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NEW FORMS OF LEARNING AND WORK ORGANIZATION IN THE IT INDUSTRY: A GERMAN PERSPECTIVE ON INFORMAL LEARNING

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Initial and Further Vocational Education and Training in the IT-Sector

According to the German Federal Association of Information Economy, Telecommunication, and New Media (Bitkom) information technology includes both the production of office machinery and data processing equipment and the domain of software and IT services while the production of communication engineering equipment and facilities as well as communications services belong to the division of telecommunication. Accordingly, production and work structures differ greatly within the IT industry as documented by the industrial sociological study by Baukrowitz and Boes (2002). The segment of software development and IT services, with which the following study was concerned, is characterized by work processes which do not correspond to a traditional tayloristic work organization and division of labor but are mostly carried out in the form of project work. This has consequences for the high staff qualification requirements and for the shaping of the qualification development.

In Germany during the boom of the IT industry in the 1990s, four new dual occupations (apprenticeships combining practical learning in the enterprise and theoretical learning in vocational schools) in the IT industry were developed under the lead management of the Federal Institute for Vocational Education (BIBB) and promulgated by the Federal Ministry of Economics as of August 1, 1997. What is new about this IT initial vocational education and about the structure of the job description is that 50% of the occupations consist of key qualifications which include both technical business and management competencies. While a high proportion of key qualifications are scheduled for the first year of apprenticeship, this will continuously decrease in favor of specialty

qualifications during the additional two years of training. The concept is advantageous for the training enterprises since the training is geared to a greater extent towards business requirements. Common key qualifications facilitate a later change to one of the adjoining lines of work for the trained specialists.

The four new dual occupations have had a positive echo in the expert public and are very popular with the adolescents and are also accepted by the enterprises. The total number of training relationships of all years of apprenticeship in the four IT occupations increased continuously since their introduction. Meanwhile in the field of IT-related advanced training the range diversified more and more in accordance with the great demand for skilled personnel, and a bewildering variety of different vocational designations emerged for the development, application, and maintenance of advanced information and telecommunication systems in the 1990s.

Especially at the higher qualification levels primarily occupied by university graduates the demand for skilled IT personnel is great. However, most first-year students do not behave anticyclically to the economic development in the choice of their field of study. In the last years probably because of the economic downswing of the IT industry, the subject of computer science has lost its attractiveness for first-year students. The still existing shortage of skilled personnel in the IT industry is opposed by a relatively high number of unemployed skilled IT personnel which has continuously increased since the year 2000 (Dostal, 2002). Despite this availability of skilled IT personnel, jobs offered can frequently not be filled immediately as IAB has found (Dostal, 2002, p. 145). Evidently skilled IT personnel, once they are out of a job, are not readily reintegrated into the job market.

Within this situation in Germany an advanced IT training system is being developed since the end of the 1990s which shall essentially take place on the job and lead to recognized occupations requiring advanced training (BMBF, 2002; Rohs, 2002). With this, a modern advanced training concept shall be implemented which will apply to the entire Federal Republic. Upon successful implementation, it would not only change vocational and on-the-job training, but initial and further education and training as a whole in its historically evolved structure. The advanced IT training system is characterized by the direct combination of working and learning in the work process which, at the same time, stands for a change of perspective with respect to advanced on-the-job training. Improvement and optimization processes, task integration, quality assurance, and other modern forms and methods of working require this combination of working and learning. It is a constitutive element of new models and concepts of work-based learning. Advanced on-the-job training is becoming more important than training courses and classes which for the most part still predominate today. Future-oriented, competence-based advanced training is characterized by process orientation, reference to subjects, self-direction, demand orientation, revaluation of experiential learning, and the combination of formal and informal learning.

The system is based on the apprenticeship; so-called lateral and re-entries are

admitted to this system, thus it also addresses those seeking work and do not have yet a formal qualification. The aim of this system is to provide "key qualifications that equip employees to cope with the rapid pace of change." (Ehrke & Müller, 2002, p. 9). It also enquires to provide a training system which is not organised exclusively for the development of product specific skills, but provides long-lived relevance. The basic idea of the professional system is to enable a "diagonal career development in the workplace" (*ibid.*, p. 12).

The qualification process itself is conducted mainly in the workplace as a work-process-oriented learning concept which is based on the assumption that, "the work process defines the relevant actions from which the learning goals and contents are derived" (Rohs & Büchele, 2002, p. 69). To identify relevant work processes reference projects, which are abstract descriptions for all typical work processes for an occupational profile, had been developed.

It is decisive for the advanced training policy that advanced IT training is primarily provided by on-the-job learning in a graded system of different occupations requiring advanced training, thus making it possible to climb to the highest professional levels and academic qualifications. The so far more than 300 job names related to information technology will be replaced by six occupations requiring advanced training and 29 specialist profiles. This advanced training system provides reliable career development paths for the currently 800,000 employees in the information and communication economy in Germany and is characterized by flexibility, transparency, and adaptability. The manufacturers' certificates predominating in advanced training up to now and the offers supported by the chambers could thereby be guided by a system that is recognized throughout the industry and the Federal Republic of Germany, and could be utilized internationally by determining equivalencies, even in the sector of academic professions.To ascertain quality standards the qualification process of operative and strategic professionals falls into an area regulated by law and certified consistent with the provisions of the Federal Education Act.

