Mechanisms to support organizational learning: the integration of action learning tools into multidisciplinary design team practice.

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Abstract

This paper reports on ongoing qualitative research into mechanisms to support organizational learning, focusing on the development of a new 'design and learning methodology' (DLM) for use by multidisciplinary design teams engaged in complex systems design projects. The methodology shifts the traditional design focus from creating *products* to facilitating team learning within daily design *processes*. The DLM is a pragmatic framework for thinking and action that integrates human-centred design methodology and action learning. It is applied, evaluated and iterated with a number of MDTs in large European financial service organizations. I use participatory action research (PAR) to achieve the goal of facilitating and analyzing team learning outcomes, simultaneously. As a participant-researcher, I evaluate the use of the DLM over a period of about 14 months. These longitudinal studies gather data on experiences and perceptions of MDTs with regard to:

- their capacity to learn as a team as a result of using the DLM
- their capacity to contribute to organizational learning as a result of using the DLM.

In this paper, I introduce the scientific (theoretical) and practical (organizational) motivation for developing the DLM, and share some preliminary lessons from its implementation. I draw tentative conclusions about the potential value of the DLM as a support mechanism for organizational learning. At the conference, I report on further results, including an analysis of:

- changes in awareness of MDTs with regard to collective design-related knowledge
- needs expressed by MDTs for improving collective design-related knowledge
- evaluations concerning what, how and why MDTs learned from each other while using the DLM
- how MDTs reapplied these team learning outcomes in other activities in the organization.

Keywords:

Action learning, human-centred design methodology, multidisciplinary design teams, organizational learning, participatory action research, team learning

Introduction

How can we facilitate multidisciplinary design teams (MDTs) to learn more effectively as a team during complex systems design projects, with a view to supporting organizational learning? We know that MDTs possess important design-related knowledge that can be very relevant for other business activities in an organization, and so have the potential to contribute to organizational learning. Dixon (1999)[1] emphasizes that organizational learning does not occur by simply encouraging people to exchange information; an organization must actively facilitate 'collective' learning in teams. To achieve this in MDTs, it would be necessary to ensure an appropriate method or approach to facilitating team learning *within the context of daily design processes*. In the design domain, however, very little attention is being paid to the importance of team learning in design. Team learning is dependent on effective collaboration in design teams, but as McMaster et al. (1997)[2] puts it, the critical role of collaboration has "once again been either ignored or forgotten, although … widely promoted over at least two decades, most particularly by Scandinavian researchers". Although design research, HCI and IS studies have sought to describe *how* design teams make design decisions

since the 1980's (Dorst, 1997)[3], they focus largely on *observing* teams, developing conceptual group dynamics *models*, or *explaining* cognitive psychological aspects of design. Few design studies actually go beyond descriptive or explanatory approaches to develop methods to actually facilitate team learning within daily design practice. Furthermore, very little is known in design science about how to support or facilitate team learning specifically in multidisciplinary design teams (Ashton, 2001)[4]. Currently there is no formal design methodology that aims specifically to at MDTs working in the context of complex systems design in large organizations, with a view to supporting team learning. Most design methodologies focus on methods to generate design products, as opposed to improving design *processes* as such. Therefore, I have developed a pragmatic 'design and learning' methodology (DLM), which builds on existing traditions of participatory design and soft systems methodology, but which also draws on recent management, organizational development, and complexity theories about team and organizational learning in order to inform design methodological development. As Richardson and Cilliers (2001)[5] emphasize, "We should not be allowed the comfort of merely sitting within the well-known domains of our own disciplines, we should be forced to transform them". I aim to push the envelope on methodological thinking in the design research community, and link the new DLM clearly to the organizational learning research.

Guide to readers

In this paper, I motivate the development of a new 'design and learning' methodology (DLM). I position the DLM as an explicit strategy for organizational learning and describe its main components. I outline the research model currently being used for implementing and studying the DLM in a number of financial service companies. I share preliminary experiences with the DLM and draw preliminary conclusions concerning its usefulness as a mechanism to support organizational learning. Finally, I indicate how my theoretical and applied research will continue with regard to the DLM.

Motivation for developing a new 'design and learning' methodology

In this section, I describe the scientific (theoretical) and practical (organizational) motivation for the development of a new 'design and learning' methodology (DLM).

1. Analyzing the nature of complex systems design in MDTs

Design is concerned with developing "visions of technology in use" (Grønbæk et al. 1997)[6] -- that is, technology as used by people in a certain setting -- as well establishing requirements for technology. Designers seek to change an environment, using reflexive thinking and action to create a "preferred outcome" (Van Langen, 2001)[7]. In many organizations, design projects are set up as a team effort, as teams are assumed to be able to adapt to rapidly changing environments and the need for intensive knowledge sharing in an organization (Jansen et. al., 2000)[8]. In many financial service organizations, heavy investments are being made into large-scale systems for knowledge management and financial analysis. As Vance (2001)[9] notes, these companies are reluctant to outsource complex systems design due to the great variety of data to be managed and the proprietary nature of systems and information. As complex systems design requires many types of knowledge -- about social and psychological aspects of work, strategic change management related to implementation of system, technological limitations, and project management (Palmer and Richards, 1999)[10], these companies seek a competitive knowledge advantage by setting up multidisciplinary design teams in-house.

