The impact of mental models on the collective management of information and knowledge in contexts of uncertainty.

Graydon Davison
College of Law and Business,
School of Management,
University of Western Sydney,
Locked Bag 1797 Penrith South DC,
NSW 1797, Australia
Phone: +61 02 9586 2400
Fax: +61 02 4620 3799
E-mail: g.davison@uws.edu.au

Deborah Blackman
College of Law and Business,
School of Management,
University of Western Sydney,
Locked Bag 1797 Penrith South DC,
NSW 1797, Australia
Phone: +61 02 4620 3534
Fax: +61 02 4620 3799
E-mail: d.blackman@uws.edu.au

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Abstract

Two case studies from markedly different environments, cartography and healthcare, are presented to elucidate two major issues in the development and implementation of knowledge management systems for multidisciplinary teams in uncertain contexts; a tendency in developers to impose their mental models, making the environment appear less uncertain and more manageable, thus reducing the range of options apparently available to users; and contemporary mental models of knowledge management systems preventing a model suitable for a diverse team in an uncertain environment being developed. It is argued that there are two imperatives to consider. The acceptance of uncertainty linked to a willingness to put aside personal and technical mental models held by analysts and a readiness to understand the generation of collective team-based mental models which will reflect stakeholder perspectives and needs.

Keywords

Knowledge management, Mental models

Introduction

It is thought that the collection, dissemination and utilisation of knowledge will enable individuals to predict eventualities, thereby managing inherent uncertainties within the system (Goh, 2002; Seng et al., 2002). The focus upon knowledge, rather than purely information sharing, is highlighted, as it is considered by many to promote greater flexibility and increased proactivity, enabling superior performance (De Geus, 1997). The currency of this issue in health care is demonstrated by Bailey asking whether the World Health Organisation (WHO) could "transform itself from a producer of information into an organisation that enables others to use and produce their own knowledge" (2003, 777). Bailey also asked the question "WHO is already a leader in global health information but can it lead in knowledge collaboration as well?" (2003, 777). This notion of managing knowledge rather than information in healthcare will be a key element of this paper, recognising that a different mindset is required for the management of knowledge; this will be explored within the context of complex care delivery teams and the stakeholders involved in developing the knowledge management system.

Brown and Duguid (1998) describe the cultivation and management of knowledge as a method of building, changing, displaying and evidencing organisational competence. Duffey (2000) describes knowledge as information that has been contextually processed and enriched via analysis and interpretation and information as data that has been organised and interpreted. This is corroborated by Davenport et al. (1998), who describe knowledge as a contextual combination of experience, interpretation and reflection. Brown and Duguid (1998)

also describe knowledge as a human property and note the difficulties and errors that can follow an attempt to equate information and knowledge, leading to the assumption that information technology can overcome knowledge deficiencies in organisations. Nonaka and Konno (1998) describe socially based knowledge generation and note that participation in a social situation defines what is knowledge and what is information. Knowledge is described as useful only at a specific time and place if it is to be of value. Knowledge that is separated from its situation becomes information, to be communicated between situations.

Mental models are a means by which organisations and individuals create and share meaning, thereby enabling a common understanding and the development of knowledge (Hill and Levenhagen, 1995; Hayes and Allison, 1998). Shared mental models occur where there is a common understanding by individuals within an organisation. They provide frameworks of value and belief systems which act as the basis for analysis of any new ideas, concepts, policies and cultural developments being considered by a team (Smith, 2002). It is argued that shared mental models provide an element of predictability which facilitates communication (Wetzel and Buch, 2000) and acts as a link between collectives and individuals. They can act as a context for the interpretation and understanding of new information (Kim, 1993; Doyle Conner et al., 1994). Such shared understandings support learning and act as a framework for all new knowledge development.

When these ideas are combined, it can be seen that shared mental models will be of great importance, providing the cognitive frameworks that affect the scope, type and acceptance of information that can be assimilated and interpreted by the individuals or teams, acting as the delimiters of new knowledge developed. Reflecting upon the dynamic nature of knowledge indicated above, where knowledge is socially constructed (Berger and Luckmann, 1966), culturally bound (De Long and Fahey, 2000) and useful only within the terms by which it is made, it is clear that the current sets of bounded rationality (Simon, 1991) which are framed by the mental models already in place will heavily influence what knowledge is developed and which new ideas, potentially useful to the organisation, will be rejected and ignored. Evans and Easterby-Smith (2000, 2) state that "*organizational knowledge creation is less a transformation or amplification of individual and group knowledge and more a result of productive inquiry consistent with the act of 'knowing*", whilst Cook and Brown (1999) talk of a 'generative dance' where new ideas are interpreted via several input sources within the organisational context, bringing forth new meaning and new knowledge. These reflect a common view that within the system there is tacit knowledge held within individuals. The more tacit knowledge there is to be transferred, the more complex the situation becomes. In this paper, the cases will be explored considering how the mental models of designers, implementers, individuals and teams within the organisation affect the creation, acceptance and usage of knowledge.