Informal Learning, Experiential Learning, and Implicit Learning

From the point of view of the enterprises it already became apparent in the 1980s that new enterprise and work concepts require comprehensive competence development of the staff and increased learning on the job. In the progressing knowledge and service society and the associated propagation of new information and communication technologies, the decrease of manual and increase of knowledge-based activities, knowledge resources and on-the-job learning play a more and more important role. Continuous learning in and from organizations shall make innovations possible, build up and extend knowledge, and enhance efficiency and competitiveness. It has turned out that the increasing outsourcing of learning away from the job is widening the gap between seminar-oriented vocational training and real professional action competence that it leads to learning and motivation problems. Action and experience-oriented learning is only conditionally possible in educational establishments; situation and process-determined
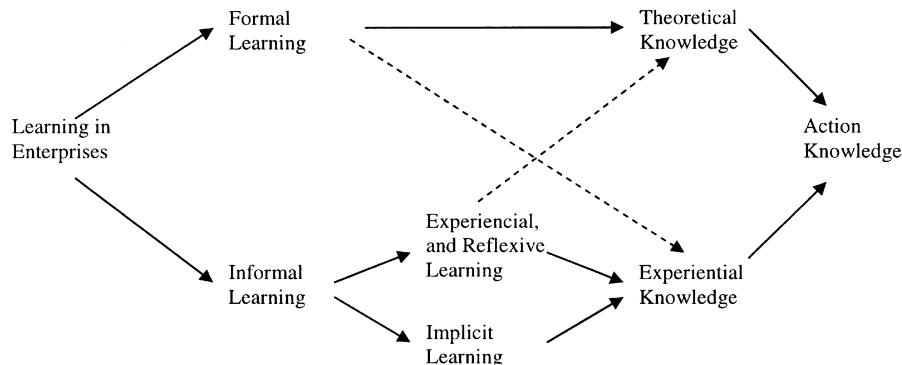
Figure 1. Kinds of Learning and Knowledge in Enterprises

modern work requirements can be anticipated and simulated less and less. Without any links to real work contents and real working conditions, vocational on-the-job learning will remain rooted in a formal understanding of education and will not lead to comprehensive professional action competence and reflexive capacity for action.

With the renaissance of learning on the job, a countertrend to the systematization and centralization prevailing until then developed for vocational training. The increasing importance of learning on the job is reflected in nearly all areas of vocational training: In advanced on-the-job training, learning on the job has been intensified, varied forms of learning have been developed, and self-directed learning has been revalued (Dehnbostel, 2002). For small enterprises, learning on the job by means of order-oriented learning and learning in networks has considerably increased in quality and scope. In large-scale and medium-sized enterprises, on-the-job qualification times have been increased, and forms of learning integrating work and learning such as quality circles and training workshops have been created. In the enterprises, the trend of centralizing vocational learning, which has prevailed for decades, has given way to decentralization which attributes decisive importance to experiential learning and informal learning on the job.

In this context, the business concepts and projects which emerged in vocational training at the end of the 1980s have been extensively discussed, among others under the heading "Dezentrales und erfahrungsorientiertes Lernen im Betrieb" (decentralized and experiential learning on the job) (Dehnbostel & Peters, 1991). Decentralization and increased learning on the job were the focus of the model test program "decentralized learning" also beginning at the end of the 1980s in which 12 individual model tests participated (Dehnbostel, Holz, & Novak, 1992). The program started out from the guiding thesis that in modern, technologically sophisticated work processes integrative forms of combining work and learning have become necessary and possible. The central issue for this combination of

work and learning in modern work processes was: "When selecting and developing workplaces as educational settings, it must be asked as to what extent systematic learning processes will be possible and how closely these can be combined with informal learning processes and learning processes guided by experience" (Dehnbostel, 1992, p. 19 *et seq.*). This combination of organized learning and informal learning is characteristic of the forms of learning "learning bay", "learning station", and "work and learning tasks" which were developed in this program and are spreading increasingly.

Informal learning is to be understood as unorganized and not formally defined learning at home and at work. According to Dohmen (1999), it is the basic "natural" self-learning of human beings, characterized as follows:

It does not take place in special educational establishments standing out from normal life and professional practice;

- it has no curriculum and is not professionally organized but rather originates accidentally, sporadically, in association with certain occasions, from changing practical requirement situations;
- it is not planned pedagogically conscious, systematically according to subjects, test and qualification-oriented, but rather unconsciously incidental, holistically problem-related, and related to situation management and fitness for life;
- It is not unrealistic stockpile-learning, but is experienced directly in its "natural" function as a tool for living and survival.

In international discussions, the concept of informal learning, already used by Dewey at an early stage and later on by Knowles, experienced a renaissance, especially in the context of development policy (Overwien, 2000, 2004). At first, informal learning was only delimited from formal school learning and nonformal learning in courses (Coombs & Achmed, 1974). Basically, this just created a residual category of learning which takes place outside of organized education. Marsick and Watkins take up this approach and go one step further in their definition. They, too, begin with the organizational form of learning and call those learning processes informal which are nonformal or not formally organized and are not financed by institutions (Watkins & Marsick, 1990, p. 12 *et seq.*). At the center of learning is the individual in a process of action and reflection. An example for a wider approach is Livingstone's definition which is oriented towards autodidactic and self-directed learning and places special emphasis on the self-definition of the learning process by the learner (Livingstone, 1999, p. 68 *et seq.*).

If one considers informal learning within the context of vocational learning, it has to be regarded as an important type of learning among all the types of on-the-job learning and knowledge. One must generally differentiate between organized and informal learning. Organized or formal learning is geared towards imparting specified learning contents and learning objectives. From the outset, it aims at a specified learning result while, with informal learning, learning is achieved without endeavoring it pedagogically.

