Chapter 8
Developing a Framework for Innovation and Learning in the Workplace

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Abstract In this chapter an analytical framework is developed for conceptualisation and analysis of the interplay between innovation and workplace learning. By introducing the concepts of preject and project as arenas for the innovation process and by pointing out some important differences in these arenas, this chapter mainly directs attention to the less developed and discussed concept of preject. Learning theory is examined from the perspective of the individual in his or her social setting, and the concepts of innovative learning, adaptive learning, and reproductive learning are introduced and discussed. By relating these concepts to a problem matrix developed by Darsø (2001), we are able to, firstly, differentiate between preject, problem solving, and project, and, secondly, associate innovative learning, adaptive learning, and reproductive learning with the above-mentioned corresponding arenas. The chapter concludes with a figure displaying the framework.

8.1 Introduction

The intent of this chapter is to build a framework as a potential analytical tool for research as well as a tool for practitioners to develop workplaces as fruitful arenas of innovation and learning.

After defining innovation, we examine the innovation process and selected innovation process models. We use the Minnesota Innovation Research Program (MIRP) framework as our point of departure to provide the overall picture and to serve as our figure-ground. Our focus is on human activities that may lead to innovation. As our figure, we have chosen the early chaotic phase of innovation

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and as our ground the social and cultural organisational environment. We begin to build our framework by introducing two concepts of working with innovation: preject versus project. Preject was coined (Darsø 2001) to differentiate the early divergent process of innovation from project, which per definition is goal-directed and convergent. The next step is to examine learning and the learning environment or context. Here we try to understand why recent literature on learning in chaotic environments often portrays learning as adaptive and reproductive. When examining a case study on learning in an emergency department (Goldman et al. 2009), we find important similarities to problem-solving, e.g. as conceptualised by Isaksen (1988). By applying a problem map developed by Darsø (2001), it becomes apparent that the innovation process in the preject can be distinguished from problem-solving. We argue that the preject should be categorised as an explorative search, because here the problem is yet to be identified. We then introduce Billett's understanding of learning by bringing into focus the interaction between the affordances and constraints of the social setting (i.e. the workplace), on the one hand, and the agency and biography of the individual participant, on the other (Billett 2004). The notion of 'self-directed' information search in the above mentioned case study by Goldman et al. (2009) has inspired us to suggest a new notion of 'inquiry-directed' search. We then introduce Ellström's concepts of developmental learning versus reproductive learning (Ellström 2010). Returning to the preject versus the project modes of working as our guiding perspectives, we are now able to identify important organisational conditions for enhancing and hindering learning and innovation in the workplace. Finally, inspired by Weick and Westley (1996) we juxtapose these conditions in order to understand how learning and innovation can analytically inform, enrich, and challenge each other.

8.2 The Innovation Process

The term innovation was coined by Joseph Schumpeter in the 1930s and defined as a novelty that creates economic value (Schumpeter 1934). This entails that ideas, creativity, or inventions can only be called innovation when they have been successfully launched or implemented into the market. Thus, the innovation process involves the entire progression from the emergence of the first vague idea to the finished 'product' being applied, bought and taken in by the users, customers, and clients. The most comprehensive innovation process model was developed by Van de Ven and colleagues in 1989 in the Minnesota Innovation Research Program, a longitudinal multiple study (Van de Ven et al. 1989). In comparison with other simpler innovation process models (e.g. the typical stage-gate model), this framework illustrates the richness and vast complexity involved in innovation processes.

As seen in Fig. 8.1, the model involves 12 steps divided into three main phases (Van de Ven et al. 1999): initiation, development, and implementation/termination. Initiation consists of steps 1–3: gestation, shock, and plans. Van de Ven et al. describe *gestation* as an extended period of 'setting the stage' for innovation.

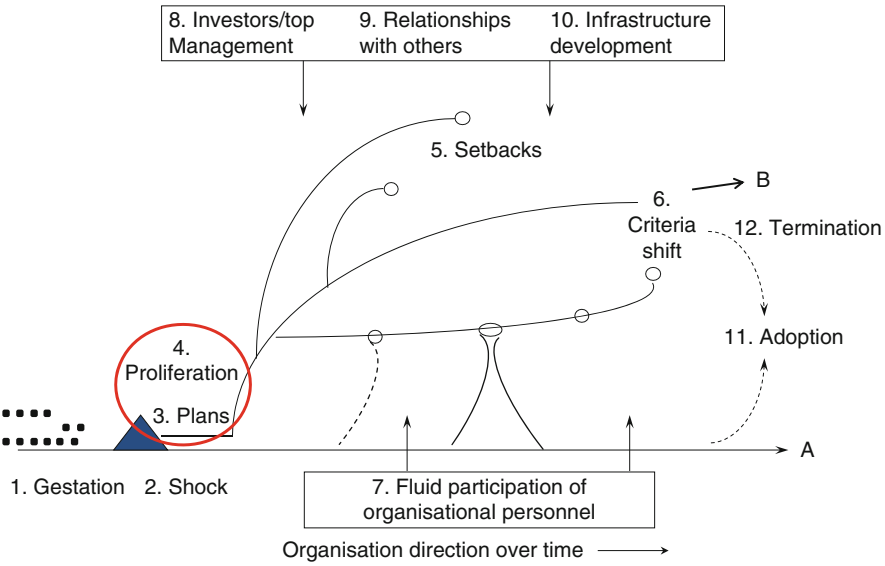

Fig. 8.1 Key components of the innovation journey (Van de Ven et al. 1999: 25)

Changes in customer needs, new technology, legislation, etc. slowly but surely make the organisation receptive to innovation so that when the *shock*, e.g. a critical incident, occurs people in charge will react and begin to focus on innovation as a way to grow and overcome the predicament. Ideas and suggestions flow and *plans* are made for investing resources and time in an innovation project.