A multidisciplinary design team (MDT) is a group of people representing various disciplines and roles in a design project. MDTs operate in "nested networks" (Ashton, 2001) in an organization, coming from different departments or specialized groups such as interface design, marketing, management, finances, engineering, and human resources. In large organizations, it is logical to assume that MDTs are an effective way to share knowledge in complex systems design projects. However, MDTs depend on effective collaboration and

shared understanding in order to make productive design decisions (Hill et al., 2001)[11]. Shared understanding depends in turn on the ability of teams to learn (Homan 2001)[12]. Team learning is a concept this defined in various ways. Argyris and Schön (1978)[13] describe 'single-loop' learning processes that involve sharing knowledge about work practice, for example about technology or design management. When an team shifts focus from the content (what) to the issue of how they acquire and share knowledge, then people start to learn from one another in a more strategic or 'double-loop' process. Checkland and Scholes (1990)[14] also distinguish between two modes of team learning. In Mode I, teams must practice skills in a structured and conscious manner in order to learn how to learn. This includes techniques to become more creative as a group, to let go of certain shared mental models and to develop new ones. In Mode II, these skills have become an intrinsic part of an individual's competence. Flood and Romm (1996)[15] describe 'triple-loop' learning, when a team questions not only what the team is learning and how they are learning but also why they are learning from each other. Triple-loop learning involves three types of management of the learning process: design management (How?), debate management (What?) and might-right management (Why?). Design management focuses on how to achieve systems design goals, dealing with technology, finances, etc. Debate management focuses on achieving shared understanding through debate, for example about what designs are most appropriate, which design decisions should to be made, and what role a team's (implicit) assumptions play in this. Might-right management deals with knowledge-power configurations, asking why a particular (dominant) way of thinking has come to the fore, and how to pursue more effective alternative knowledge constructions. Torlak (2001)[16] notes that teams need to become "aware of and use all three centres of learning, continually looping among these three questions and functions intelligently and responsibly". Argyris (1992)[17] calls this continuous process 'multi-loop' learning.

But how can a multidisciplinary design team actually *achieve* this kind of triple or multi-loop learning in practice? Theories of team learning assume that a MDT can continuously be aware of what, how and why they learning, as a team, during design practice. In my experience, there are fundamental challenges for MDTs to achieve this in the context of complex systems design work in large organizations, as a number of internal and external factors may block team learning in MDTs. I describe a few of these factors in the next section.

2. Identifying factors that influence team learning in MDTs

Some factors affecting team learning in MDTs are external, deriving from organizational situations and influences outside of the team. One external factor is the organizational positioning of a complex systems design project, which affects where the project starts off and how an MDT is set up. For example, knowledge management systems projects tend to be IT-led, and often the 'multidisciplinary' design team is dominated by one main discipline (engineering). As Laudon and Laudon (1995)[18], Beyer and Holtzblatt (1998)[19] and Norman (1998)[20] report, IT-led projects tend not to involve stakeholders such as future users, marketing, content specialists, or human resource development in the core design team. There are also very few explicit collaboration strategies in IT-led systems design projects that address how to meet all these stakeholders' expectations (McMaster, 1997). Furthermore, MDTs often work on parallel projects, under extreme pressure to produce results quickly on all of them. MDTs are under pressure to focus on external factors such as 'meet roll-out deadlines' or 'survive the next budget cut'. Collaboration can fall apart when participation in parallel projects becomes increasingly complicated. This is compounded by frequent changes of membership in MDTs as people switch jobs or companies. Due to these external factors, there is very little room for people to reflect upon design processes, let alone on team learning.

Other factors that block team learning are internal, relating to skills and interaction processes inside a team. For example, MDTs may have difficulty learning from each other because of team members may not possess all the types of knowledge needed for complex

systems design. Lei (1994)[21] finds that projects fail because designers are incapable of "faithfully" reflecting multiple perspectives and complexities in design decisions. Also, in my experience, many team members approach collaboration in a very ad hoc manner, depending on quick solutions and agreements made between a few individuals rather than solving a problem collectively in collaboration with the whole team. More fundamentally, however, I find there is a lack of recognition for or 'ownership' of the very issue of team learning in MDTs. Although sharing 'explicit' knowledge via e-mail and a project database on an intranet is considered quite normal, the more difficult, 'implicit' process of team learning, which involves integrating experience-based knowledge from the whole team, receives less than adequate attention in daily design practice. Making team-based design decisions is difficult ti achieve, as researched by Toerpel (2001)[22], but an implicit lack of commitment to making team-based decisions is, in my view, due to problems with social interaction in MDTs. Social interaction is a "significant determinant of the success of collaborative design" (Bucciarelli, 1994)[23], but easily gets stuck if people do not communicate clearly, consistently and with the whole MDT about their objectives. Also, many MDTs lack experience working as a team through *all* phases of a complex systems design project, and so the process of social interaction sometimes is minimal, and sharing knowledge within and between MDTs becomes too difficult to start and sustain in practice.