Informal learning can be in turn subdivided into two types of learning: experiential learning, and implicit learning. To roughly distinguish between the concepts – which can only be separated analytically anyway – it can be stated that experiential learning is achieved by reflectively processing experience while with implicit learning the process is more likely unreflected and unconscious. In experiential learning, experiences are integrated into reflection and lead to cognition. This presupposes that the actions are not repetitive, but are integrated in problems, challenges, and uncertainties and thus affect the actor accordingly. This is usually the case in dynamic work processes and environments. Compared with experiential learning, implicit learning generates a learning process where the learner is not conscious of and does not reflect its progress and result. Pertinent examples for this are the learning processes which enable the learner to swim or ride a bicycle. But the skills of a chess champion and experienced physician or motor mechanic are also essentially learned through implicit learning processes. Learning is a rather unconscious process; it is experienced directly in the situation, without rules and regularities being recognized or even turned into the basis for structured learning processes.

The experiential knowledge accumulated through informal learning and the theoretical knowledge accumulated through organized learning is pooled in action knowledge. Experiential knowledge is not only accumulated through experiential learning and implicit learning, but also through organized learning provided this takes place. For in almost any situation in life, and thus also in the situation of organized learning, informal learning is going on – even though incidentally. Theoretical knowledge, on the other hand, is enriched through experiential learning inasmuch as theoretical discoveries can be made by reflecting on experience.

Research Studies about Informal Learning Related to Work in Germany

In the German context, there have been comparatively few studies so far which explicitly use the concept of informal learning. Already in 1994, the German Youth Institute (Deutsches Jugendinstitut) conducted a study on "informal education for adolescents by use of computers and media" (Tully, 1994). As a basis for the then following analysis of the media and courses provided, the author developed his own concept of "computer competence". This study is important because of the interaction addressed here between different educational settings and ways of learning for the mostly informal acquisition of the bundle of competencies important for the use of computers. Tully emphasized the role of informal forms of acquisition. He was brought to this by the obvious realization that the handling of programs could only be learned in practice. In addition, he discussed the dynamization of software knowledge, the speed of change which could not be anticipated, and, against this background, thought about which of the competencies acquired would later on be of application relevance for the adolescents in the professional context. According to this, computer knowledge, unlike general knowledge, can hardly be imparted by

school training. Here, "informal education" is prominent which is characterized especially by an individualization of learning and acquisition strategies. He attributed not only importance to it for directly computer-related learning processes, but also a special relevance for using computers as tools in learning processes going beyond this. "Informal learning" is particularly characterized by "… individual learning speed, own planning of learning progress, reinforcement and practice as required and not according to schedule as at school" (Tully, 1994, p. 183).

A qualitative study by Kirchhöfer dealt with informal learning in the daily conduct of life with direct reference to professional competence development (Kirchhöfer, 2000). Informal learning processes in everyday life were identified by means of recorded daily routine. From the record analyses, learner typing and learning strategies were derived. These were based on an increasing debordering of many people's situation at home and at work. Again and again, learning situations develop in the social environment where the results influence the process of professional competence development. The author thus directed special attention to questions of competence transfer from the social environment to the professional sphere. Kirchhöfer based this on a concept of informal learning which is closely related to the concept of self-directed learning and Livingstone's concept. According to this, informal learning has a "concrete goal anticipation". It is a conscious, reflected, and problem-oriented learning within a self-determined learning process. Formal learning is problem-independent and characterized by externally determined objectives and learning processes. Kirchhöfer also identified an incidental learning similar to implicit learning.

The particular importance of Kirchhöfer's study lies in its meticulous reconstruction of everyday learning situations and their analysis. Thus, it is established that learning situations are determined by work contents, organization of work, and the social context within the learning environment. Closed routine activities provide less learning content then relatively open work processes where the sequence is not yet predetermined. An externally provided structuring of the learning environment conducive to learning supports the individual learning performance, but at the same time the individual also structures the learning process by changing the learning situation (*ibid*., p. 80). In other words, the learning situation contains externally determined portions and, at the same time, it is also changed by the learning individual with respect to learning. The exploitation of learning opportunities will depend on the self-learning competence acquired in the course of the individual's life and an his/her motivation to learn. Kirchhöfer identified many learning strategies. He found observation, imitation, and experiential learning as well as mental trial actions. "Social-communicative strategies" play an important role: Talks and consultations make it necessary "to formulate action programs". It is also important to specifically use written resources such as instructions, technical literature, or internet inputs. Critical system analysis is also counted among the strategies (*ibid*., p. 81).

At work, a direct competence transfer will always occur if the learning situation is directly transferable, if the developed learning strategies are usable, and/or if

knowledge acquired in the everyday environment can be used. An indirect transfer will occur if a more general competence enhancement and identity growth, combined with improved self-esteem, positively affect the professional competencies. Since Kirchhöfer also analyzed case examples where unemployment or job-creating measures played a role, he realized that a professional transfer is also connected with employment prospects. With respect to his case studies and the transfer in professional activities, he regarded a "stockpile" acquisition of competencies as unrealistic (*ibid.*, p. 85). The typing of learning and the identification of learning situations, learning strategies, and transfer processes permit a number of suggestions for the shaping of learning environments and for combining informal learning with various forms of formal learning.

Stieler-Lorenz described a study conducted in the "New Länder" (former GDR) in 2000 (Stieler-Lorenz, 2002). It centered on the acquisition of job and occupation-related competencies which also consider references to learning in the social and political environment. The questionnaire for the 30 to 45 minute telephone interviews with 1012 persons was based on Livingstone's definition of informal learning. Only the learner him-/herself could evaluate his/her learning "by him/herself and reflexively" (Stieler-Lorenz, Frister, Jakob, Liljeberg, & Steinborn, 2001, p. 281). Experts would only be able to evaluate explicit learning, but not the individual's learning process. The study of the group around Stieler-Lorenz went one step beyond the Canadian study (see above) in that it combined the quantitative survey with qualitative parts of the study. 24 employees and 6 managers of three enterprises from "traditional industries" and "knowledge-based services" were additionally questioned within the framework of focused interviews since it was assumed that the enterprises were interested in the results of informal learning (*ibid.*, p. 302 *et seq.*). The results of the study emphasize the great importance of informal learning, especially in fields of learning relating to the general conditions of work (labor protection, labor law, organization of work, etc.), work with computers, customization, or work using new technologies and products (*ibid.*, p. 286).

