PAINTING WITH AND WITHOUT NUMBERS: THE USE OF QUALITATIVE AND QUANTITATIVE METHODS TO STUDY SOCIAL LEARNING

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INTRODUCTION

The Enterprise Social Learning Architecture (ESLA) team of the Defence Science and Technology Organisation (DSTO), conducted a four-year research study investigating social learning within the Australian Defence Organisation (ADO). The immediate aim of this research was to understand the issues inherent in building learning, adaptive and sustainable systems. The long-term objective was to develop architectures that would support the development of information systems to guide and enhance organisational learning and facilitate knowledge management. In this paper we will discuss the methodologies used by the ESLA team to gain understanding into effective social learning and the organisational and cultural factors that support such learning. Also, the paper will discuss the lessons learned from methodological approaches to this study as well as support tools used to analyse large volumes of qualitative data.

There has been an increasing emphasis in the past decade on investigating the social and organisational factors that may underpin successful information system development and usage (Butterfield and Pendegraft, 1996; Davenport and Prusak, 1992; DeLone and McLean, 1992). Investigation of these issues necessitates a sound understanding of organisational culture, human social interactions, communication and relationships, and reflects an increasing awareness of the importance of the social aspects of socio-technical systems that people work and operate in.

This paper describes the process by which the qualitative methods in this study of knowledge processes were expanded to include quantitative methods. It focuses on how this combination of data collection methods evolved, and the ways in which it was capitalised on to provide a much more enriched set of findings than would have been the case if qualitative or quantitative methods had been used alone. The paper also focuses on pitfalls that arose in the use of the various methods, including those associated with the use of software for qualitative data, and the means by which a successful methodological blend can be achieved with research relating to knowledge and its management.

BACKGROUND TO THE STUDY

Social learning

The study investigated social learning in a range of settings within the Australian Defence Organisation (ADO). Social learning is usually associated with Albert Bandura (1977), and emphasises the vital role of observing and modelling the behaviours, attitudes, and emotional reactions of others in the learning process. Like Lave and Wenger's (1991) situated learning and Vygotsky's (1978) social development theory, social learning considers social interaction to be at the heart of learning. For Lave and Wenger, social interaction is critical to situated learning because the learning process is seen as unintentional rather than deliberate, and as a function of the activity, context, and culture in which it occurs. Similarly, for Vygotsky, social interaction plays a fundamental role in the development of cognition because the observational and imitation aspects of learning particular behaviours precede their incorporation into the individual's personal repertoire. With its emphasis on attention, memory, and motivation, social learning spans both these behavioural and cognitive frameworks of learning.

This study adds to the work of Bandura and others by investigating adult social learning in organisations. Informal, activity-based learning is inherent to all human activities. It is this capacity to learn from one another that leads to the advancement of the human race. Workplaces are full of learning opportunities and in work life, socially based learning is occurring all the time. Interaction occurs between peers, genders, functional groups and ages, and across hierarchies and it happens in ways not normally recognised as learning. It is through learning that we see ourselves in a different context and this transformation of oneself through learning is particularly important (Jordan, 1996). Information systems can and should be developed to facilitate this process, though many systems developed in the past have been shown to be so prescriptive they can inhibit learning and stifle innovation.

For the purpose of the ESLA research, social learning is defined as learning occurring in or by a group, an organisation, or any cultural cluster and includes:

> the procedures by which knowledge and practice are transmitted across posting cycles, across different work situations and across time; and
>
> the procedures that facilitate generative learning – learning that enhances the enterprise's ability to adjust to dynamic and unexpected situations and to react creatively to them.

The use of the 'social' in learning reflects that organisations, organisational units, and work groups are in fact social clusters as are study groups and task groups and thus learning occurs in a social context. It is therefore, necessary to examine how individuals learn in an organisational context and what it means for an individual to learn, to understand how people work most effectively together and what their support requirements are. Individual learning is an important component of social learning. However, this study focused primarily on the social context and cumulative effects of learning, rather than on individual learning alone.

Description of Study Settings

The ESLA team completed three studies into social learning processes. The first of which was a pilot study.

The pilot Study was conducted over a six-month period in 1998 in the tactical environment at an air base. It involved five field trips. The pilot study had two purposes: firstly to see if it was feasible to observe, understand and document social learning processes, particularly in command and control situations, and secondly to trial the use of ethnographic techniques for this purpose.