Development consists of steps 4–10: proliferation, setbacks, criteria shift, fluid participation of organisational personnel, investors/top management, relationships with others, and infrastructure development. *Proliferation* is a divergent process of many parallel paths of ideas and activities. *Setbacks* happen when unexpected developments occur, when the environment changes, or because of surprising information and knowledge. *Criteria* for success and failure change with time and with the development of the project, often involving dynamic power struggles in the organisation. *Fluid participation of organisational personnel* influences the innovation process in various ways. History and continuity can be problematic as people walk in and out of projects and organisations. Projects undergo ups and downs to such a degree that Van de Ven et al. talk about changing human emotions as 'gut-wrenching' experiences (1999: 24). *Investors and top management* perform different roles during the innovation process, which can have a significant influence on both process and outcome. *Relationships with others* concern networks, collaborations, and partnerships with external stakeholders. This can involve economic investments or marketing relationships with distributors, etc. and can consequently be quite risky. *Infrastructure development* is often needed for commercialising the innovation, such as changing institutional norms and financing agreements or other types of resources.

Implementation/termination consists of the last two steps, 11–12: adoption and termination. In Fig. 8.1, the letters A and B indicate ongoing operations in the general direction and an innovation proceeding in a new direction, respectively. *Adoption* involves introduction, application, and diffusion of the innovation. Adopters often modify the innovation in order to make it fit their specific needs as well as their local context. A classical organisational challenge is to link the new with the old. *Termination* is not as easy as it may sound. For some innovation teams it can be difficult to realise that the project must come to an end. Evaluation, feedback, and learning from the process become complicated and tricky, because so many people have been involved, which tends to entail diverse perspectives, attributions, and opinions.

Evidently, challenges and opportunities involved in innovation are manifold and thus impossible to cover in a single chapter. The above-mentioned framework offers a valuable, research-based foundation for selecting and discussing some important conditions for successful innovation in organisations.

We are mostly interested in the human aspects of innovation and learning in the workplace, which we consider a form of *social innovation*. The term has been used by Drucker regarding renewal based on social needs, e.g. in the public sector (Drucker 1985). Yet, social innovation can also be used regarding renewal of social interaction, social relations, and social behaviour, e.g. in the workplace. Consequently, our focus is not on technology, product development, strategy, research and development, production, marketing, and sales. Our argument is that innovation always involves people, and while research on management of innovation is abundant, the employee and workplace perspective has been somewhat neglected. This chapter will focus on the early innovation process, corresponding to steps 3–4, plans and proliferation, in the MIRP model. We introduce a specific framework, *The Diamond of Innovation* (Darsø 2003), based on empirical research, which conceptualises the innovation process as preject versus project (Darsø 2001).

8.3 The Stage-Gate Model

In most companies the innovation process is represented by the classical stage-gate model (e.g. Cooper 1986), which works more or less like organisational management models in providing an organisational overview. Stage-Gate models are descriptive, e.g. by indicating in which department the innovation project physically takes place. A stage-gate model can also focus on activities, such as idea generation, screening, development, marketing, etc. or it can be based on gates related to criteria that needs to be met and decisions of go/no-go. The main problem with stage-gate models is the so-called ‘over-the-wall’ problem. This has been discussed by Takeuchi and Nonaka (1986), who came up with three expressive metaphors: relay race, rugby model, and sashimi.

However useful the stage-gate model is for organisational overviews, it reveals little about what is actually going on during the innovation process. Another way to understand the innovation process is to examine when the process opens up or diverges and when it closes down or converges. How are ideas and concepts developed? When and how are the different elements of the innovative idea or concept defined? In traditional product development certain features must be defined at specific milestones, after which there is no way back – except starting all over. This is the case in the car industry, for instance. In the 1990s, however, it was found that Toyota had developed a different model, which was much more open. In fact, the idea was to keep everything open for as long as possible in order to adjust measurements of all the parts towards standards and prices (Ward et al. 1995). The newest innovation process models are even more open, such as the 'never-finished' model (Austin and Darsø 2009) found in IT companies that keep adding and updating software in new versions. It should be emphasised that all the mentioned models concern the innovation process conceptualised from an internal organisational perspective and should be distinguished from the concept of 'open innovation' coined by Henry Chesbrough (2003). The latter concept is related to strategy and business models and designates open interaction between an organisation and external networks and partnerships.

As business develops from producing products towards producing and selling services, and as products and services become more oriented towards involving experience (Pine and Gilmore 1996), the traditional innovation process models become more and more obsolete. New types of models have been suggested, such as the Ibbotson theatre model, the innovation journey, and an art-making model (Austin and Darsø 2009).

8.4 Divergence – Convergence

The innovation process consists of several periods of opening up and closing down, i.e. of divergence and convergence. Divergence is aimed at exploring, finding out, asking questions and discovering new possibilities, whereas convergence is aimed at reaching the set goal, making decisions, limiting possibilities and controlling the results. Evidently, both are needed in the innovation process. It is also evident, however, that the balance has been extremely biased towards the convergent side. In the second half of the twentieth century, innovation and project management were closely linked (Cooper 1986), which can be seen in the massive literature published on project management. Here a project is defined as a task that is goal directed, involving a group of people (usually from different departments) with a budget and a specific time limit. Projects are per definition convergent. How do we articulate the corresponding divergent counterpart? The term preject has been suggested by Darsø: "…the preject is characterised as nonlinear, divergent and process driven…" (2001: 196). The Diamond of Innovation, developed through action research, illustrates the concept of preject (Darsø 2003); see Fig. 8.2.