On the basis of criteria generated by means of bipolar estimation scales and hypotheses based on the evaluations provided by those interviewed, the qualitative part of the study established that the work contents found in knowledge-based activities in "traditional enterprises" as well as in "knowledge-based enterprises" from the sector of software applications particularly encourage learning (*ibid.*, p. 306). In the latter enterprises, formal advanced training played a relatively minor role and was often limited to certificates from software producers. Those interviewed were of the opinion that organized advanced training could no longer keep up with the learning requirements of the job. Especially communication skills and social competence as prerequisites for market domination, handling of customers, and teamwork were acquired through informal learning. The "traditional enterprises" interviewed which evidently were larger enterprises (no details given), rather complained that their staff was too much orientated towards organized advanced training and had not yet learned to continue their training informally (*ibid.*, p. 311). All in all, one was faced with a situation where

informal learning was expected, but not stimulated and promoted by the enterprises. As a consequence of the study, it was noted as an unsettled issue that it would be necessary to find out how precisely informal learning processes took place, under what conditions, and how this type of learning could be promoted (*ibid.*, p. 213).

New Forms of Learning and the Organization of Work

Apart from the primarily analytical examination of competence development and different types of learning, the important question to be asked with regard to the practical side of on-the-job learning concerns the form of organization in which this will take place. Compared to functional adaptive learning for which traditional craft and industrial work processes at best provided instruction methods as a form of organization, a great number of different forms of learning organizations – briefly: forms of learning – have developed in the enterprises with the debordering and pluralization of educational settings and types of learning; namely, coaching, e-learning, quality circle, work and learning tasks, learning bays, and communities of practice, among others.

With respect to on-the-job learning, the question is, however, whether it is organized at all in special forms of learning such as those mentioned, or simply integrated into the normal work process. Especially the forms of work such as teamwork and job rotation associated with new business and organizational concepts are characterized by the fact that they combine working and learning to a high degree. The relative autonomy, unrestricted objectives, disposition diversity, and totality of reorganized work processes require this. Against this background, the new forms of learning and new forms of working shall be considered in more detail in the following, with the form of learning "qualification network" being dealt with separately because of its special significance to small and medium-sized enterprises.

New Forms of Learning and Working

If one considers the new forms of on-the-job learning, then the most important feature they have in common is that they purposefully combine informal learning with organized or formal learning. Even if these forms of learning clearly differ in their structures, objectives, and degrees of distribution, they have in common that work tasks and work processes are extended and enriched with learning systematic and work pedagogy in mind. Or, in other words: Working and learning are combined; informal learning incorporated into work-related actions is interleaved with organized learning by means of experience.

The new forms of on-the-job learning are also called decentralized forms of learning. They are characterized by a dual infrastructure: on the one hand, a work infrastructure appropriate to the respective work environment with respect to work tasks, technology, work organization, and qualification requirements; on the other hand, a learning infrastructure providing additional space, time,
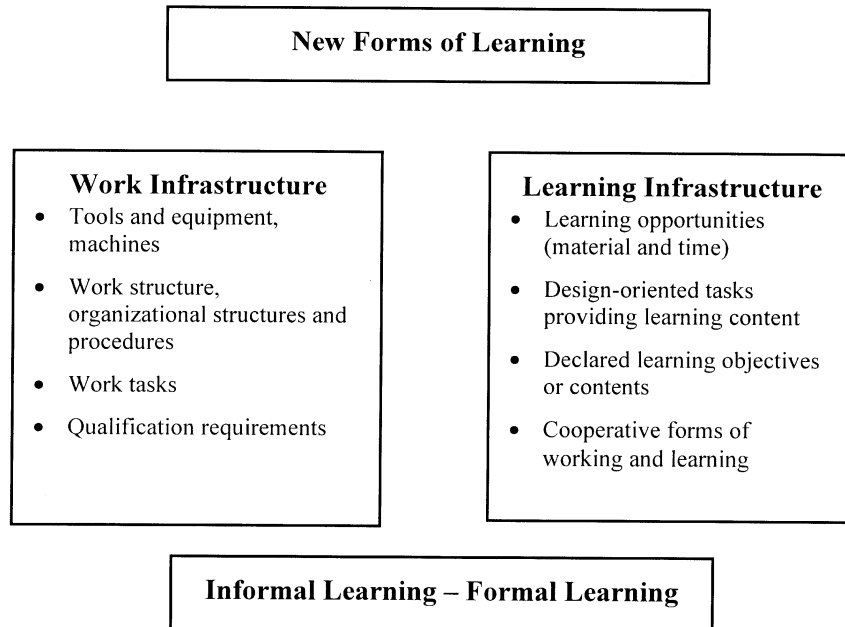
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│            New Forms of Learning             │
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┌──────────────────────────┐   ┌──────────────────────────┐
│    Work Infrastructure   │   │  Learning Infrastructure │
│  • Tools and equipment,  │   │  • Learning opportunities│
│    machines              │   │    (material and time)   │
│                          │   │                          │
│  • Work structure,       │   │  • Design-oriented tasks │
│    organizational        │   │    providing learning    │
│    structures and        │   │    content               │
│    procedures            │   │                          │
│                          │   │  • Declared learning     │
│  • Work tasks            │   │    objectives            │
│                          │   │    or contents           │
│  • Qualification         │   │                          │
│    requirements          │   │  • Cooperative forms of  │
│                          │   │    working and learning  │
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│     Informal Learning – Formal Learning      │
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Figure 2. Dual Infrastructure of New Forms of Learning

material, and personnel resources. The learning is work-based, but not limited to experience-related learning processes during work. Work-related actions and reflections related to them are interrelated with the declared objectives and contents of on-the-job training activities. As the following illustration shows, informal learning and organized learning are systematically combined on the basis of the work infrastructure interleaved with a learning infrastructure.