Considering these internal and external factors, how can we support MDTs to actually achieve multi-loop learning within the context of complex systems design in large organizations? In my view, MDTs need to be provided with tools that facilitate team learning within their daily design practice, and as part of their core design methodology. As stated earlier, however, current design methodologies offer guidelines for undertaking systems development with a view to generating a design product (Van Langen, 2000), and do not focus on facilitating team learning within a design process. I discuss this limitation in more detail in the following section of this paper.

3. Limitations of design methodology to facilitate team learning.

Many studies have pointed to design methodology as a significant influence on design thinking and practice. A methodology is a normative framework for thinking that "determines the meta-characteristics of modes of inquiry" (Torlak, 2001). In using a particular design methodology, designers consciously develop and capture design elements using a common framework of thinking and acting, as opposed to depending on ad hoc methods that may be useful but limited to individual expertise or practice. A method is a mode of problem-solving that can be used within a larger design methodology as a set of procedures that lead to an assumed outcome. Methods are often tricks of the trade that a particular designer uses to get tasks done quickly. Methods involve no extensive "reflective intervention" (Mingers and Gill, 1997)[24] in design practice.

So what are the limitations of current design methodology in facilitating multi-loop learning in MDTs? Firstly, as Laudon and Laudon (1995) find, the majority of large organizations use ad hoc design methods or linear, technology-driven design methodologies. Technocentric methodologies narrow design thinking down to technology problems, and narrow design practice down to using a fixed sequence of rational problem solving steps, tackling one task at a time from systems definition to implementation to technical testing. A major critique is that this does not encourage thinking outside of technological domain to consider complex, interrelated social, political and ergonomic issues that significantly influence the success of a design product (Rosenbrock, 1989)[25]. Button (2001)[26] finds that many design methodologies "… seem to be intent on ripping use out of its context. Thus, modelling work … is intentionally … context free, to … escape the tyranny of the particular. (…)context appears to be troublesome for designers … they often seem perplexed that people use their designs in ways that they, the designers, had not anticipated within particular circumstances. (…) context is a mysterious world inhabited by wayward users."

In order to deal with this limitation, as least in part, methodologies such as participatory or cooperative design, concurrent engineering, user-centred design (Bekker and

Long, 2000)[27] and soft systems methodology (Checkland and Scholes 1990) have been developed since the 1970s. Soft systems methodology (SSM) encourages people to increase complex thinking by considering many types of situations, dilemma's, boundaries and developments related to the context of an organization. Like participatory design, SSM uses a non-linear rather than linear mode of analysis and design, and involves users and other stakeholders in the design process. But how do these 'alternative' design methodologies fare in practice? Unfortunately, Gulliksen et al. (1999)[28] has found that participatory and collaborative design is not used very consistently, if at all, in large organizations. Wilson et al. (1996)[29] indicates that many design specialist view user-involvement as an efficiency-related cost rather than a benefit. Other studies show that even when MDTs are ostensibly engaged in collaborative design, they end up using solutions generated by a dominant 'Project Champion' from one discipline who is has a large stake in a design project (Ball and Ormerod, 2000)[30]. Olson et al. (1996)[31] and Turner and Cross (2000)[32] also find that in many MDTs, design decisions tend not to reflect input from the whole team. Most of the time is spent *explaining* decisions "at the expense of evaluating them through the application of criteria" that should be generated as a team, and more than 33% of contributions or alternative solutions contributed by different members are not evaluated at all (Ball et al., 2001)[33]. Wilson et al. (1996) report that IT experts view multidisciplinary design as leading to too many opposing views due to non-specialists' lack of knowledge about technology, too much feedback to be managed, and too much time spent seeking compromises that between stakeholders. SSM goes a step further than participatory and collaborative design, focusing on complex thinking and offering the 'CATWOE' method as a way to reveal and contrast multiple perspectives on a design problem. The point of CATWOE is to deal with context and synchronize perspectives in a design team, rather than forcing consensus. However, SSM tends to idealize collaboration in design teams, as it adopts principles for negotiation and collaboration (for an example Jackson, 1991)[34] that are based on *equality*. It is not that these principles are not correct or that they are not extremely laudable. In large-scale, presitigious and therefore politically laden complex systems design proejct, however, it is extremely challenging to avoid knowledge power configurations and to ensure 'equal' participation of all stakeholders in a project (Galliers, 2001)[35]. Torlak (2001) concludes that SSM cannot cope with "anomalies" such as coercion, contradiction, and power struggles that emerge in these situations, as they do not offer methods for debate management and might-right management in design processes.