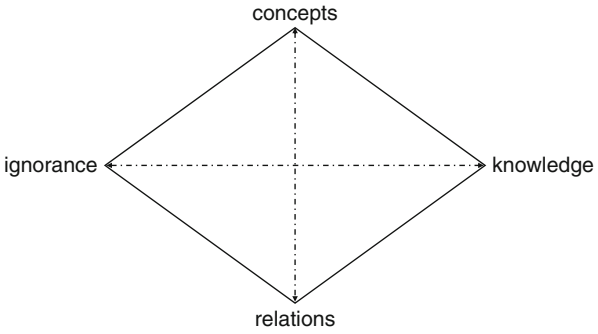

Fig. 8.2 The diamond of innovation (Darsø 2001: 336)

8.5 The Diamond of Innovation

The Diamond of Innovation has been developed in a 3-year research project that aimed at mapping the early phases of innovation in groups working in a pharmaceutical company (Darsø 2001). The research questions were: How is innovation born? What encourages and impedes innovation in the early phases? Focus was on human communication and interaction, and the model is based on an empirical study of how innovation happens in practice. The model is conceptual and is intended to illustrate dynamic interaction. The innovation process is constituted by two simultaneous and interconnected dynamics; a *knowledge dynamic* between knowledge and ignorance and a *communication dynamic* between relations and concepts. The parameters can be seen as opposites (analytically), though it should be emphasised that in real life situations they co-exist as complex and dynamic innovation processes. In the following we will describe each of the four parameters: knowledge, ignorance, relations, and concepts.

8.5.1 Knowledge

It comes as no surprise that *knowledge* is necessary for innovation. The surprising part is that knowledge can also curb innovation. How is that explained? It appears that knowledge is often accompanied by a subjective ingredient of opinion or attitude, which is not conscious to the knower. Most knowledge is to some degree influenced by underlying assumptions. Groups working with innovation are usually put together by criteria of diversity in order to represent different departments, professions and markets. This way each group member is regarded an 'expert' in his/her area, and statements are consequently not questioned. The data (i.e. taped conversations from meetings) from the study demonstrated how 'experts' would restrain possibilities by saying things like: 'That's impossible', 'can't be done in X market', etc. The dilemma is that, on the one hand, knowledge is the foundation for innovation (Simon 1986) and, on the other hand, innovation is often successful

because people do not know it cannot be done. Knowledge then must be critically scrutinised in order for groups to distinguish between data, facts, opinions, attitudes, experiences, suppositions, and beliefs.

8.5.2 Ignorance

The opposite of knowledge is *ignorance*; that which we do not know. When applying the Diamond of Innovation as the starting point, the theme or subject should be represented in the middle where the axes cross. Moving from the middle to the left there are different degrees of ignorance. Close to the middle is what we know that we do not know. Further to the left is what we do not know that we do not know. All the way towards ignorance is what we cannot fathom could be known. Why is ignorance needed for innovation? An important finding from the study was that innovation was triggered by open questions, i.e. ignorance. The problem is, however, that most people shy away from ignorance, because it makes them look 'stupid', whereas contributing from the arena of knowledge makes people feel competent. Asking ignorant questions not only makes people feel incompetent, it also frightens them to be working from an arena of uncertainty, shaky ground and chaos. In fact, it takes courage to navigate in chaos, but how can that be accomplished? This is where the other dynamic comes in.

8.5.3 Relations

Another important finding was the significance of relations. *Relations* are the invisible and tacit ties between people; the way people bond with each other. Relations are about how open or closed we are when meeting new people. Relations are about sympathy and incomprehension, about attraction and repulsion, about inclusion and exclusion and about trust and distrust. In the study, the quality of the relations in the group was the decisive factor whether the group would venture into ignorance or not. It showed that relations characterised by trust and respect constituted a constructive foundation for innovative crystallisation. Relations are typically formed as a tacit, subconscious process whenever people meet. Yet, they can also be shaped or created explicitly. For that to happen we need the fourth dimension, concepts.

8.5.4 Concepts

Concepts are forms, structures or descriptions that can help conceptualise ideas and themes. While relations are tacit, concepts aim at turning speech and conversations explicit. Concepts are important in innovation and a successful innovation process in the initial stages often concludes with a new concept, which will, naturally, have

to be tested at a later stage. This is crystallisation (Darsø 2001: 173): ". . .innovative crystallisation is defined as the outcome of a process involving collective transformation of accumulated and integrated ideas into a new conceptualisation or prototype". Conceptualising is an ongoing process of describing, illustrating and clarifying ideas, thoughts, knowledge, and ignorance. Communication is central to innovation which many groups fail to acknowledge. They talk for hours and not much comes out of it. Ways of dealing with this challenge is for instance to use metaphors, associations, examples, images, or drawings to share what lies behind the words; the more facets, nuances and depth, the richer the concept.

8.6 Dynamics of the Preject

The dynamic of communication can be understood as an iterative process moving between relations and concepts. Both parameters will be at play in communication whether the focus is on relations or on concepts. If a group decides to work on developing relations of trust and respect, it will evidently involve concepts, and, vice versa, when the group develops concepts, it will naturally involve relations. Likewise, the dynamic of knowledge-ignorance is an iterative process moving between knowledge and ignorance. Talking about what the group knows will reveal gaps of not knowing and asking open questions will lead to some answers and to seeking information and data. The dynamics occur simultaneously in groups working on innovation and are inherently complex. In order to complete the first building block of the framework, we will now return to the concept of project.

8.7 Project Management

As mentioned earlier, the project format has become the most applied system for working with innovation. The concept of project has its roots in scientific management, i.e. in a functionalist paradigm. A project is defined as a temporary endeavour with a specific beginning, a precise goal, a budget, an assigned group of people from different departments, and a definite date for delivery of the result. Project management was implemented primarily in engineering, construction, and the military around the 1950s as an alternative to industrialism and standardised bureaucracies for evoking renewal and change. Later, project management also became established in other types of organisations, particularly with the introduction of the matrix organisation. Projects have defined milestones, and it is the responsibility of the project manager to plan tasks, time, and resources well, for instance in a Gantt chart.[1] For many years, project management followed the

[1] Named after Henry Gantt (1861–1919), who invented it.

functionalist paradigm of a stage-gate model. Most prominent became Robert G. Cooper, who in 1986 published the book 'Winning at New Products', in which innovation was portrayed and understood as product development. His proposed stage-gate process had 5 stages: scoping, build business case, development, testing and validation, as well as launch. This model has greatly influenced how companies organise and work with innovation in practice. However, in the 1990s, a new paradigm emerged contemplating the project as a temporary organisation. This indicated a shift from an instrumental product approach towards an increased focus on the process and on human interaction, which led to a focus on expectations, human actions, and learning (Lundin and Söderholm 1995; Packendorff 1995).