Methodology

A literature review of knowledge management, mental models and palliative care is used to establish a theoretical framework for understanding knowledge management applications in two case studies. The framework is then tested against data from two cases. Case 1 relates to a mapping agency regarded as a world leader in its field, which was planning to manage increasing levels of uncertainty about its customer base and shifting market. The development and implementation of a knowledge management system is described in order to identify the problems of assumptions made by those implementing the system about the views of other stakeholders. In this paper it is not analysed in detail, but more details can be found in Smith et al., (2003). Case 2 describes a palliative care organisation in Australia which is participating in research into managing multidisciplinary patient care teams to enable innovative practices. Case 2 manages uncertainty as a persistent characteristic of its operating environment. Data for Case 1 was collected via interviewing, participant observation and analysis of secondary data such as meeting minutes etc. Data for Case 2 was collected via interviewing and participant observation.

Case 1: The Mapping Agency

Case 1 is a global digital mapping company. Following its privatisation, a Customer Relationship Management system was installed to be the supporting mechanism for a knowledge management initiative throughout the company. In order to manage an increasing range of customers and maintain the advantages of being first to market with the new mapping technology, a much better understanding of, and relationship with, customers was vital. However, midway through the implementation process it became clear that potential benefits were unclear and the first stage goals were not being achieved. Although a great deal of information was being collected the system users were, for the most part, not interrogating the database, and, in worst case scenarios, were ignoring it completely. The information was not up to date and the system was not being used as a basis for generating new knowledge. The question was why this should be, so data was collected from users, managers and customers in order to establish why the system was not being utilised and why it was not being seen to be an advantageous supporting mechanism.

Knowledge Management Assumptions in Case 1

Three major assumptions about knowledge management were identified in Case 1 which underpinned the way the project was conceived, planned, communicated and implemented (Smith et al., 2003). Firstly, that system implementation changes processes and behaviour. From the data it became apparent that it was thought that, by changing the work processes within the organisation in order to facilitate a sharing of knowledge, new

behaviours would emerge as a direct result. Thus, the new knowledge that was accessible to all would encourage learning and new behaviour. That this was a reasonable belief can be seen when considering work by Argyris and Schon (1996, p.3), who note that an '*organisation may be said to learn when it acquires information (knowledge, understanding, know-how, techniques or practices) of any kind by whatever means*'

This suggests that merely enabling the provision of more information is in itself learning. Several writers have indicated that there is confusion between information and knowledge in general terms within organisations (Blackman, 2001) and this too may be leading to a greater focus on the provision of new information, rather than upon the processes that develop new knowledge and behaviours. However, merely having a knowledge management system, and providing access to it, will not produce changes of behaviour or lead to greater understanding. Effective knowledge management only occurs if there is a knowledge sharing culture that promotes learning.

There is another important issue here; the current behaviour of employees should act as an indication of the level of learning. In Case 1, the view taken was that as there were no overt problems then things must be going well. However, it seems that the view should have been that if the behaviour does not change then the learning is static also. This was a very clear level of feedback that needed to be considered more carefully – especially where no change was occurring.

Assumption two argued that systems are mechanistic in nature. There are many ways of looking at organisational realities (Morgan 1986). In this case, in discussions with employees (especially managers) it emerged that they had a mechanistic view of the organisation as a machine, with the employees as cogs working within it. The focus within the company upon business process re-engineering and the way it was described supports this view of the organisation as a machine that can be rebuilt, fixed and have new parts fitted. Such a metaphor meant that it was assumed that changing the mechanics (i.e. organisational systems and processes) would naturally change the outputs in some way. There was no need to analyse the machine as they already understood how it worked, as they had designed it. This is a very clear example of how the mental models already held about the organisation itself, as well as the way that knowledge management would affect the organisation, prevented those implementing the new knowledge management system from realistically assessing the situation they were working with.