Considering the limitations of current design methodology to address team learning, I undertake to develop a new methodology that places team learning at the centre of a design process, rather considering it irrelevant to design methodology. Such a methodology should integrate learning tools into design, and consider team learning as a main 'product' of design processes. In an integrated 'design and learning' methodology, MDTs should be given a chance to stop what I call the 'production efficiency train' from running away with them, at the cost of ensuring team learning. MDT members should be encouraged – and at the end of the day held responsible for – the team learning outcomes that emerge in complex systems design projects. This is important because, in my view, design methodological thinking needs to be expanded to include – and concretely address – the goals of learning organizations. As Croasdell (2001)[36] puts it, a learning organization should consciously evaluate and redesign its culture and systems are to allow for diversity in interaction and learning, with the aim of achieving qualitative improvements in organizational performance. This does not mean avoiding conflict or power-struggles. Rather, as King (2001)[37] notes, organizational learning is a question of empowering all people in the organization to become aware of and to manage their own learning process. The success of such a strategy depends the ability of a team to re-examine experiences and assumptions in order to change them (Argyris, 1977)[38]. Therefore, the new design and learning methodology must be based on design and learning tools or components that are suited to an organizational learning strategy. These components will be described in the following section.

Components of the new 'design and learning' methodology (DLM)

Considering the requirements of an organizational learning strategy, the DLM has two aims:

1. To improve the capacity of MDTs to become aware of what, how and why they learn from each other, within the daily design practice of a complex systems development project (facilitation of multi-loop learning)
2. To support organizational learning as related to complex design projects, by encouraging the MDT members to share, evaluate and reapply team learning elsewhere in the organization.

I therefore base the DLM on two selected components: human-centred design and action learning. I will briefly describe what each of these components are, and why I have selected them for the DLM (see Figure 1).

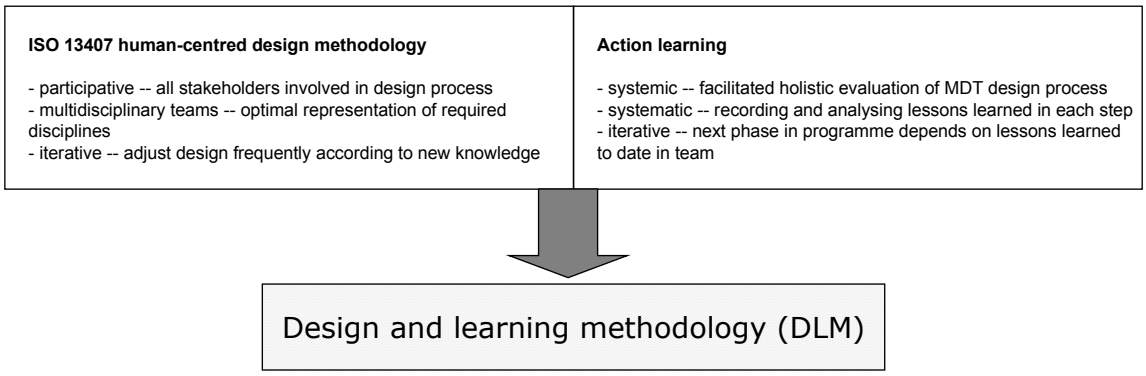

Figure 1. Components of the DLM

The design component of the DLM, human-centred design methodology, is an approach to design that intends to increase human purpose, skills, creativity and knowledge in organizations, rather than producing technology that ends up taking over people's tasks and trivializing human knowledge (Gill, 1996)[39]. Human-centred design is "a multidisciplinary activity, which incorporates human factors and ergonomics knowledge and techniques with the objective of enhancing effectiveness and productivity, improving human working conditions, and counteracting the possible adverse effects of use on human health, safety and performance" (Bevan and Earthy, 2001)[40]. A basic framework for the "human-centred design of interactive systems" was published by the Geneva International Standards Organisation in 1999 (ISO 13407)[41], as part of a larger set of standards for achieving 'quality' systems (ISO 9002 and 9003). ISO 13407 lists four main activities:

1. participation of actual system users in the design process
2. formation of multidisciplinary design teams
3. appropriate allocation of functions between people and technology
4. multiple iterations of design solutions

Practically speaking, this ISO norm is suitable for the DLM, as it specifically targets multidisciplinary design teams. Politically speaking, the ISO label, however basic it may be, makes it easier to get support for the DLM to be adopted by MDTs in large organizations, as it is based on a recognized interntional standard rather than on 'alternative' approaches to systems development.

The learning component of the DLM, action learning, is a method that involves teams to learn to solve real problems, while at the same time asking them to evaluate what they are learning and how their learning can benefit others in an organization (Marquardt and Revans, 1999)[42]. Action learning is not simply encourage people to learn and reflect on the job in an ad hoc manner; rather, it is a long-term program that provides tools for team negotiation, evaluation of learning, and structuring and planning the re-application of learning in an organization (Revans, 1998)[43]. Action learning questions assumptions rather than seeking

quick solutions based on existing knowledge (McAdam & Leonard, 1998)[44]. It develops *awareness* of learning processes, *assessing* process with a view to "continuous improvement" (Coughlan et al. 2001)[45]. Action learning requires actually take action to change processes in an organization, however it does not assume that teams will learn easily, equally, 'overnight' or without failure. Action learning is suitable for the DLM, as it supports team learning and organizational learning simultaneously.