In spite of these attempts to renew the rationale behind project management, most efforts are still directed towards improving the existing toolbox of project management. Here, two statements, both deriving from Cicmil et al. (2009: 83–84), are relevant for critical reflection:

> "Given the above characterisation of projects as a progressive and alternative way of working, it appears on one level paradoxical that the normative toolbox of Project Management originates from the very same conceptual and ideological foundations as Fordist mass manufacturing." "A growing body of literature, as well as a growing body of empirical evidence and the voices of numerous practitioners indicate that accepting and applying these widely promoted project management 'good practice' standards does not eliminate project failures, nor does it guarantee project success (Williams 2004). On the contrary, a number of studies within the field of project management suggest that it is the use of project management, or a certain conception of project management, as a methodology for organisational innovation and change which is at the heart of project failures (Currie 1994; Thomas 2000; Maylor 2001; Geraldi et al. 2008)." (Cicmil et al. 2009)

From these critical statements it could be concluded that project management has gone awry. The problem is, however, not project management per se. The real problem is that there is no alternative, that project management is considered the only correct approach. Project management works well when the goal has been established and specific tasks can be defined and delegated. Yet, whenever conditions change, when critical incidents happen and when unexpected outcomes are obtained, a much more constructive approach to deal with these would be through the preject. We contend that all projects ought to be preceded by prejects, but what is even more imperative is that both forms should be existing and available all the way through innovation projects; see Fig. 8.3.

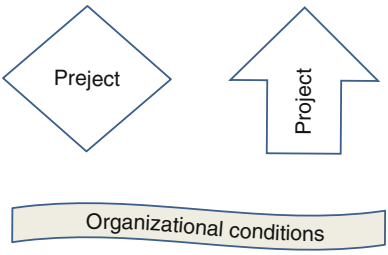

Fig. 8.3 Preject – project (Darsø 2001: 196)

At the beginning of this chapter we stated that we intend to discuss innovation and learning. We will therefore leave the theme of innovation for a short while to continue with learning.

8.8 Linking Learning and Innovation

Only little research has been conducted in the field of linking learning and innovation, especially concerning the micro level of learning (group/team/individual) (Crossan and Apaydin 2010), or – in other terms – with focus on creating a learning perspective on innovation. This may be due to the many different approaches to learning and the apprehension of learning as highly diverse processes occurring at different levels: the individual level, group level, organisational level, network level, and the interconnection of these levels. Most research in the field relates innovation to the organisational level and tends to conclude that organisational learning is an antecedent for innovation and that organisational learning influences innovation in different positive ways. Yet, this approach to learning does not help us gain insight into the micro processes of learning and innovating; it does not enlighten us about what is actually going on.

As mentioned earlier, we are mostly interested in the human aspects of innovation and learning in the workplace. Consequently, our chosen learning approach emphasises the following perspective: the individual in his or her social setting. Experience and what people do with their experience lies at the core of our conception of learning (Jarvis 2006: 6–7). Actions take place in social settings and experiences occur at the intersection of the individual and the social world. Learning often occurs at this point of interaction. A constructive approach to link learning and innovation may therefore be to see the social processes and the social system, constituted by the preject and project logic, as the social context of the learning process. In the following, we will apply the preject – project logic as a means to enquire how innovative processes and learning processes interact and create preconditions and implications for each other.

8.8.1 Disjuncture

In spite of the many divergent views on learning, it seems that researchers to a high extent agree on what initiates the learning process, i.e. the question: What are the triggers of learning? Peter Jarvis emphasises that the driving force for learning often is a certain tension – a disjuncture – between the individual (inner self) and the outer world (Jarvis 2006: 7). Disjuncture is a kind of disharmony between what the individual brings to the situation (experiences, cognitive structure, etc.) and what the situation demands of the individual. It is thus the desire of the individual to overcome this disharmony and return to a state of harmony, which constitutes an

important motivation for learning. This idea of disharmony or imbalance – as the trigger for learning – is shared by many learning theorists. Dewey, for instance, states that 'habits do not work' as the starting point of reflective thinking. He adds (Dewey 1997: 74):

> "In cases of striking novelty or unusual perplexity, the difficulty, however, is likely to present itself at first as a shock, as emotional disturbance, as a more or less vague feeling of the unexpected, of something queer, strange, funny, or disconcerting."

Based on Kurt Lewin's thinking, Schein states that uncertainty, in terms of lack of confirmation or disconfirming cues (in relation to existing cognitive system, attitudes, etc.) from the social setting, is the starting point for learning (Schein and Bennis 1965). At the same time, this uncertainty creates a mild or strong anxiety in the individual. This anxiety may foster or be a barrier to learning. Too strong anxiety activates defence mechanisms that hinder learning.

Ellström also adheres to this thinking of disharmony in describing the driving forces for learning and innovation processes. Basic to his thinking is "that tensions and contradictions between work processes as officially prescribed (the explicit dimension) and as perceived and performed in practice (the implicit dimension) create potentials for learning and practice-based innovations in an organisation" (Ellström 2010: 32).

Comparing steps 1–3 in the model of Van de Ven with the above mentioned conceptions of learning triggers, it seems evident that it is basically the same conditions that initiate innovative and learning processes; gestation may be out of reach for most employees, but may form the starting point for management. Shock – the critical incident – corresponds very well to the disjuncture and disharmony as triggers for learning. Plans may be the actions that have the potential to create new experiences and reconstruction of experiences, i.e. learning. The next phase might take the form of the preject; a phase where divergent and convergent processes alternate, although the divergent processes are more prominent. Looking at the preject as an arena of learning, how does the preject relate to learning in terms of fostering different kinds of learning processes? Here the question is: What kind of learning processes are spurred by the social processes predominant in the preject imbedded in the innovation processes?