Decentralized forms of learning play an important role in both qualification and the initiation and establishment of innovations and improvement processes. They are geared towards the acquisition or extension of professional action competence and professional capacity for action and at the same time meet the qualification requirements on the job. The form of learning "learning bay" which has, in the meantime, become more and more common in on-the-job initial and advanced training is described in the following as an example.

In the early 1990s, learning bays were introduced within the framework of the model test program "decentralized learning" and have become conceptually and practically established within a few years (compare Dehnbostel, Holz, & Novak, 1992; Dehnbostel and Molzberger, 2001). Learning bays mostly originated in connection with business reorganization and restructuring measures, first in industrial-technical vocational training. They then gained increasing importance in advanced on-the-job training and were also adopted in the commercial domain. All in all, learning bays have proliferated greatly and become more

varied since their introduction a few years ago. Different forms of the learning bay concept have been developed in business use, such as the "learning and working bays", "temporary learning bays", and "learning centers". Their high acceptance must surely be attributed to both the qualification quality and cost-effectiveness.

Learning bays are a form of qualification and learning on the job. In learning bays, real work tasks are processed largely autonomously by teamwork, this being the same work tasks as those performed in the learning bay environment. As opposed to the surrounding workplaces, however, more time is available to carry out the desired qualification and learning processes. Summarily, learning bays are characterized by the following overlapping features:

- Learning bays are workplaces with added learning equipment where real work orders are processes and qualification takes place;
- the work orders meet the criteria of all-inclusive-type work and provide good opportunities and stimulation for learning through complexity, problem content, and a wealth of variants;
- in the learning bay, work is carried out in teams, with this form of organization being structured according to the principles of partly autonomous teamwork;
- a qualified person of the respective operating division who primarily plays the role of process advisor and development tutor of the learning bay team and has qualified in work and vocational pedagogy is in charge of the learning bay;
- learning bays can also be places of innovation in the work process, primarily for organizational, social, and methodological areas of work.

Although learning bays and other forms of decentralized learning have become established in individual enterprises, their distribution and growth will essentially depend on the extent to which learning for business requirements is not covered by new forms of work such as teamwork, project work, and job rotation because it is characteristic for these forms of work that they systematically fall back on learning during task processing in order to find problem solutions and decide on possible dispositions. As an objective of the development of business competencies, the "reflexive capacity for action" discussed above is essentially based on this.

These forms of business work must be considered as a special type of on-the-job learning. Learning is primarily carried out as informal learning and experiential learning; organized and intentional learning do usually not take place. Experiential learning is intensified especially in task processing, group meetings, or in continuous improvement and optimization processes; i.e. it is promoted by measures conducive to learning and by appropriate working methods. It is an informal, not organized, learning, but for all that its effects are taken into account because experiential learning essentially makes it possible to stick to the agreed objectives and establish integrated quality assurance processes and

participative improvement processes. Learning time is integrated into working time; the workplace thus also functions as an educational setting.

Qualification Networks as Modern Form of On-the-Job Learning

Traditional forms of learning and cooperation in vocational education such as the dual system as well as initial and advanced training networks are based on firm, mostly contractually fixed arrangements and offer traditionally oriented qualification measures and education. Most cooperation models have clear hierarchies and high commitments in organizational, legal, and financial matters. The didactic-curricular orientation is also mostly fixed and, at the most, provides the learner with opportunities for self-direction and co organization at the methodological level. This is contrasted by more flexible and open network approaches developed primarily in the industrial sphere, but also in the IT sector, during the past years.

Compared to traditional forms of advanced education and organization, including networks, vocational education networks are characterized by new control and cooperation principles. It must be pointed out in particular that there are no specified and hierarchically supported curriculum and qualification schedule, and competencies are developed on the basis of learning in interconnected structures and jointly supported agreements on objectives.

In vocational education, qualification networks seem to be most suitable for ensuring the cooperation and coordination of educational settings under self-direction and self-qualification aspects. It is a matter of promoting competence development processes as well as planning, organizing, executing, assessing, and evaluating qualification and vocational education measures (Benzenberg, 1999; Kremer, 1998). If one defines the concept of network more precisely semantically, it must be pointed out that networks comprises interactions and co operations between persons, groups, and organizations.

The Study "Informal Learning in Modern Work Processes"

Research Design, Methods and Description of the Field

The empirical research project, discussed in the following section, is based on a multi-methodical approach encompassing a survey of 110 written questionnaires of 500 SME in the IT-sector in Berlin, document analyses and three case studies. The case studies were at the heart of the study. All together 13 guide-oriented interviews with employees and management were conducted. The aim of the interviews was to induce the reflection of own learning processes in those interviewed without committing them to certain strategies, concepts, and learning routes. Consequently the interviewed persons could ex-post emphasise, retell or caricature specific facts on their learning and working routines. Since informal learning is tied to the subject, methods of data collection are required in any case which are open and thus permit research into individual, frequently incidental, learning processes.