The second study took place in a strategic environment, at the Australian Defence Headquarters (ADHQ). That study initially involved one branch of the ADHQ and commenced in June 1999. After three months, this study was extended to a fuller research study at the strategic headquarters. That setting was of particular interest as its personnel were distributed across different geographical locations, different services, and different functional branches where work outcomes were heavily reliant on the prevailing economic and political climate, and a number of information systems were already in use. This contrasted with the tactical headquarters where the environment was very structured. The work environment in the strategic headquarters lacked the same degree of structure and had a much higher degree of ambiguity.
The third setting for the study took place in a single service strategic headquarters and the focus was to find out whether social learning constructs differ in a single service strategic headquarters as opposed to a joint service environment.

STUDY METHODOLOGIES

The following section describes the methodological approaches to the research involving qualitative and quantitative methods. The methodological approach was initially qualitative only, but it evolved to include quantitative aspects. The qualitative methods comprised ethnographic observations and semi-structured interviews, whereas the quantitative method consisted of a survey.

Qualitative methods

Ethnographic Observations

The methodology employed in all phases of the study was based on ethnography. Researchers are increasingly employing qualitative methods, specifically ethnography, to gain an understanding of social, organisational and information systems interactions (Myers, 1999). Ethnographers acquire data that provides a rich context because they do so by immersing themselves in the situation – this enables them to gradually see and understand the key concepts that influence the setting. The research team used ethnographic techniques in the form of fieldwork, which entailed observing the work taking place in different settings, and using directed questioning to clarify issues. According to Harvey and Myers (1995), ethnography is ideal for providing information systems researchers with rich insights into the human, social and organisational aspects of information system development and implementation. It is appropriate where a key aspect of the research is to analyse, or at least take into consideration, various aspects of the context and the social process. Given the exploratory nature of the pilot studies, as well as the importance of context in understanding the social process of learning, ethnography was deemed the most suitable methodological tool. The advantages of ethnography for this particular study are depicted in the following diagram (Figure 1):

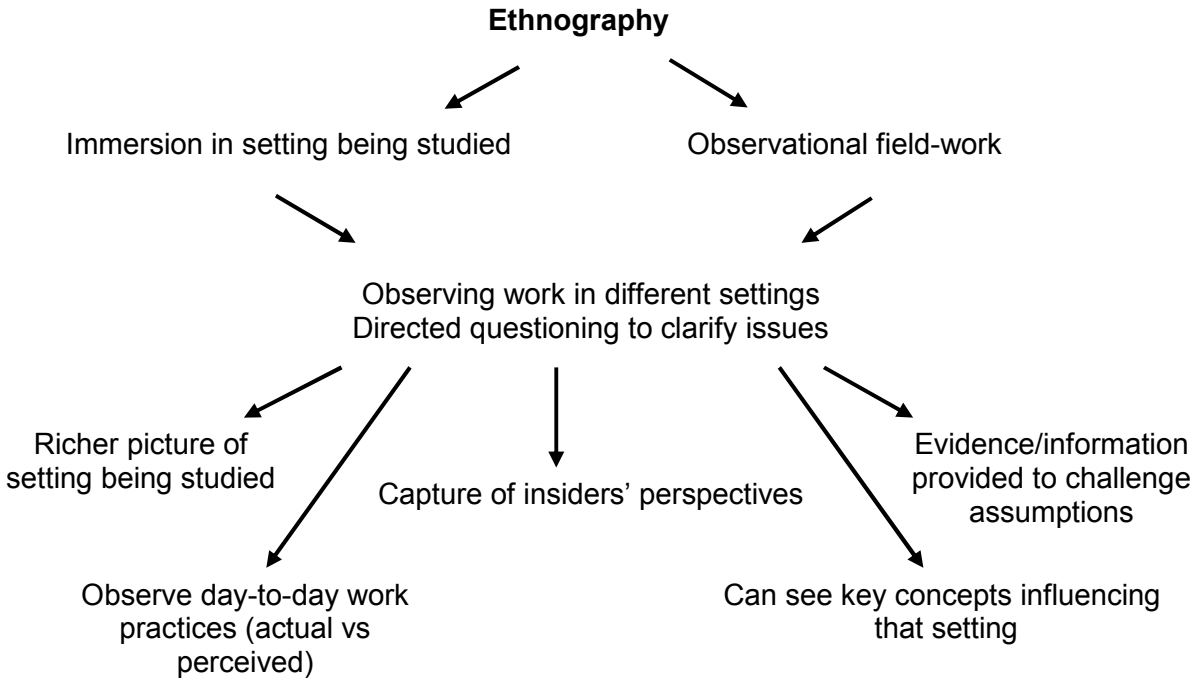

Figure 1 Benefits of Ethnography as a Data Collection Method

Prior to the commencement of the research study, the original team members were thoroughly briefed on the principles and ethics of ethnographic research by Gitte Jordan and Bill Clancy (then from the Institute of Research and Learning associated with Xerox Parc) who helped to popularise the use of ethnography in industrial settings.