8.8.2 The Preject in a Chaos Perspective: Learning in Chaos

Chaos is commonly understood as a condition of disarray and confusion, where order is absent (Goldman et al. 2009; Fitzgerald and Van Eijnatten 2002). Referring to Van Eijnatten and Putnik chaos may be understood as "a condition of disarray, discord, confusion, upheaval, bedlam, and utter mess arising from the complete absence of order" (Van Eijnatten and Putnik 2004: 419). Yet, according to chaos theory and complexity theory, chaos and order in organisations are not to be seen as opposites, but as complementary. This is underlined in the term *chaord*, coined by

Dee Hock, combining the words 'order' and 'chaos' into the single term 'cha-ord' to indicate the simultaneous presence of both. A chaordic system is a holon with behaviour that is both unpredictable and patterned at the same time (Van Eijnatten and Putnik 2004).

The preject may thus be characterised as a chaordic system. It is remarkable that environmental dynamics such as disruption, confusion and chaos historically have been seen as negative factors, often indicating the impending demise of an organisation (Goldman et al. 2009: 556). Looking at the potential of the chaordic system to foster or impede different kinds of learning, it is important to note that there are high levels of autonomy for individuals working within successful complex systems (Goldman et al. 2009: 560). Autonomy is often stated as an important supporting factor in workplace learning (Ellström 2010).

In a thorough literature review addressing learning at work accomplished by Fenwick (2008), the author only finds a few articles that make use of complexity theory. It seems that complexity theory is a rarely used frame of reference in the field of workplace learning. Nevertheless, it appears to be fruitful because it treats learning as an inventive/adaptive activity produced continuously through action and relations of complex systems, particularly triggered by disturbances (Fenwick 2008: 236). This is quite in line with our approach. Yet, it is remarkable that much learning in chaos is described as adaptive and reproductive learning. Survival in the system is important (adaption), and in the case study of Goldman et al. most of the learning seems to be reproductive (learning tips and tricks) (Goldman et al. 2009). Learning as an adaptive/reproductive activity implies that the learning product is not new; it often includes some kind of socialisation, implying that the individual complies with the demands at hand, which is contrary to innovation.

What about *innovative* learning, which means that what individuals learn – for instance by co-creating knowledge – is new to the organisation? Fenwick states that the concept of 'context', i.e. the context of learning, seems to be important for the categories of learning we identify: adaptive learning basically implies conceptualising context as a container in which the individual moves about (Fenwick 2008: 237). If, however, we conceptualise context as a web of relations, it becomes possible to identify learning – workplace learning – as exploration, which is innovative learning. This means that learning involves new behaviour and creation of new knowledge that may change interaction, relationships, and knowledge in the organisation, i.e. create process or organisational innovation.

8.8.3 Adaptive and Innovative Learning in the Preject: What Do the Learning Processes Look Like?

When applying the term adaptive learning we should call attention to what Ellström calls the inbuilt duality of the concept: "In one sense adaptive learning is about

learning to handle certain tasks or to master the norms, practices and routines in an organisation. In another sense adaptive learning is about the learning and reproduction of a prescribed order. . .” (Ellström 2010: 33).

In literature, we find several examples of adaptive learning in settings of chaos that are comparable to the conditions of the preject. It seems possible to identify:

- Different types of learning processes
- Context factors supporting the learning processes

An example of adaptive learning in a chaotic environment is presented by Goldman et al. (2009). The concrete working and learning environments – the emergency departments – are chaotic by nature and characterised as busy environments, and those working in them are subject to frequent interruptions. The workload is unpredictable and uncontrollable (Goldman et al. 2009: 559). Goldman et al. identified four different types of what they call learning episodes, activities, or events during which learning did occur:

- *Participation in the environment* concerns the day-to-day work processes that involve seeing and managing patients, observing and talking with others and participating in formal education. These activities facilitate the participants’ general knowledge and understanding of emergency medicine (Goldman et al. 2009: 563–564).
- *Focused learning moments* involve short, focused learning moments when something very specific was learned. This is about ‘learning tips’ related to particular procedures or ways of managing patients. This learning always involves another source such as an attending physician, colleagues, consultants or published material.
- *Repetitive cycles* involve repetition; repeated occurrences of the same patient symptoms or situations. This may imply development of skills concerning patient management, multitasking or specific procedures (Goldman et al. 2009: 565).
- *Intense experiences* include a high level of interpersonal exchange between the participant and other healthcare professionals involved in patient management. These experiences are identified as sources of substantial learning.

All four types of learning involve adaptive and reproductive learning, and it is remarkable that different aspects of the chaotic learning environment clearly support this learning. We can understand this by turning to Billett (2004), who argues for a view of workplace learning as the interaction between the opportunities or constraints of the environment and individual agency. The degree of relatedness between what the workplace affords and what the individual engages in affects the nature of learning (Goldman et al. 2009: 557). What then characterises the chaotic learning environment in this perspective? In relation to individual agency, the author underlines self-direction, i.e. self-directed information search. It seems that the chaotic system produces conditions of great autonomy and freedom for the participants, which support learning.

The characteristics of the chaotic learning environment are *role expectations* within the system that promotes *participation* and implies possibilities to observe, act and talk with others (peers and experts); expectations initiated by the individual, and a great volume of cases to observe and act upon. The great volume ensures diversity in cases; difficult cases (problems) as well as unusual cases. Moreover, the corresponding experiences also ensure repetition of situations and problems to frame and act upon. Repetition pushes the individual to act and reflect and it implies facilitation of learning including practice and *reflection,* which often lead to additional self-directed learning, i.e. possibilities to ask questions and elicit feedback, when wanted. This may include self-directed activities in terms of asking people to share knowledge and possibilities to follow-up on self-directed activities. Intense experiences typically involve high levels of interpersonal exchange between professionals.