There are various classifications of enterprises according to their size. In this study, the EU definition is used as a measure for determining the size of an enterprise. It results from the strength of the staff of an enterprise and its annual turnover (compare Bulletin EU 1996). Following the definition of the European commission SMEs engage less than 249 persons. Especially micro (1–9) and small enterprises (10–49 persons) usually don't have structural personnel development or formalized structures for learning as they can be found in large enterprises. They develop forms of learning through their own practice. In the past SME have not been in the focus of German vocational and educational research projects, although most of the employees are work in SMEs.

Summary and Key Findings

In the following the results of the study will be discussed along the lines of the main topics of, which are:

- Enterprise data and gender aspect
- Informal learning during the hours of work
- Formal learning and organized advanced training
- Competence development
- Work conductive to learning and new forms of learning

Under the last of the topics listed above, "work conductive to learning and new forms of learning", learning organization forms – in short learning forms – that were developed by the case enterprises are described. In those forms work is purposefully linked to formal learning. Thus they meet the requirements of modern enterprises by creating a purposeful framework that structurally and lastingly supports, requires and promotes learning. Additionally, some variants of different work organization forms are described, which are practiced in case enterprises and which also include learning components, so that they are conductive to learning.

Enterprise data. Initially the survey by questionnaire was used to register the structural characteristics such as size, areas of business and qualification of the employees of small and medium-size enterprises in the Berlin IT industry. It can be said that the majority of the small and medium-size enterprises are small and micro enterprises with less than 50 employees. The enterprises are relatively young; more than half of them were founded in the nineties. Their areas of business also show industry-specific structures, from consulting and the sale of systems over the administration and maintenance of these products to software development and the development of data bases. Enterprises of the telecommunications industry are not part of this study.

The three enterprises that were studied in more detail in our case studies represent in their variety the spectrum of the economic sector of the IT industry. A first, smaller enterprise developed an astonishingly broad offering of IT services that are connected with the sale of corresponding products. Most of the employees do not have completed a formal IT qualification. Some joined the enterprise

while studying computer science at the university and since then have not had a chance to complete their university education. The second enterprise works for a permanent customer and orients its business areas exclusively towards the needs of this customer. In contrast to the enterprise of the first case study, in this enterprise many employees have several qualifications and all have completed a university degree. Both enterprises have short communications channels and display an almost informal working climate. Finally, the third enterprise is larger and evidently about to develop a division of labor that is differentiated in more detail for a better handling of its business areas in the field of system support. The employees of this enterprise include lateral entries as well as formally qualified and certified personnel. Common to all three enterprises is that they strive to achieve "flat hierarchies". This goal, however, sometimes clashes with the requirements of smooth working processes. Thus the enterprises have a very heterogeneous staff structure with regard to the formal qualification of their employees, which is also confirmed by the survey by questionnaire.

Informal learning on the job. Both the case studies and the questionnaire survey give evidence of the great importance of informal learning processes in IT enterprises. The quantitative interviews show that the overwhelming majority of the enterprises assume that business knowledge is obtained informally. When on-the-job learning is considered as a whole, there is a different importance of different types of learning. The importance of communication-focused approaches for on-the-job learning, such as inquiries on the phone or direct consultation with colleagues, becomes evident.

> "And there is of course also a distributed knowledge here in the company. You can ask your colleague, who may not be able to solve the exact problem, because he is new, but who sees the problem from a different point of view or who has a different competence. Thus you are lead on a different track and you may then find a solution yourself." (GZ § 88)

The reason why the forms of e-learning play a comparatively subordinate role in the enterprises is probably also the great importance of direct communication among colleagues. Even if working with new media and technologies is a matter of course in IT enterprises, the proximity of the colleagues for learning processes is obviously an important basic requirement for successful work-related actions. The internet is usually used as a knowledge and information storage device that supplements the distributed knowledge of the employees within the enterprise. People resort to the internet, if a new work task cannot be performed with routine, in order to meet the learning requirement and if no colleague is able to help. In this process for example knowledge bases from product manufacturers are used, which serve as a replacement for on-the-job experience. A similar function is performed also by chats and newsgroups whose use varies greatly. As a learning strategy people resort to such platforms in particular if even an approach for the solution to the problem is lacking.

In practice informal learning appears generally as part of a problem-oriented

approach to work tasks. In the center is the problem that has to be solved. Strategies to solve this problem are to a large extent identical with learning strategies. In addition to discussing the problem with colleagues, actual approaches include making phone calls to personally known specialists or resorting to the internet, books or journals, though those are read mainly to update the knowledge about new products in general and more selectively. One employee ironically gets to the heart of the issue of learning and work by saying that learning must be "some kind of disease" that accompanies him all his life.

If the employees are approached with a new topic, at first it is important to isolate the relevant issues. In the case studies the employees describe the subsequent course of informal learning processes approximately as follows: A new work task, such as the installation of a new product, is supported by personal basic skills and basic experience concerning the behavior of computer systems. There may be situations, however, in which no more progress is made. People then consult help files or books or resort to the internet, where they visit newsgroups or certain forums. This involves experience from former work tasks. It is approximately known how a program was made to run and how a complex system reacts if individual components are changed. The employees that were interviewed also said that people should be capable of making good guesses. If concrete, sensory experience and trial and error on the acute problem are required to achieve sustained learning successes in the cognitively highly demanding field of information technology, this indicates a new form of tacit knowledge. Implicit learning and reflected learning experience complement each other.