Applying the DLM in practice

In this section, I explain what processes are involved in the DLM (see Figure 2).

Participation

The DLM requires significant participation of stakeholders in complex systems design projects, including people from both within and outside of the MDT, in order enrich design-related knowledge and organisational experience emerging from team-based design decisions. In order to achieve this, as many members of the MDT as possible should be present in all design sessions. At least four MDT members should work together at any time.

Evaluation

The DLM assumes that the task of MDTs is not just to build systems as quickly as possible or to provide a single technical solution. Rather, the DLM implies an iterative process that requires seeking multiple solutions to many types of problems impacting both design and learning. This requires MDTs to evaluate multiple strategic, market, social, cultural, and technological perspectives that affect design decisions. Team-based evaluation is a skill that must be learned, and the action learning component of the DLM aims to assist MDTs to learn to think in a more inclusive and strategic way. Evaluation increases the ability of MDTs to make design decisions (single loop), to reflect on what they have learned from evaluation (double loop), and to question why they evaluated and learned from their process in the way that they did (triple loop), as they proceed.

Negotiation

The DLM assumes that sufficient time and energy will be invested to help MDTs to constructively and openly negotiate and debate during design. Debate is a powerful way to discover the thinking behind team decisions or ways of working. Negotiation entails a deliberate confrontation of beliefs, intentions and assumptions held by the MDT and in comparison with other stakeholders. In the DLM, debates are not just restricted to discussing design issues such as user requirements or systems specification, but are focused on negotiating about how team members collaborate, communicate, contribute to team learning and how they could improve learning processes on an ongoing basis.

Creativity

MDTs need to share different types design knowledge in a structured way in order to make effective design decisions. In order to integrate knowledge, MDT members need to (dare to) become more creative. There are many creative thinking tools to support this process, such as creating scenarios, mood boards, using 180 degree thinking, and so on. A scenario is a description of activities in narrative form, describing "the future as a general picture in alternative views by quantitative and qualitative factors" (Baets, 1999)[46]. A mood board is a rapid visual sketch or collage that expresses the main feelings and images that people have in their minds when thinking about design. 180 degree thinking is an activity where a team takes an idea or suggestion and plays with it, flipping it around to come up with an opposite idea or suggestion, in order to discover other solutions.

Iteration

Importantly, the DLM is not intended as an abstract theoretical construct or modelling language. As illustrated above, the DLM consists of ongoing iterations, in practice, of both design and learning activities (as indicated by the cyclical arrows in Figure 1 below).

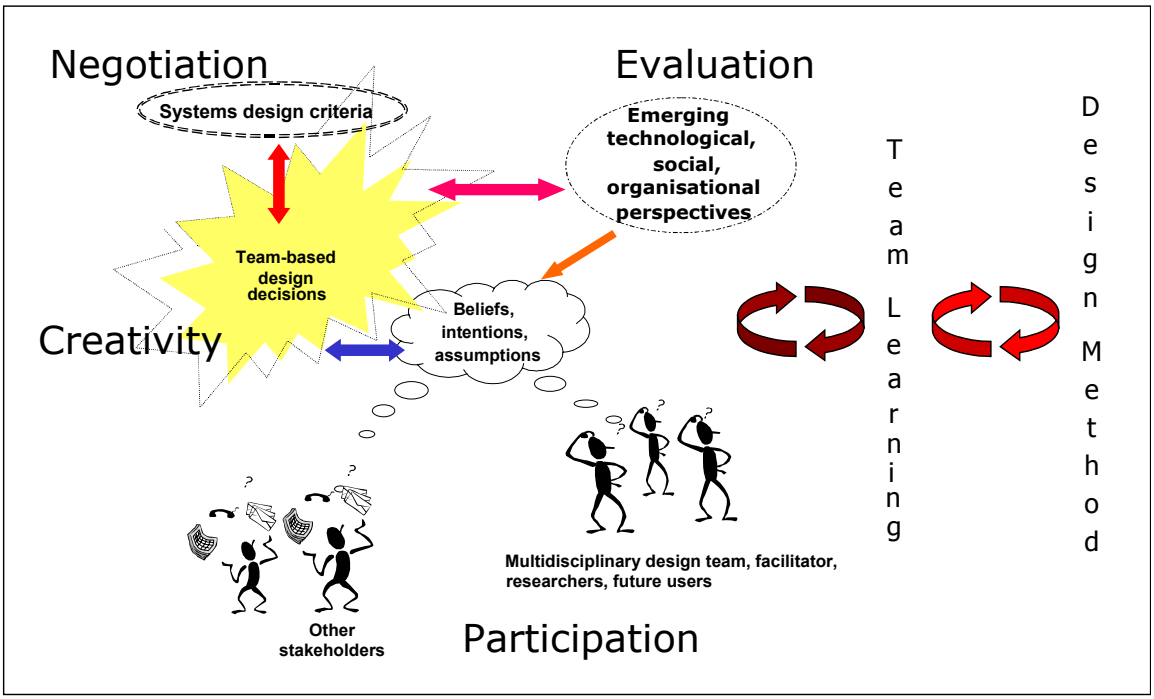

Figure 2: processes involved in the 'design and learning methodology'

