adult education: andragogy versus pedagogy*, New York: Associated Press.

Lissack, M. (1999) *Complexity: the science, its vocabulary and its relation to organizations*. Available at: <http://emergence.org/Complexity1.htm>.

Long, D. (1990) *Learner managed learning: the key to life long learning and development*, New York: Kogan Page.

Nita, C. (1999), *Action Research: A Pathway to Action, Knowledge and Learning*, Melbourne: RMIT University Press.

Phelps, R. and Hase, S. (2002) Complexity and action research: exploring the theoretical and methodological connections, *Education Action Research*, 10(3), 507-523.

Revans, R. (1980) *Action Learning: New techniques for management*, Blond & Briggs, London.

Revans, R. (1982) *The Origins and Growth of Action Learning*, Chartwell-Bratt, Bromley.

Revans, R. (1998) *ABC of Action Learning: Empowering managers to act to learn from action*, third edition, Leomos and Crane, London.

Rosenhead, J. (1998) *Complexity theory and management practice*. Available at: <http://www.human-nature.com/science-as-culture/rosenhead.html>.

Rogers, C. R. (1951) *Client centred therapy*, Boston: Houghton Mifflin.

Stephenson, J. (1994) Capability and competence: are they the same and does it matter? *Capability*, 1 (1), 3 – 4.

Stephenson, J. & Weil, S. (1992) *Quality in learning: a capability approach in higher education*, London: Kogan Page.

Tay, B. H., 2003, Using Action Research to develop a Social Technical Diagnostic Expert System for an Industrial Environment, Ph.D. Dissertation, Graduate Research College, Southern Cross University, Australia.