All employees know the necessity to learn in the course of work projects – sometimes they feel that this is a pressure, sometimes they feel that this is a stimulus. If they are left alone with the informal learning during work, they get in a dilemma. This dilemma will become clear especially in the different assessment of advanced training and learning issues from the point of view of the management of the company and from that of the employees. This different perspective or the conflict of interest will become evident mainly in the handling of time and pressure of time with regard to project work as well as with regard to learning and learning needs. This results in the necessary balancing of business requirements and learning requirements within the enterprise that can be highlighted in the following fundamental question: At what time is learning useful? In the sense of our second thesis this "conflict" may be interpreted in such way that in the long term those enterprises will prevail that will support the informal learning of their employees in a way that it has its own legitimacy as an integral component of work.

Some enterprises have installed e-mail accounts for certain groups of employees or established their own documentation to record and transfer business knowledge and to permit communication between colleagues at different work locations. However, the handling of such data bases, guidelines, work process and project descriptions with established routine knowledge is still in the experimental stage. The aim is to make experiential learning of the employees a permanent process.

As a whole the studies show that qualification and business innovation are supported essentially by and through informal learning. The emphasis on and the extension of these learning processes in "natural" work-learning environments corresponds with the new appreciation of self-organization processes as well as with the orientation in everyday life and at work. Or, from a different point of view, this indicates that goal-oriented and largely organized learning is abandoned. The workplace as an educational setting is thus upgraded in its original form, which was oriented towards functional learning. At the same time this tendency involves considerable dangers, at least if the structure and intention of the learning were narrowed to the business function and if external educational settings were excluded. In this case personnel development and advanced training could not be performed systematically and in connection with inter-company and social standards. The studies have shown the intensity of informal learning. At the same time, however, they have shown that it depends to a large extent on the workplace and the specific order, and that it does not promote the general acquisition of competences on a broad basis.

Formal learning and organized advanced training. For the enterprises that were interviewed advanced training plays an important role; at least, it enjoys a high esteem. In particular in-house workshops, but also external seminars are considered the preferred forms of advanced training. The systematical development of their employees, of which two thirds of the interviewed enterprises say that they support it, includes for at least almost half of them also the release from duty.

However, in the case studies also a certain skepticism concerning concrete issues with regard to advanced training is encountered. Stockpile-learning is mostly not considered practical. In particular certification courses conducted by software manufacturers have a dubious reputation. Although they are considered necessary, this is justified by their publicity value. With regard to the contents and didactic organization of the courses, the statements of the people that were interviewed are rather reserved.

"For some time we also attended their demonstrations. However, I must say that I was not very much convinced by the results. Half of the demonstration is always a promotion event for beautiful new products. (…) Judged by the content, it is really not of much use, you rather have the feeling of having wasted your time. At any rate, this has been my experience to date" (BK § 246).

The advantage of product-oriented certifications is that with them a marketable qualification system has been established, which in certain market segments has also become a standard for quality control and order placement.

Nevertheless, there is a necessity for small and medium-size enterprises to design their own career development paths, because they usually cannot compete with large enterprises for highly specialized experts. However, the enterprises did hardly develop their own ideas in this respect, which is evident, among other things; in their reserved to skeptical view concerning a system for advanced IT training. In the opinion of the management of the enterprises company-specific competence requirements cannot be imparted within the framework of a "system" because of the dynamics of the development in the field of IT. The employees,

on the other hand, are interested in a systematic advanced IT training, because the chances for their professional development are better on the basis of qualifications that are also valid outside the company. It seems that presently the organized advanced training of the employees in the enterprises is limited to contractual provisions, the right to advanced training measures and the participation in courses of the product manufacturers. These marketable qualifications of the employees, however, are connected with dependencies of the corresponding employees and enterprises on the product manufacturers, leading to a orientation of the courses with regard to learning theory and methodology that is questionable.

Competence. In the case studies we asked in detail about the importance of human, social and functional competence in the business context. The answers given to these questions show that, although these competences are attributed an equal role compared to functional competences, subconsciously functional competences are considered to be more important. In case studies it is always stressed that although human and social competences matter too, these competences cannot be seen without the functional competences. Because they solve problems in record time, even "eccentrics" or "IT freaks" are valued with their functional competence in such a way that they can have their place in the enterprise as long as the other employees compensate for their lack of communication skills. The special emphasis on functional competence also corresponds with the repeatedly voiced comment that in the case of IT experts the important things are their fundamental attitude, talent, special approach and personality. In their self-conception as IT experts the interviewed persons have a certain "affinity" or a "potential". They see themselves as "persons doing their job out of conviction" or as "curious nursery children". Thus they consider their individual talents and their individual educational and professional biography particularly important to the development of their competences.

The empirical analysis of the functional, social and human competences, which jointly form the professional action competence, deals primarily with the interplay between these competences. According to our studies, one capability that integrates these three competence forms is the communication competence. In the case studies all interview partners mention the communication with colleagues in the work process as a central capability.

"In principle, this was in a purely autodidactic manner: by learning in various projects, which I initiated myself. (…) For me, this is the interesting thing about the IT sector (…), that I can define a learning path for myself wherever I want to go, whatever I want to learn next. You can realize this rather openly – in contrast to a large-scale enterprise or a government agency. There are those who also have an appropriate formal qualification" (UT § 53).

What is striking is that in particular lateral entries stress their non-functional knowledge and capabilities, emphasizing their self-learning capability and their communicative competences.

Organization of work so as to promote learning and new forms of learning. In the enterprises included in our study there are in some cases forms of learning

of the type discussed in Chapter 4. The great learning demands at work have obviously leaded to the development of new forms of learning. Only part of these learning forms, however, has been specifically developed for this purpose. Characteristic of such new forms of learning, such as quality circle, learning bays, coaching or e-learning, which appeared in large and medium-size enterprises, is the systematic linking of a work infrastructure with a learning infrastructure. In most of the enterprises of our case study, however, only the beginnings of the development of such structures, which are to ensure a continuous learning process in the enterprise and contribute to an increase in efficiency, exist.