Now let us conssider how these processes might occur within the context of a complex systems design project. In one team session, a MDT may spend two hours on design issues, and an hour on learning evaluation. However, both activities must take place in the session. Action learning and human-centred design processes involve a double-layered analysis of design and learning issues. When a MDT focuses on design processes, a facilitator may ask team members to consider how and why they are using a particular way of thinking and acting to generate an assumed design outcome. Various techniques are used to assist the MDT to become aware of design issues such as:

- The implications of certain scenario's about the way people will use the system in a future setting
- The consequences of changing the target environment as a result of design decisions
- The need to establish acceptable requirements, standards and guidelines for systems implementation and use

When a MDT focuses on team learning processes, team members are asked why they hold specific points of view, what assumptions they made, and how they wish to deal with a conflict that may have emerged. They are asked to actively change their way of communicating in order to integrate more knowledge from the group and improve collaboration. Action learning tools help MDTs to:

- gather insight into social processes and the relationships that inform team competence,
- analyse their motivation as a team
- make explicit what factors are involved their ability to express and innovate knowledge as a team.

Studying the impact of DLM on team learning

The challenge in this research is to evaluate the use the DLM in practice, where data is based on experiences, perceptions and behaviour of participants, and must be collected within the daily design practice of MDTs. It is not possible to be an 'objective observer' in such a

sensitive and intensive team process, so traditional ethnographic methods are not suitable for research in this setting. Also, as the point of the research is not just to describe but also to facilitate change, the research method must, at the very least, mirror the dynamics and goals of the DLM. To achieve this, I look to action science, specifically participatory action research (PAR) as developed by Whyte (1991), as a method to create open, rigorous and meaningful debate in a research context. PAR does not seek singular answers or a closed system of meaning, but an open system of evaluation. PAR ostensibly encourages people to view their analysis of process and practice as a contribution to organisational learning. Like any form of action science, PAR expects a participant-researcher to intervene in processes, to facilitate teams of organisational actors, and to generate continuous and evolving evaluations of learning outcomes. In a PAR approach, MDT members generate data for the research, and contribute to interpreting new knowledge that emerges from this data. All data generated by participants, participant-reseracher, facilitator or moderator concerning the impact of the DLM on team learning are assessed together with MDT members and managers. PAR evolved out of three streams of thinking in scientific and business communities: social research methodology, participation by low ranking people in decision making, and socio-technical systems thinking on organizational behavior.

In the next section, I outline the implementation model I am currently using to carry out PAR in a number of large financial service companies.