The third assumption was that the organisational systems would be rational. There was an assumption of logical cause and effect relationships between the inputs and the outputs of the systems and processes. Within knowledge management development, this would indicate a set of linear systems and processes that could be determined as the right way to manage the organisation in order to gain the desired outputs; the search for the appropriate input will lead to the right output. Furthermore, the more knowledge which is available, the more likely it is that the individuals within the organisation will be able to manage situations and predict potential solutions. Moreover, linking to assumption 1, implementing the appropriate system will ensure that the organisation will adopt logical, linear developments which will lead to appropriate knowledge. It appears, therefore, from this analysis that the role of mental models in implementing knowledge management may have more of an effect than expected, particularly when there is a greater level of uncertainty.

The Impact of Mental Models of Knowledge Management in Case 1

The assumptions outlined above are focussing upon rational knowledge development that infers that knowing the 'right' way to do something enables organisations to predict solutions and events more clearly. However, this does not fit with a more complex pattern of knowledge development behaviour outlined earlier in the paper. Kakihara and Sorenson (2001 p.16), reflecting the points made earlier, paint a picture of complexity in the development of knowledge: *"knowledge, is by nature emergent in terms of its interpretative, process-oriented and relational properties. And knowledge in organisational contexts is generated through complex, dynamic interactions between actors, organisations and social environments"*. Such arguments about knowledge creation infer that there is a current level of knowledge within individuals and that a team or organisation can be developed and interacted with, in order to cultivate something new. Unless the individual engages with the process, what they already know is likely to remain outside the formal system (Jacob and Ebrahimpur, 2001). The original informal knowledge management system is likely to continue making the new infrastructure even more redundant.

What was seen in Case 1 was that because the mental models held by those implementing the system did not reflect the complex nature of the scenario or the stakeholders that they were dealing with, the new system did not improve the transfer of knowledge. Most of what was being collected was in fact information and it did not improve the outputs of the teams. It was clear that the culture of the organisation (as indicated by the

managers' perceptions) also heavily influenced the potential outcome. It can be argued that culture is an organisational mental model (Blackman and Henderson, 2003) and this would explain the work of others who are linking organisational culture to the effectiveness of knowledge development and use (De Long and Fahey, 2000)

From this it was thought to be interesting to consider the case of a complex palliative care team and what knowledge management systems were actually in place – prior to the implementation of a system. The case was analysed in order to consider whether a standard knowledge management implementation would help or, possibly, actively hinder the knowledge within the teams.

Case 2: Palliative Care Organisation

The palliative care environment is one of "active and compassionate care primarily directed toward improving the quality of life for people who are dying, and toward supporting patients and families as they incur multiple losses" (McDonald and Krauser, 1996, 2). Case 2 is a palliative care organisation in Sydney, Australia. It contains approximately fifty beds and operates inpatient, outpatient and home care multidisciplinary teams. Case 2 does not contain a technologically based knowledge management system. However, this is not to say that knowledge management is not a key concern of this organisation. Indeed, the management of knowledge that is contextually based and contemporary is crucial to the effective delivery of palliative care (Davison, 2004).

The palliative care environment is attended by a number of disciplines including nursing, medicine, pharmacology, physiotherapy, occupational therapy, social work, pastoral care, grief counselling and administration. People are the centre, not diseases. Care results from the understanding of the causes of suffering (Barbato, 1999) and multidisciplinary teams work collegeately, so that the primary issue becomes and remains patient comfort.

Uncertainty pervades the palliative care environment. The trajectory disease is uncertain (Rose, 1999). Symptoms, for example pain, are not necessarily linked to obvious causes (Lewis et al., 1997). Reactions of patients and patient based carers to the end of life process are uncertain (Pierce, 1999). The reactions of palliative care professionals to the situations that they encounter during the end of life process of those in their care can vary (McDonald and Krauser, 1996). The required level of extension of the palliative care service to individuals and groups who accompany the patient is uncertain (Lewis et al., 1997). In addition, the range of palliation requirements, driven at the conscious and unconscious levels, varies as does the depth of experience of each patient (Kearney, 1992).

According to Lazarus and Folkman (1984) uncertainty, as it is considered in the social sciences, can be said to fall into two categories, event-based and temporaly-based; uncertainty about what will happen and what the results will be and uncertainty about when it will happen and how long it will take. Both types of uncertainty are capable of generating confusion and helplessness, particularly in cases of physical illness and disability. Uncertainty is also capable of immobilising anticipatory coping and, therefore, the necessary decision making for dealing with the uncertainty being faced. At the end of life, changes occur at multiple levels, sometimes in parallel, without obvious causes, without notice, without clear causal linkages between change and effect.

As the majority source of uncertainty is the patient, this means that the patient becomes the major informant of situational change (Henkelman and Dalinis, 1998). This makes palliative care professionals dependent on each patient's ability to explain what is changing, when and at what level and requires that the professionals be able to enable and understand that explanation. The use of multidisciplinary teams is a response to the levels of uncertainty noted above and to the range of palliation requirements that could be necessary for any given patient (McDonald and Krauser, 1996).