Like every research method, ethnography has some limitations. It is time consuming, both in terms of fieldwork, writing up of fieldnotes and in their analysis. It does not offer much breadth as only one organisation or one culture is studied at a time. The ESLA team addressed this issue by conducting research in a variety of settings.

With ethnography there is also a danger of influencing the subject's behaviour, and, furthermore, according to Atteslander cited in Fredrichs, (1975, p26) "We only believe what we see; unfortunately we only see what we want to believe". In order to overcome this constraint, to better understand the setting under study and to gain insights into the social processes of learning, the ESLA team used orientation as an initial step in the strategic settings. During this stage, no data was gathered but researchers sat in on meetings, work areas, gathered documentation, and generally made themselves an occasional part of the work place. Only after it appeared that the researchers' presence was no longer regarded as an unusual distraction, did observations begin. The issues were further addressed by working in teams, whenever possible, of two researchers from different professional backgrounds and specialties. The multidisciplinary composition of the ESLA team shaped the type of ethnography that took place, as well as providing a richer picture of the setting under study.

For most of the study, the team consisted of four researchers: one social scientist, one interpersonal

communication specialist, one information management/information seeking specialist, and one researcher from an information systems/organisational studies background. The multidisciplinary nature of the team meant that the data collection and analysis was enriched by the members' different perspectives, expertise and experiences, thus providing reliability for the findings. Team meetings were held regularly to corroborate and consolidate the findings as the work unfolded, and to identify emerging key social learning issues.
Due to the nature of the tactical environment, ethnography proved to be a very successful research and data gathering tool in that first setting. However, that setting was the only place where the ESLA team felt that ethnographic techniques alone were sufficient and timely enough.

Semi-structured interviews

In addition to ethnographic observations, the ESLA team undertook extensive, semi-structured interviews with a sample of staff in the two strategic settings. A stratified sampling technique was used to ensure that an adequate representation was achieved. The specific characteristics of interest were branch and directorate affiliation, gender, rank, whether military or civilian, work location, and duration of placement. In total, 15 interviews were conducted in the joint strategic setting and 48 at the more populous (about 115 staff) single service strategic environment. The duration of the interviews ranged between an hour and an hour and a half.
The semi-structured interviews proved to be a very useful tool for capturing perceptions about the work-place, and in some instances, was clearly cathartic for interviewees who felt that their opinions were not sought or valued in their immediate environment. While there was a consistent set of topics covered in each interview to guarantee uniformity of data across the whole sample, each interviewee was also given full rein to discuss what they perceived to be related topics, or other burning issues, so that new concerns emerged and the researchers were able to build on their understanding of the setting being studied. The following set of topics was covered by the semi-structured interviews: personal background and career history, familiarity with duty statements and job expectations, job handovers, match between personal knowledge / skills and knowledge / skills required for the position, on-the-job learning, information seeking strategies, communication climate, networking, records management, corporate knowledge, work environment / physical location, gender issues, and other issues that emerged during the interviews.
The interviews were transcribed and coded according to a Thesaurus of terms developed by the ESLA team. These coded interviews and the coded field notes from observations were entered into the qualitative analysis database N'Vivo and were subsequently rigorously examined and cross-checked against the quantitative results.

Quantitative

The strategic settings under study were characterised by a highly politicised and unstructured climate and the areas relied on input both from internal parties and from outside agencies. Furthermore, the outcomes of work were dependent on the vagaries of the economic and political climates. In the first of these settings, the ESLA researchers encountered a new problem. The personnel being observed sometimes interpreted occasional passing comments made by the ethnographer as statements reflecting the research findings. In one instance, one of the ethnographers commented to a Director that ethnographic work in his area had slowed because his subordinates were so busy they were rarely at their desks. The director's response was to send an e-mail to all his staff to say that "DSTO says you attend too many meetings". To counter such misinterpretations, a survey questionnaire was constructed and implemented. It served to move the

participants' attention from 'what DSTO thinks' to 'what staff member's think' (Bailey, 1982; Harvey and Myers, 1995; Myers 1999). However, the survey also served as a validation of the observational data. The first survey administered in the joint strategic setting consisted of three parts - part A comprised forty-seven Likert scale questions, several of which acted as consistency check questions; part B comprised six 'open ended' questions, inviting respondents to give a brief statement on each of them. These questions were prompted by, and further explored, the data collected through ethnographic fieldwork. Finally, part C was designed to gather some demographic details about the respondents.