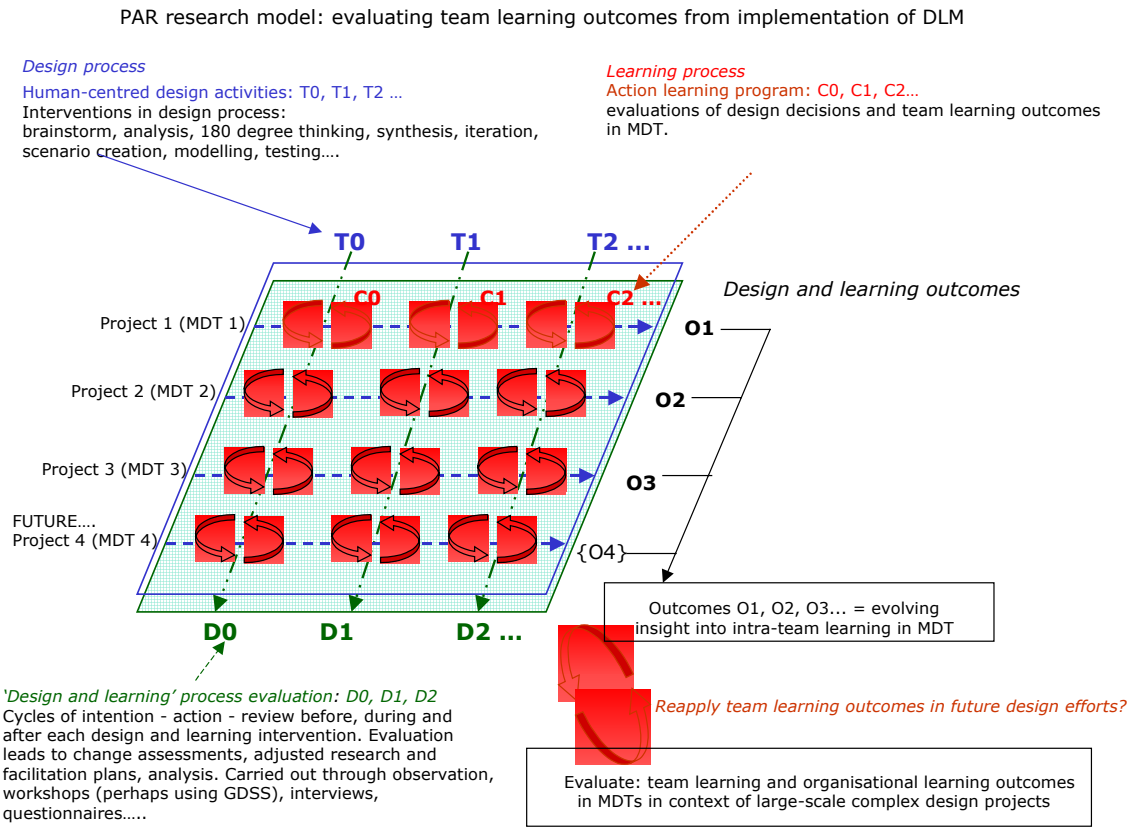

Figure 3. Matrix for studying and facilitating team learning in MDTs, simultaneously

As shown in Figure 3 above, a number of multidisciplinary design teams (MDT 1, 2, 3) are engaged in separate complex systems design projects (project 1, 2, 3). The design component of the DLM (T0, T1, T2, …) involves a series of design interventions guided by a facilitator or the MDT project leader. The same types of interventions are made in each design project (cutting diagonally down the matrix), but the sequence of which interventions activities are done when differs per MDT. Design interventions include analysis of multiple perspectives on systems design, brainstorming, creation of design scenarios, and evaluation of

design outcomes. The action learning program (C0, C1, C2…) is initiated within each design intervention (T0, T1 etc.), focusing specifically on learning tools and facilitation of social interaction in the MDT. A team facilitator plays a role in seeking out situations in which action learning interventions can take place both within and between sessions, so that an MDT can begin to reapply what they have learned into other activities in the organization.

Importantly, neither the design nor learning interventions are set up as an attempt to set, predict, limit, or control outcomes in advance. Rather, interventions follow and feed the dynamics of the MDT's own process, which remains unpredictable and emergent. Interventions seek to evaluate team learning processes including questions about whether:

- MDT members become more effective as team leaders or team contributors
- The MDT members are more pro-active in sharing knowledge with others
- They have become more consistent in seeking feedback about or action on development of their team competencies
- The team members recognize and are aware of the knowledge in the team
- The team members are able to facilitate sustainable communication and social interaction in a project.

After a number of interventions across projects and in different MDTs, the participant-researcher solicits more meta-level evaluations about the impact of DLM as a whole on the MDT's design and learning process (D0, D1, D2…). The participant-researcher plays a role in assessing the satisfaction with DLM in contributing to organisational learning outcomes, asking the following questions:

- Is the learning culture, as practiced in the participating teams in this process, permeating the way other teams in the organisation work and learn?
- Is the organisation's management beginning to placing a high priority on learning in teams in its further operations and planning as it is carried out here?
- Is the organisation expanding its learning via ongoing questioning and reflection sessions or evaluation moments within and between groups, in a structured and systematic way?
- Is the learning acquired in the teams involved in these sessions being specifically reapplied elsewhere in the organisation at this time or in the very near future?
- Is learning that is taking place in teams documented, measured, and stimulated in a consistent way in the organisation?
- Does the organisation reward those who share their knowledge and learning?
- How does the organisation support teams to share knowledge and learning across the boundaries of their team or department?

At the close of each project, cumulative team and organizational learning outcomes are evaluated and compared within each project (O1, O2, O3…) by the participant researcher in cooperation with managers and facilitators.

In this research, evaluations are generated by multiple methods and use many sources of data. For example, we ask MDT members to keep a diary, we use open interviews and ask stakeholders to fill in e-mail questionnaires about their experiences with the DLM. We also make regular use of group decision support software or GDSS (Galliers and Baets, 1998)[47], in order to expand the number of participants involved in a design and learning intervetions at any one time, and yet still keep design sessions manageable for 5 to 40 participants. MDTs are asked to prepare their own agenda of questions for each design and learning session, with the help of a 'team facilitator'. The agenda points are fed into the GDSS by a 'technical moderator' and projected onto a central screen in the session. Participants then dealt with the questions on the agenda by typing ideas on the topic into the GDSS display on individual computers, which run on a local area network. The GDSS software sorts ideas, and sends participants' input to all terminals as well as centrally displaying the aggregate results. The MDT can prioritize, vote or comment on collective ideas, "talking" simultaneously about different points of view. The GDSS stores, compiles and prints out a record of the entire process, capturing what questions led the session, which ideas the MDT produced, what comments where made, and how contributions were prioritized in each stage of a meeting.

After each session, participants receive a detailed summary for evaluation and to guide the next agenda. In all sessions using GDSS, a complete record of process, input and outcomes is stored and available for consultation.