What can be seen from the above is that if knowledge management systems could be implemented effectively they would support the outcomes of the multidisciplinary care delivery teams in palliative care. However, many knowledge management implementations are limited in their success (Jacob and Ebrahimpur, 2001) and it is important to understand why this might occur in palliative care.

Managing Knowledge in Multidisciplinary Palliative Care Teams

The key to understanding the management of knowledge in multidisciplinary palliative care teams is an understanding that uncertainty in patients' situations means uncertainty in efforts to provide care and, consequently, a necessary preparedness to change care management as necessary. Members of a number of disciplines reflected a doctor's comment at interview, with regard to patients, "... *each day things change as their illness goes onwards and therefore they always have changing needs.*" Another doctor, relating the process of first meeting patients at admission, noted the following considerations; *"... are they the sort of person that can cope with what's happening to them? Do they need more support than another person? Are they an outgoing person or a withdrawn person? Are they being honest with you? Do they come across as genuine? You try and build rapport, to try and get information. It needs honesty, it needs trust and therefore that's what we build. Of course you pick up the other things, is it going to be easy to look after them or are they going to need prompting? Will we need to recheck again and again, 'are you sure you've got no pain?'".*

A nurse described some of the first impressions gathered from patients, "*Emotional, whether they're terrified, how they're handling it*", and a social worker described looking for, "*Their adjustment to their illness and how they perceive they are, and the whole process of it. And what, the kind of things they talk about, whether they talk about death and dying or whether they're still talking about treatment. What kind of phase they're in emotionally and psychologically.*" Again, each patient is different and the delivery of care requires different management from patient to patient.

Interviews produce evidence of constant communication. Discussing holistic care as a driver of the need to gather and exchange information, a team member noted, "*..constantly, formally and informally, probably definitely more informally than formally, you can see everyone's having these little conversations all over the place, bouncing ideas. Trying to decide if there are any more ideas. So that you are not doing it on your own.*" A large effort goes into communicating about patients and patient situations, "*We all talk amongst ourselves. I mean we'll sit down and talk about the troubles that a patient might be having at home. Is there something that can be done? Would this benefit the patient? Do you think that if you saw them this would help? So that's how we all talk together about these sorts of things.*" On providing palliative care if they were structured as a set of individual disciplines instead of a multidisciplinary team, one team's first, and strongest, response was, "*But you wouldn't have the communication. People would ask for things and you'd just say no.*" While operating as team members, individual disciplines observe aspects or requirements of care outside of their disciplines. This does not seem to be resented by other disciplines, as all appear to be involved in this practice. The results of these observations are shared within the team. One team member talked about observing "*issues that might relate to another professional so that I could give that person an idea that they were needed. They have particular specialist skills and knowledge. We all have the overview.*"

Generating and disseminating knowledge in multidisciplinary palliative care teams is a matter of utilising frequent, informal communications to supply information from multiple sources that the team can synthesis for a particular contemporary context.

The Impact of Mental Models of Knowledge Management in Case 2

The only certainty in palliative care is that all patients will die. This aside, uncertainty drives care. A key shared mental model in this case study organisation is the need to deal with persistent uncertainty. This overriding mental model drives several others to enable care delivery to operate successfully. These are: respect between the disciplines for the skills contained within them; informal communications which are

frequently more relevant, temporally, than formal communications and that all members of disciplines observe on behalf of other disciplines, reporting the results of observations to relevant parties.

Respect was an issue that was related to the credibility of information exchanged between the disciplines, particularly when team members were discussing the use of informal communications to report observed changes, or impending changes, in patient situations. Respect was referred to as an enabler of inter-team relationships, as in the following examples: "*If something's not communicated then that's usually where our problems begin. But, I mean, one of the good things about this team is positive atmosphere and the relationships. You know, there's little communication breakdowns here and there once in a while, from my experience, and, but it's not a great thing, you get over it and move on. I think 'cause there is that respect, you know, it's not a personal affront to anybody, it's just that you recognise that it's just a communication breakdown*" [physiotherapist]. "*I'm new to the team here and I think that more than anywhere else I've been before that everyone respects each other a lot more, and each other's opinion. Like, quite often in regard to a patient someone will come up and say 'what do you think about this patient?', or you've gone, you know, 'I'm having trouble with this person, what do you think is the best way to approach it?'. And I think there's a lot more respect than there is in say other areas of the health system*" [doctor].