The chaotic environment can be characterised as a forceful stimulating learning environment, because chaos, on the one hand, ensures a vast amount of affordances and cases that include great diversity, severe cases and problems, and in that way directs access to real life 'learning-material', including repetitions and pressure to act, frame and solve problems. On the other hand, *social relations* are vital in the chaotic context: We apprehend a social system as a system that supports action and problem-solving, a system that supports participation in a social unit in which observation of peers and experts and sharing of knowledge are prominent features. Mistakes may be unavoidable but they are conceptualised in reflection activities. Furthermore, the system provides freedom and autonomy for the individual and paves therefore the way for self-directedness. In this way, it is the individual or the agency that creates the basic relation between the two sides of the system that makes it a potentially strong learning system. Goldman et al. state that one of the most striking findings about learning in the chaotic emergency department environment was how much self-direction was involved (Goldman et al. 2009: 568).

The chaotic context of an emergency unit resembles the preject regarding the important role of social relations. As pointed out earlier, the quality of relations concerning trust and respect constitutes the foundation for successful innovation processes. In that respect we find significant similarities. But there are, however, also some important differences that become apparent when we try to categorise these two contexts in a problem map (Darsø 2001: 146); see Fig. 8.4. The problem map is a matrix with one axis referring to the problem (as known or not known), and one axis referring to the solution (as known or not known). Obviously, when both problem and solution are known, work is in the area of *routines*. In the emergency unit there are situations where routines can be applied, but the majority of situations are characterised by at least one unknown feature. It can be a known problem with an unknown solution, i.e. unknown to the doctor or nurse, until a colleague with more experience can provide it, i.e. *problem-solving*. Or the problem can be more complex (not known), which means that several solutions are available, i.e.

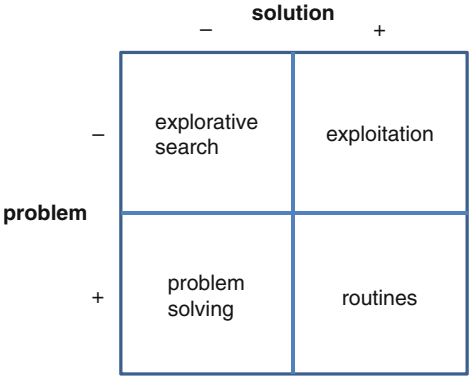

Fig. 8.4 Problem map[2] (Darsø 2001: 146)

exploitation. Whatever the case in the emergency room, it will rarely be characterised as *explorative search* – fortunately for the patients.

In comparison, the preject is distinguished by the fact that the participants neither know the problem nor the solution. Thus, the preject is per definition *explorative search*. The central purpose of the preject is to explore what the problem could be, i.e. to determine the problem or rather to identify the 'threshold' question (Austin and Darsø 2009). The idea of identifying a threshold question, which can set the direction for the search, is underlined by a quote attributed to Einstein, in which he states that if he had one hour to solve a significant problem he would spend 55 minutes on identifying the question and only 5 minutes on the solution (Vogt et al. 2003). Why? Because finding the right question implicitly holds the solution. Furthermore, the preject explorative search is guided by insistent and inexorable enquiry. We therefore argue that while individual agency takes place as *self-directed information search* in chaotic learning contexts, such as emergency units, individual and team agency take place as *enquiry-directed search* in the learning context of the preject and innovation processes.

8.9 Innovative Learning: What Are the Preconditions of Learning?

Innovative learning seems to be an underdeveloped field of research. In relatively new books by Jarvis (2006) and Illeris (2006) they only deal with the subject in a few lines, and both refer to Botkin et al. (1979), who make a distinction between *maintenance learning* and *innovative learning*. *Maintenance learning* is the

[2] In Figure 8.4 minus indicates: not knowing (the problem or solution). Plus indicates: knowing (the problem or the solution).

acquisition of fixed outlooks, methods, and rules for dealing with known situations and recurring situations. It enhances our problem-solving ability for problems that are given. It is the type of learning designed to maintain an existing system or an established way of life. Maintenance learning tends to take for granted those values inherent in the status quo and to disregard all other values.

Innovative learning – according to Botkin et al. – occurs in times of turbulence, change, or discontinuity. These conditions seem to match the essence of chaos. Innovative learning is the type of learning that can bring change, renewal, restructuring, and problem reformulation. Using the term *developmental learning* (synonymous to innovative learning) implies a strong emphasis on the subjects' capacity for self-management and their preparedness to question, reflect on, and, if necessary, transform established practices in the organisation into new solutions or ways of working (Ellström 2010: 34). In conceptualising *practice-based innovation* Ellström prefers to use the term developmental learning, synonymous to innovative learning (Ellström 2010).

Characteristics of learning contexts that foster innovative learning are thus new problems and unknown situations. Unknown situations may arise when individuals, groups or organisations face situations they have never met before, including complex situations, turbulence, change and discontinuity. This is to a certain extent in line with the characteristics of the preject.

What are then the decisive factors that foster innovative learning? Ellström states that "innovation may be viewed as the result of learning and knowledge creation through which new problems are defined and new knowledge is developed to solve them" (Ellström 2010: 36).

Using Billett's concept of *affordances of the workplace* as our point of departure, three factors seem to be prominent for distinguishing adaptive and innovative learning: (1) traits in the culture and management of the organisation, (2) the character of the tasks/problems that challenge the individual at work, and (3) structural conditions of the workplace to allow employees to share and re-combine knowledge in new ways (Hargadon 2002).

Culture and management should value and support that the individual questions the taken-for-granted in offering possibilities to: challenge routines and possibly the security of the organisation, reflect on basic premises and conditions, behave in an explorative mode, be given the possibilities to experiment or make mistakes, behave in a self-directed manner and make efforts to create new ideas and knowledge.

In order to understand the impact of the *task- or problem-structure* that challenges the individual at work, we turn to a conceptualisation elaborated by Herbst (1977). In broad terms, the problems we meet and can learn from may diverge in nature, due to three parameters: (1) How strict, precise or specified is the problem situation at the outset? (2) The procedure to solve the problem: Is there a predetermined procedure to reach the solution or are there many possibilities? (3) The solution to the problem, the end result: Is there a predetermined 'correct' result or can a broad range of results be accepted as satisfying solutions?