At a later stage, it will be interesting to evaluate the contribution of all MDT learning outcomes, that is, in comparison with experiences from other MDTs (as indicated in the bottom right hand of the research matrix diagram). However, this is beyond the scope of our research. The scope of this study also does not allow us to assess the impact of the DLM on the whole range of learning processes that have been identified in the literature, i.e. individual, intra-team, inter-team, intra and inter-organizational learning. Rather, the current research focuses only on facilitating intra-team learning (within MDTs) and evaluating the contribution of these MDTs to organizational learning. We also do not study, at this point, the process of sharing team learning outcomes between the MDTs that are involved in this research. Due to time limitations we focus on team learning as shared within each MDT and within each project, and the reapplication of that learning into related business activities, over a period of about 14 months. In the next section I share a few of the experiences we have had with the implementation of the DLM to date.

Preliminary results of using the DLM in practice

We have just begun to implement the DLM in three MDTs over the last half year. We have learned the following preliminary 'lessons':

1) The DLM is a methodology which is quickly understood and seen by managers involved in complex systems design projects as a valuable way to offer concrete 'knowledge development' support in their product development teams. The DLM is considered a generic enough method to be able to be applied in areas other than systems design. In the large financial organizations I am studying, however, many companies are merging or being sold, and people are changing roles or jobs very frequently. Also, the basic logistics of freeing people up to actually work together in regular, face-to-face sessions is problematic.
2) The action learning component of the DLM requires as much planning, facilitation, structured questioning, systematic evaluation, documentation, and action plans as the design component. Also, the action learning component must not be set up for a MDT whose members will only be assigned to a (small) part of a complex systems design project. It is essential that the organization commit time and resources for all MDT members to get to know one another and work consistently on significant problems over a relatively long period of time.
3) We set the goal of a minimum of six months to a year to study team learning in MDTs, incorporating as much of a complex systems design process as possible. However, managers prefer to commit one phase at a time, and then review at each phase what the way forward should be. This is a potential threat to the continuity of team learning in MDTs.
4) Using a GDSS saves a tremendous amount of time and increases participation in MDTs, as the influence of 'dominant' team members is limited by the facilitator, by the fact that all members type in input into the GDSS anonymously, and by the fact that results are presented as aggregated output.
5) We discovered that the role of the team facilitator is critical to the success of the DLM. Initially we depended on the managers and project managers to assign themselves as facilitators. However, we find that it is much better for the feeling of trust and safety in the MDT if the facilitator is an objective party, not a manager or significant stakeholder in the design project. The facilitator should, however, be an employee of the organization, as opposed to being an external consultant, due to proprietary knowledge issues, as well as issues of trust, commitment and continuity in a MDT. It is extremely important that facilitation is seen as a different role from project leadership or management, thereby keeping the need for effective debate management and might-right management in mind. In choosing a facilitator, it is important to consider what knowledge he or she has of both

design and learning processes, so that the MDT can trust guidance by that person. I suggest starting off with a dual team of a design specialist from another MDT and a mentor from human resource development who has experience with action learning, in order to balance input into design and learning interventions.

6) Besides having a team facilitator, we discovered that it is important to involve a 'process moderator' to take notes on processes in a team session. The moderator in our projects was usually someone from the MDT itself. The moderator would comment on where he/she though the collaboration process got 'stuck' so that the team can evaluate these moments at some point in that session or later.
7) We noticed that specific criteria should be used to evaluate team learning outcomes, which should be generated in cooperation with the MDT itself. MDTs in this project showed a keen interest in determinig their own learning goals. The following criteria for team learning were selected, as they can apply to both design and learning. In order to learn as a team, each MDT member must be learn to:

- Identify objectives and set priorities as a team not just as individuals (collaboration skill)
- Invest in social interaction with other MDT members (collaboration skill)
- Show respect for individual differences and learning styles in the MDT (emotional intelligence).
- Play a role in decreasing unhealthy competition between stakeholder or team members (might-right management)
- Contribute to team problem solving by clarifying specialized knowledge to others and explaining how this is relevant to another member's knowledge / perspective through reports and presentations (design management)
- Suggest ways to improve communication processes among MDT members when there is a conflict or misunderstanding (debate management)
- Identifying whether and how a particular team learning outcome can be shared with other MDTs or in other business settings (organizational learning)

These particular criteria are adapted from guidelines by Harvey and Brown (1992)[48] for effective collaboration in teams. These criteria are by no means exhaustive, nor are they the only criteria that can apply. Rather, they are criteria the MDTs feel they are suitable for measuring whether they are balancing design and learning.

Conclusions

The scientific contribution of this paper is the presentation of a new design and learning methodology (DLM) that offers a framework for facilitating team learning in multidisciplinary design teams in the context of complex systems design in large organizations. The DLM is applied and iterated in the context of large financial organizations within the daily design practice of MDTs engaged in complex systems development. The DLM is intended to help MDTs shift focus from design products to design processes, seeking ways to achieve triple-loop learning by integrating action learning tools into human-centred design methodology. I consider the DLM as a mechanism to support organizational learning through design practice, because it encourages MDTs to specify the reapplication of collective, design-related learning in the larger organization. Considering the longitudinal nature of this research, it is my intention to make a much broader study of both intra- and inter-team learning, as well as of sharing team learning between projects over time, and to continue to develop the DLM methodology for use by MDTs in complex systems design projects.

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