Informal communications are used constantly, as referred to in the quotes from the interview above. Particular references were made to the value of communicating informally. From a clinical nurse educator, with regard to patient admissions: "*Yeah, I mean formally it's in the nursing and medical admission that you ask the patient what their expectation of the admission is. But I think, probably even in an ad hoc manner, the allied health staff would also do that. You know, you gauge from the patient what the care should be.*" The temporality of informal communications was evidenced in the following statement from a social worker, "*There'd not be a day when you didn't talk to other members of the multidisciplinary team about most patients. You'd be saying, what's happening with this patient? You know, this is something that's come up as a highlighter for me, you know, and we discuss possible solutions or ideas around issues. You know, no one person really makes decisions on, you know, their bit of information that they've found and this is the solution for it. We all kind of rely on each other for opinions and, you know, ideas of how to then move forward with the information that we've all gathered individually.*"

With regard to all members of disciplines represented in the team observing on behalf of the team, the following is an interesting example from a nurse; "*Yeah, I mean I think there are no interdisciplinary boundaries, per se, here. I think nobody's going to get annoyed if a physio comes to a doctor and says 'this patient needs more pain relief'. Or if an occupational therapist comes to a social worker and says 'this*

patient's having problems with their family'. You know, it's that interlinking and the blending of the roles that hopefully creates a better care model for the patient.".

These mental models appear to set and maintain an environment for the open exchange of information that is capable of generating collectively held knowledge. This seems to encourage and enable contributory membership of the team. This case study organisation has a working knowledge management system that is based in the care delivery teams. It is flexible and articulate and enables spontaneous knowledge creation and transfer in a multidisciplinary, polycultural environment without conflict with collective mental models.

Mental Models and the Construction of Knowledge Management Systems

There is a great deal written about the complexity of knowledge management development and why systems are not always successful. In this paper we argue that the mental models held by parties affecting the design, implementation and use of a knowledge management team will affect the effectiveness of the outcome. Knowledge management systems within healthcare are generally described as value based propositions that provide systemic, technology based tools for the storing and recall of information (Abbott, 1998; Choo, 2000). Even where tacit and explicit knowledge are recognised as different, the former held in people, the latter codified, the focus is still upon storing the details of who knows what in order to make complex situations more predictable and manageable via simple routines. Davenport et al. (2001) discuss the concept of a need to actually generate knowledge. However, this is still being driven by data collection and analysis of the data in order to determine new solutions to problems. What emerges is that such systems reflect the assumptions of linearity and rationality outlined in Case 1. Such systems would be unsuitable for the palliative care team.

Case 2 will need a system that enables teams to mirror the informal knowledge systems in place: enabling fast, accurate communication and accessible to all members of the palliative care team. It will need to act as an information highway not an information storage bank. Moreover, for it to be of use the system will have to log new ideas and information easily in order to ensure that the current context can always be understood, whilst integrating information flexibly to develop knowledgeable solutions. Such a design is very different from the majority of systems in place. Designers will have to start from the knowledge management already in place, not the technology, in order to specify requirements. Analysis of the current knowledge management system will need to reflect not merely the types of information used but also the way that such information is communicated and the mental models of the users. Developers need a clear picture of what the team needs the knowledge for, which reflects the team's understanding about itself and its goals. A new system not enabling the team to better achieve its goals will not be used (as seen in Case 1); the formal system will wither away whilst the informal system develops and strengthens.

The other set of mental models to be considered belongs to the developers. For example, in Case 1, there was potential for the system to work as the design was not inappropriate. However, those developing and implementing it made assumptions about the way that knowledge worked and the way the users would accept the system. They failed to explain the user benefits clearly and, as a result, the formal system was being ignored. It was only when the users' mental models were analysed by the developers and implementers that they began to understand why the system was being ignored and, therefore, how to integrate the system into the work processes and begin to make it useful. Davenport et al. (2001) act as warning that the same might occur with case 2 as, even if a knowledge management system is designed, developers and implementers have to install it in conjunction with the team and maintain the openness of the system. It is likely that concerns on security will prevent the system being as current or as accessible as it needs to be.

Conclusion

This paper has identified that knowledge management, because it is contextually and socially derived, is affected by the mental models in place within individuals in a self-reflexive way. Multiple sets of mental models need to be recognised if there is to be a successful implementation: those of all the stakeholders involved, in this paper specifically the designers, the implementers and the users. This is because otherwise the assumptions made about the information or knowledge management system will drive the implementation in a way that does not reflect the current users or their needs. The more complex the scenario the more important the analysis of the current context and the current mental models of the users will be in order to ensure the system is (a) useful and (b) actually used.

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