By combining the degree of specification/predetermination with these three parameters, it is possible to distinguish between the most open problems

(low specification on all three parameters), the closed problems (specification on all three parameters) and various types of semi-open/closed problems. Evidently, open problems are conducive to innovative learning. This could be the reason why the case on learning in the emergency unit chaos does not produce a high degree of innovative learning. In the practice of emergency, medicine professionals can challenge problems that are open in the outset, but procedures and product (diagnosis and treatment) are rather predetermined elements in the problem situation.

Regarding *structural conditions in the workplace*, we would like to draw on Hargadon's thinking (2002). The basic question he enlightens is: *How existing knowledge becomes the raw material from which individuals in organisations construct innovative solutions?* Hargadon constructs a complicated model linking learning and innovation in organisations. Only some essential ideas should be presented here. A basic idea is that innovation is created by moving ideas and knowledge in the organisation from where they are known to where they are not known. In this process, new combinations of existing ideas and knowledge are created. These new combinations are *the essence of innovation*, whereas the process of knowledge sharing and recombination of existing knowledge represents *the learning process*. This is not an easy and ongoing process in organisations, due to the fragmented nature of the larger social structures predominant in many workplaces. The fragmented social structure is created to promote specialist development and professional knowledge, but it does not support innovative processes. One important means to create innovative capacity is consequently to create possibilities to bridge multiple domains and move ideas from where they are known to where they are not (Hargadon 2002: 44). The essence of learning is knowledge-moving and sharing as well as recombination of existing knowledge, whereby innovative learning and innovations are created in the organisation.

8.10 Summary and Conclusion

We started by introducing the concepts of preject and project as two different modes of working with innovation in the workplace. In a time perspective, this would mean that the preject precedes the project. Yet as mentioned, in real life they alternate as projects often meet unforeseen challenges that, in a way, turn them into prejects for a while, until the challenges have been dealt with. The preject is divergent and has its focus on identifying the goal, while the project is convergent and begins when the goal has been identified. Chaos therefore prevails in the preject compared to a dominance of order in the project.

The next step was to link innovation with learning focusing on the individual in his or her social setting. Here we found that disjuncture is a common trigger for both innovation and learning. By examining literature from the field of chaos theory applied in organisations, we found – to our surprise – that chaotic environments apparently support adaptive and reproductive learning, as demonstrated in the case study by Goldman et al. (2009) from an emergency department. To understand this

we applied a problem matrix by Darsø (2001), which helped us differentiate chaos in an emergency unit from chaos in a preject. While the former generally concerns problem-solving, the latter concerns explorative search. In relation to the matrix, projects can be categorised as routines.

Weick and Westley juxtapose order and disorder in their conception of learning (1996: 456):

> "The act of repunctuating continuous experience is what we mean by learning. What people learn are intersubjective meanings embedded in culture. To make repunctuation even a possibility, organisation must be reduced and doubt and curiosity must be cultivated. These changes, which mix together order and disorder, juxtapose sufficient order to sustain a learning entity and sufficient disorder to mobilise forgotten material and new alternatives. This juxtaposition is dynamic and represents a transient window of opportunity."

Under this heading our basic perspective on the learning – innovation relation is that innovation may be apprehended as the result of learning. Problem-solving is an important part of learning and in this process problems may be framed in new ways and the solutions may create new insight and knowledge. Conceptualised as arenas of learning, preject and project support adaptive and reproductive learning. Moreover, both types of learning arenas provide many learning conditions that generally support learning.

The preject, however, also seems to support innovative learning, as the need for self-direction and autonomy is often greater here. Cultural/managerial factors are also prevailing, such as support for questioning the taken-for-granted, challenging routines, reflection on basic premises and conditions, explorative behaviour, possibilities to experiment, etc. Ultimately, the open character of problems in the preject and the possibility for people to build bridges between domains of

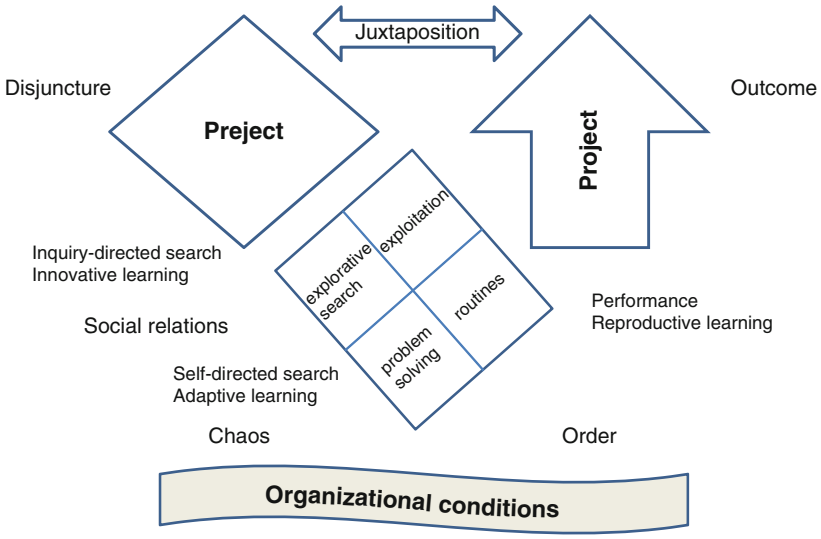

Fig. 8.5 The framework for innovation and learning in the workplace

specialised knowledge to recombine existing knowledge in new ways are dominant features of the preject. The preject thus constitutes a strong learning environment that supports the production of creative ideas, new questions, new knowledge and new solutions to new as well as known problems. These important resources can then feed into the project. The framework we elaborated is shown in Fig. 8.5. The core and the integrating element of the framework is the juxtaposition of the preject and the project in terms of innovation and learning. The preject and the project inform, enrich, and challenge each other through the interplay of innovation and learning.

References

Austin, R., & Darsø, L. (2009). Innovation processes and closure. In N. Koivunen & A. Rehn (Eds.), *Creativity and the contemporary economy* (pp. 55–81). Copenhagen, Denmark: Copenhagen Business School Press.