Similarly, the survey administered to staff of the single service strategic environment consisted of three parts, however, the questionnaire (Part A) was more in depth and comprised ninety two questions; in Part B respondents were asked to rank listed attributes (or add others if considered necessary); and Part C gathered demographic data. This same survey (with minor changes to organisational acronyms) was also applied at the follow up visits to the tactical setting and the joint strategic environment, giving a quantitative means of comparison of all three settings.

The response rate to the first survey in the joint strategic setting was 96.7%; for the single service strategic setting it was 73%; for the tactical setting, a much smaller sample, the response rate was 92% and a repeated survey in the joint strategic setting – applied to ensure findings were consistent over several years - was 73%. The survey became a part of the methodological toolbox used by the ESLA team and also served to facilitate the comparison of results across different settings, and across time in the same setting.

The combination of qualitative and quantitative techniques was facilitated by the use of a qualitative analysis software tool – N'Vivo.

N'Vivo database

N'Vivo is a database designed for analysis, storage and retrieval of qualitative data and includes a facility for reducing qualitative data to a quantitative matrix. The ESLA team used N'Vivo version 2.0 which allows users to edit, annotate, code and link data as well as import rich text format documents and link directly to multimedia, document files and websites external to the database. This facilitates the indexing and co-location of multiple sources of data producing a rich picture of the setting under study.

By using N'Vivo, the researchers had at their disposal a wide range of protocols for linking data and ideas, and combining processes as the data and the method required, allowing findings to emerge logically. The Document Browser facility is a rich text editor, a coder and a coding viewer. As concepts were developed, they were gathered in a flexible system of nodes, and the Node Browser displayed the coded material as required. The coding in N'Vivo was done by dragging and dropping selected text to a previously devised node(s) or node(s), or for those members of the team that were not co-located, by marking up transcripts that were later added into N'Vivo by a research assistant. Coding could also be done automatically by Section Coding or using the Search Tool, however, this facility was not used by the researchers.

To analyse and explore relationships in the data the ESLA team used N'Vivo's integrated Show Tools. These integrated tools support qualitative searching and the program allows users to scope searches as specifically as required by filtering or combining search terms, nodes, attributes or text strings. Searches could be expanded or refined, asking the same question of a different combination of data or a new question of the same material. The results of searches could be coded, so they could be built on to explore other questions if required. The ESLA research team underwent extensive training on the use of N'Vivo, but still feel they have not managed to exploit its full potential. The tool has proved to be an invaluable analysis utility.

LESSONS ABOUT METHODOLOGIES AND METHODOLOGICAL TOOLS

The multidisciplinary nature of the team meant that there were, initially, multiple understandings about the most appropriate methodological approaches to the research. The pros and cons of various methodologies were vigorously debated before a consensus was reached. The lessons learned from this included:

> the desirability of having a personal and collective 'faith' in the approach to the research before beginning the work, and
>
> the need for ensuring that all team members have the knowledge and skill necessary to apply the chosen methodology, and
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> furthermore, if a consensus of confidence in the work cannot be reached despite training, discussion and team building exercises, the team should be disbanded or dissenting members should move on to other areas of research.

The research team was aware that they were engaged in work that was largely alien to the 'hard-science' approaches in DSTO. In order to maintain the credibility of the research, it was important to ensure that the chosen methodology was rigorously applied and robust. To ensure this was the case, the team set out to:

> collaborate with universities where the chosen methodological approach was more commonly applied; and to expose the research to consistent peer review through presentation at conferences and publication in journals.
>
> While this proved to be a very successful tactic for re-enforcing confidence in the rigour of the research, it also resulted in a frequently excessive publishing workload. By raising the profile of the work, it also increased requests for presentations and collaboration which, in itself, also added to the team's workload.