The results of the case studies cannot be generally brought into correspondence with the information obtained from the enterprises that participated in the quantitative study. In the case study there are for example no clues for a purposeful coaching or for structured team discussions that, according to the questionnaire survey, are both performed by more than half of the enterprises. Nevertheless it can be said that the enterprises strive to support the communicative exchange about in-house work processes systematically and with the intention to achieve gains from learning. There are forms such as meeting day, team meetings for the discussion of problems that have to be dealt with or project manager circles for the discussion of current projects. These are mostly intended to provide for a smooth work process, but on the other hand provide time and space for learning. They can be called forms of work organization that are conductive to learning and that, in this function, are definitely comparable to semi-autonomous team work and other team meetings in reorganized enterprises.

A substantial characteristic of the work in the IT industry is that jobs are performed in the form of projects. In such projects, which may be oriented towards a complete business process, routine actions are again and again brought together with new experience, because they always lead to new situations.

> "Usually I will not go somewhere and do my routine job. Only once in a time. It is always a new situation. If I have here a permanent position, I know my stuff. But in project-related work and when workings at the customer's, things are always different." (BS § 95)

Beyond these project form of the work, the enterprises of our case study fulfill the criteria of a work that is conductive to learning that are presented in Chapter 4 to a varying extent and have also developed elaborated company-owned forms of learning.

For example the larger enterprise studied in the case studies has developed an individual form of learning by establishing so-called specialist working groups. In this groups employees of all fields that deal with specific problems meet. By the employees it is considered a distinction to be a member of a specialist working group. Interested colleagues may take the initiative if they want to become a member of a specialist working group. Each of the specialist working groups, whose job is the further development of the know-how of the enterprise, has a chairman who structures the work. Some topics may also be brought into

the monthly meetings by the executive board. The chairmen of the specialist working groups discuss matters regularly and form technical management levels. At the same time the specialist working group structure show the employees an opportunity for an individual development and career path.

Another variant to promote on-the-job learning that was tested in an enterprise of the case study included the setup of a model computer system in order to practice the installation of an operating system in the form of a game. When taking into account the working time allocated to this purpose, this measure was considered expensive, but on the other hand a workshop-like initial indoctrination and a follow-on coaching on such a system were considered more important than formal weekend seminars.

> "In this case we try to learn from each other and to learn by trial-and-error. Currently we are thinking how we can push that a little. We are thinking about whether it makes more sense to have people try out the new operating system and play with it on five computers for four weeks. This is pretty expensive. But on the other hand we do not think that it is useful to send people to a weekend seminar which is equally expensive (…). We rather consider providing a one- or two-day workshop-like initial indoctrination with technicians from partner organizations or even real lecturers and then a workshop-like coaching, so that there will be somebody around whom people can ask from time to time. But this trial-and-error process is important." (LK § 105)

This approach includes in turn linking the work infrastructure with the learning infrastructure. This is, however, more a work-associated learning, i.e. it is not directly integrated in the real work, but associated with it. It is also obvious that in this learning form the method of simulation can be directly connected with workplace-related learning. Additionally, this indicates that coaching as a learning form should follow the workshops.

In the three qualitatively studied enterprises organized workshops are the most distinct learning form that exhibits signs of the formalization of informal learning. In these workshops for example an employee with special knowledge or an external person presents his knowledge about specific business topics and if necessary demonstrates the required skills. Also personal networks are used to invite known personalities to lecture on business matters or an up-to-date operating system. The choice of words of the interviewed persons ("indoctrination" etc.) indicates that these workshops are demand-oriented, but nevertheless formal. A didactic approach is explicitly expected ("viewgraphs and documents"). The different forms and arrangement variants of in-house workshops range from casual meetings with friendly experts to indoctrination-like "events" extending over several days. The use of the things that have been learned ranges from direct application to additional background knowledge. Common to these different variants is common that a defined learning space is created that is relieved from acute work requirements and in which expert knowledge is presented systematically. In these work-related and mostly work-associated workshops working and learning are brought together. They also perform the function

of reflection discussions as they are planned in the new advanced IT training in accordance with the APO concept.

> "Another thing we did, and where the result was not bad, was to invite two friends who talked to us about various topics for one or two days. We paid them for this, to be sure. And they gave us lectures on some ideas and technologies we already knew well. These lectures were worked out in detail with viewgraphs and documents and all, which was very nice. The drawback was that although we needed this knowledge we did not directly have the opportunity to use it at that time. If I remember well that since then half to three quarters of a year has passed, and now we are beginning to work with it, but you find that you have already forgotten approximately 90 percent of it." (BK § 185)

Workshops are thus an important form of in-house support for the learning of the employees and they fulfill this function in the sense of our initial theses by combining informal learning and formal learning. For a more detailed understanding of the processes it is necessary to find out in each case whether it is an workshop with the primary aim of learning and qualification. In this case this is a form of learning. If it is, however, a workshop with the aim of working on a job, then this is a form of work that includes informal, if necessary also formal learning. Both forms can be encountered and the transitions are fluid. Also these working-learning forms are quite obviously just being developed and shaped.

To summarize it can be stated, that the SME of the IT-sector have recognized the need to systematically support their employees and that at the same time they are testing various forms of such support. This is substantiated by the results obtained by the questionnaires as well as by the case study. The organization of work by including criteria concerning the promotion of learning is done more intuitively and based on slogans like "we can manage it", "to pull oneself out of the mud" or "to make a virtue of necessity". This situative handling of learning and advanced training of the employees does hardly exhibit any structural and sustained enterprise-specific concepts. The thesis that we placed at the beginning of our study, i.e. that a professional education management is required to support learning at work, is thus convincingly proven.

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