Billett, S. (2004). Workplace participatory practices. Conceptualizing workplaces as learning environments. *Journal of Workplace Learning, 16*(6), 312–324.

Botkin, J. W., Elmandjra, M., & Malitza, M. (1979). *No Limits to Learning: Bridging the Human Gap, A Report to the Club of Rome*. Exeter, UK: A. Wheaton and Co. Ltd.

Chesbrough, H. W. (2003). *Open innovation. The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business School Press.

Cicmil, S., Hodgson, D., Lindgren, M., & Packendorff, J. (2009). Project management behind the facade. *Ephemera, 9*(2), 78–92.

Cooper, R. G. (1986). *Winning at new products*. Reading, MA: Addison-Wesley.

Crossan, M. M., & Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: a systematic review of the literature. *Journal of Management Studies, 47*(6), 1154–1191.

Currie, W. (1994). The strategic management of a large scale IT project in the financial service sector. *New Technology, Work and Employment, 9*(1), 19–29.

Darsø, L. (2001). *Innovation in the making*. Frederiksberg, Denmark: Samfundslitteratur.

Darsø, L. (2003). Findes der en formel for innovation? [Is there a Formula for Innovation?]. *Børsen Ledelseshåndbøger: Innovations- og Forandringsledelse*. Copenhagen: Børsen Forum A/S. (In Danish.)

Dewey, J. (1997). *How we think*. Mineola, New York: Dover.

Drucker, P. F. (1985). *Innovation and entrepreneurship: practice and principles*. London: Pan Books.

Ellström, P.-E. (2010). Practice-based innovation: a learning perspective. *Journal of Workplace Learning, 22*(1/2), 27–40.

Fenwick, T. (2008). Understanding relations of individual-collective learning at work: A review of research. *Management Learning, 39*(3), 227–243.

Fitzgerald, L., & Van Eijnatten, F. (2002). Chaos speak: A glossary of chaordic terms and phrases. *Journal of Organizational Change Management, 15*(4), 412–423.

Geraldi, J. G., Turner, J. R., Maylor, H., Söderholm, A., Hobday, M., & Brady, T. (2008). Innovation in project management: voices of researcher. *International Journal of Project Management*, *26*(5), 586–589.

Goldman, E., Plack, M., Roche, C., Smith, J., & Turley, C. (2009). Learning in a chaotic environment. *Journal of Workplace Learning, 21*(7), 555–574.

Hargadon, A. B. (2002). Brokering knowledge: Linking learning and innovation. *Research in Organizational Behavior, 24*, 41–85.

Herbst, P. G. (1977). *Alternativ til hierarkisk organisasjon [An alternative to hierarchical organisation]*. Oslo: Tanjum-Norli. (In Norwegian.)

Illeris, K. (2006). *How we learn. Learning and non-learning in school and beyond*. London and New York: Routledge.

Isaksen, S. G. (1988). Innovative problem solving in groups. New methods and research opportunities. In Y. Ijiri, & R. L. Kuhn (Eds.), *New directions in creative and innovative management. Bridging theory and practice*. Cambridge, MA: Ballinger Publishing Company.

Jarvis, P. (2006). *Towards a comprehensive theory of human learning. Lifelong learning and the learning society* (Vol. 1). London and New York: Routledge.

Lundin, R. A., & Söderholm, A. (1995). A theory of the temporary organization. *Scandinavian Journal of Management, 11*(4), 437–455.

Maylor, H. (2001). Beyond the Gantt chart: project management moving on. *European Management Journal*, *19*(1), 92–100.

Packendorff, J. (1995). Inquiring into the temporary organization: New directions for project management research. *Scandinavian Journal of Management, 11*(4), 319–333.

Pine, B. J. I., & Gilmore, J. H. (1996). *The experience economy. Work is theatre & every business a stage*. Boston: Harvard Business School Press.

Schein, E. H., & Bennis, W. G. (1965). *Personal and organizational change through group methods*. New York: Wiley.

Schumpeter, J. A. (1934). *The theory of economic development*. Cambridge, MA: Harvard University Press.

Simon, H. A. (1986). What we know about the creative process. In R. L. Kuhn (Ed.), *Frontiers in creative and innovative management*. Cambridge, MA: Ballinger Publishing Company.

Takeuchi, H., & Nonaka, I. (1986). The new product development game. *Harvard Business Review, 64*, 137–146.

Thomas, J. (2000). Making sense of project management. In R. A. Lundin, & F. Hartman (Eds.), *Projects as Business Constituents and Guiding Motives*. Boston: Kluwer Academic Press.

Van de Ven, A. H., Angle, H. L., & Poole, M. S. (Eds.). (1989). *Research on the management of innovation: The Minnesota studies*. New York: Harper & Row Publishers, Ballinger Division.

Van de Ven, A. H., Polley, D. E., Garud, R., & Venkataraman, S. (1999). *The innovation journey*. Oxford and New York: Oxford University Press.

Van Eijnatten, F., & Putnik, G. D. (2004). Chaos, complexity, learning, and the learning organization. Towards a chaordic enterprise. *The Learning Organization, 11*(6), 418–129.

Vogt, E. E., Brown, J., & Isaacs, D. (2003). *The art of powerful questions; catalyzing insight, innovation, and action*. Mill Valley, CA: Whole Systems Associates.

Ward, A., Liker, J. K., Cristiano, J. J., & Sobek, D. K., II. (1995). The second Toyota paradox: How delaying decisions can make better cars faster. *Sloan Management Review, 36*, 43–61 (Spring).

Weick, K. E., & Westley, F. (1996). Organizational learning: Affirming an oxymoron. In S. Clegg, C. Hardy, & W. R. Nord (Eds.), *Handbook of organization studies* (pp. 440–458). London: Sage.

Williams, T. (2004). *Assessing and building on the underlying theory of project management in the light of badly over-run projects*. Paper presented at PMI Research Conference, London, UK.