Upon reflection, it became evident that the team undertook what might be considered an over-ambitious approach. Qualitative research is both time and labour intensive, and it is important not to over-burden it with nugatory processes, like over interviewing and over-coding, and in some cases, repetitive or non-constructive discussions about code terms or emerging findings.

In the quest of conducting thorough research and validating all the data, the team probably conducted too many interviews, particularly at the single service strategic setting. Data analysis indicated that, after a certain point, the team was not getting any new insights or richness of data and, as it turned out, the conducting of further interviews proved to be futile. While the sample of interviews conducted at the joint strategic setting was adequate at 22% of total staff, at single service strategic HQ, 44% of the staff were interviewed. The lesson derived from this is that:

> a sample of 20-30% of total staff can be an adequate representation for semi—structured interviews.

If the team had taken more time to reflect on the adequacy of the data already gathered this might not have occurred.

Another aspect of conducting qualitative research is to carefully think through and plan how the data is to be coded and subsequently retrieved. The coding of data, in particular, is a very time consuming process and the team did not pay enough attention to how the coding would impact on retrieval of information, concentrating instead on lengthy, detailed discussions on the nuances of code terms. This was largely due to their unfamiliarity with the qualitative software package N'Vivo, but also their concern that some important finding might be overlooked. The end result of this concern was that there were too many code terms used and multiple code terms were applied to individual paragraphs, thus making the retrieved data very cumbersome. This was exacerbated by the fact that the team attended the N'Vivo training course much too early, long before needing to

apply it. Therefore the software was not utilised to its full potential. Lessons learnt here include:

> know your software packages before using them – schedule training for when it can be backed up by using it, and avoid over-coding –bearing in mind that the purpose of coding is the retrieval of data that is effectively categorised (and not too cumbersome to be meaningful).

Furthermore, the primary lesson reinforced here is the first rule of research which is violated by the inexperienced and experienced alike:

> know exactly how you are going to analyse your data before you collect it.

CONCLUSIONS - THE SUCCESSFUL BLEND

Researchers frequently combine different methods of data collection when studying the same social issue in a process known as triangulation. This concept has been discussed intensively in the area of social and information systems research and is a recognised way of validating research data (Silverman, 1985; Miles & Huberman, 1994). The ESLA research team was able to strengthen the key findings from the qualitative techniques by triangulating with quantitative data from the survey (Kidder, 1981; Bailey, 1982). Surveys can provide an accurate description of a real world situation from a variety of perspectives (Galliers, 1992) and the survey used by the ESLA team extended its understanding of the factors under investigation through the collective perceptions of the personnel involved. This blend of both qualitative and quantitative methods of data collection was used in all settings studied after the first pilot study.

The combination of qualitative and quantitative research methods provides data and findings that are much richer than those derived from one of these methods alone. Qualitative methods are commonly used as a first step in quantitative studies (Tucker et al, 1995), and the ESLA team used observational data to formulate quantitative surveys as well as to focus researchers' attention on pertinent issues that were further discussed in semi-structured interviews.

Furthermore, the combination of methods enabled complementary perspectives of each of the settings. The observations and interviews provided not only data that offered the insiders' point of view but also shed a light on the unique aspects of the various social settings that were studied (Pondy et al, 1983). On the other hand, the quantitative surveys enabled generalisations across the settings. It is this combination that has given the ESLA research strength and validity.

Not only was the research study triangulated by method (observations, interviews, and quantitative surveys), but additionally by data source (data had been collected at different times throughout the study and from varying settings). Triangulation was further facilitated by the multi-disciplinary composition of the research team.

The ESLA team took the opportunity to discuss the methodological approach to this study at numerous seminars and special interest group's meetings. Feedback from these was that the methodology was rigorous and the findings well triangulated and valid. The effectiveness of the methodology used by the ESLA team and the strength of its findings add weight to the view that the dichotomy of a qualitative-quantitative separation is now archaic (Miles & Huberman, 1994).

It is hoped that the lessons learned from this study will be of benefit to those who are planning to undertake research using qualitative methods or a combination of qualitative and quantitative approaches.

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Note: this paper is not an original work. It is based on a research report that the ESLA team prepared at the conclusion of the Social Learning study: Warne, L. Ali, I. Pascoe, C. (2003) *"Social Learning and Knowledge Management - A Journey through the Australian Defence Organisation: the final report of the Enterprise Social Learning Architectures Task"*, DSTO RR 0257 AR 012 854, Defence Systems Analysis Division, DSTO Information Sciences Laboratories, South Australia.