Work Process-based Competence Development in the Software Industry

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Abstract

Learning is an important part of work. This is especially true for knowledge work. The core activity of knowledge work is problem-solving under utilization of domain expertise. Domain expertise is likely to outdate quickly, unless learning is applied. The professional has a variety of options for organizing the learning process. Beyond organizational training offerings, the professional can learn on his or her own.

The thesis has the goal of answering the following guiding question: *How do professionals in organizations learn in the work process?* This leads to three subgoals: 1) Theoretical research related to professional learning and organizational support, 2) Conducting empirical research with a focus on learning needs and learning in the work process, 3) Transfer of the results into the organizational domain.

The research has been performed with the following constraints. Focus is the learning process at work. The investigation only considers experienced professionals in the software industry. Experience means that someone has more than five years of on-the-job expertise and has been promoted to a senior-level position. The workers considered include topic experts as well as managers.

To investigate the work, a qualitative study is conducted in a software company. The study includes 50 participants. The study has a mixed-method design, integrating different data collection strategies, and combining qualitative and quantitative inductive methods in the data analysis. The study was performed over a period of one year and collected 800 hours of participant observation data in six countries.

The results show, that learning is an inseparable part of the work process. A number of similarities and differences are identified, based on the job type and work location for the investigated professionals.

Zusammenfassung

Lernen ist ein wesentlicher Bestandteil der Arbeit. Dies gilt insbesondere für die Wissensarbeit. Die Kerntätigkeit der Wissensarbeit ist Problemlösung unter Ausnutzung individueller Fachkompetenz. Fachkompetenz kann schnell veralten. Darum ist kontinuierliches Lernen eine zentrale Herausforderung. Der Professional hat eine Vielzahl von Möglichkeiten, den Lernprozess zu organisieren. Über die organisatorischen Schulungsangebote hinaus gibt es auch die Möglichkeit selbstständig zu lernen.

Diese Arbeit hat das Ziel, die folgende Leitfrage zu beantworten: *Wie lernen Fach-und Führungskräfte in Organisationen im Arbeitsprozess?* Dies führt zu drei Teilzielen: 1) Theoretische Forschung in Bezug auf professionelles Lernen und organisatorische Unterstützung, 2) Durchführung empirischer Forschung mit dem Schwerpunkt auf Lernbedürfnisse und Lernen im Arbeitsprozess, 3) Transfer der Ergebnisse in die Organisation.

Diese Forschungsfragen zielen auf die Untersuchung des Lernens im Arbeitsprozess ab.

Folgende Einschränkungen gelten für die vorgestellte Forschung. Der Schwerpunkt liegt auf den Lernbedürfnissen, wie sie sich für erfahrene Fachleute in der Softwareindustrie ergeben. Erfahrung bedeutet, dass jemand über mehr als fünf Jahre Erfahrung in seiner ausgeübten Tätigkeit verfügt und diese in leitender Position ausübt. Zu den in Frage kommenden Mitarbeitern gehören sowohl Domänenexperten als auch Manager.

Die wesentliche Forschungsaktivität der Arbeit ist die Durchführung und Analyse einer qualitative Studie in einem Softwareunternehmen. Die Studie umfasst 50 Teilnehmer. Die Studie verwendet einen mixed-method Ansatz. Es werden verschiedene Datenerhebungsstrategien und sowie qualitative und quantitative induktive Methoden bei der Datenanalyse integriert. Die Studie wurde über einen Zeitraum von einem Jahr durchgeführt und sammelte 800 Stunden Beobachtungsdaten der Teilnehmer in sechs Ländern.

Die Ergebnisse zeigen, dass das Lernen ein untrennbarer Bestandteil des Arbeitsprozesses ist. Es werden zahlreiche Ähnlichkeiten und Unterschiede identifiziert, die für Lernen im Arbeitsprozess gelten. Dies insbesondere im Hinblick auf die Art der Arbeit und den Arbeitsort der untersuchten Fachkräfte.

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1 Introduction

Many professionals perform knowledge-intensive work in organizations. A work type that relies on the ability to realize work goals based on expert knowledge, experience, and non-routine problem-solving. The constant increase of information, fast-paced innovation, and organizational transformations make it necessary that professionals continuously learn to adapt to new requirements. Regarding learning, organizations and professionals share the same goal. Learning needs should be addressed efficiently.

In an organizational setup, the responsibility for learning is typically taken over by the individual as well as by the organization. In the first form, the learner takes responsibility by executing his work in a way that supports learning. This includes, on the one hand, reinforcement of abilities by repeating familiar activities and, on the other hand, understanding learning needs and addressing them in the work process. Both examples stand for individual learning in the workplace. In the second form, the organization takes responsibility. Learning offerings for selected topics are created and distributed to the professionals. The professionals learn by making use of these offerings.

An alignment of individual learning and organizational support is necessary. This should be achieved through a good understanding of the learning needs of professionals.

In this thesis, the work process of professionals is analyzed to gain an understanding of learning needs and the way learning activities take place during work. This information is intended to support the process of developing learning opportunities in organizations. In this way, the learning responsibility of professionals can be recognized and supported by the organization.

Section 1.2 sketches the background of the thesis in more detail, giving specific focus to workplace learning concerning organizational people's development. In section 1.3 the concrete goal of the thesis is specified. The section 1.4 provides an overview of the chapters of the dissertation.

1.1 Basic Definitions

Initially, a set of definitions is required. The terms *organization* and *company* are used interchangeably within this work. They reference a legal entity and association of people with a declared goal, typically profit-orientation. The goal is achieved by selling products or services. These are created in a collaborative effort of the workforce in the use of goods. The organization is composed of functions that organize the associated people and allow interaction with individuals and other businesses. The main functions are production, research, development, purchasing, marketing, human resource management, accounting, and finance. Organizations participate in a market economy. All organizational interactions with the economy follow legal regulations.

The people associated with the organization form the workforce. People who belong to a specific profession based on education and related specific knowledge sets are called *professionals*. People are associated with an organization based on contractual obligations. Professionals apply their skills and get compensation for this. Typically, the contract specifies a job role, assigns people to a business function, and outlines the main goals of the activity. The type of work done by people varies significantly from one type of company to another, and concerning the company function people are assigned to. Typically jobs will have different degrees of autonomy and control imposed on the individual. When it comes to the required capabilities, the degree of autonomy plays an important role as it roughly distinguishes rule and skill application from using complex problem-solving skills at work. The thesis concentrates on the domain of knowledge-intensive companies with a specific focus on high-tech products. For this domain, autonomy and problem-solving orientation are of great importance.

1.2 Problem Definition

Societies have undergone several changes, in all cases affecting the way people invest their abilities to satisfy existential needs. Dominant work activities included hunting, later farming, manufacturing, and finally, work with information in the industrialized and post-industrial societies (Patrick Nolan, 1999). Work with information as knowledge typically is attributed to the knowledge society. Knowledge has become the core productive factor in knowledge societies (Drucker, 1993), which can materialize in several ways (Bindé et al., 2005). The productivity of the knowledge society, to a large extent, is generated by organizations that employ knowledge embodied in the workforce.

The related transformation process started as early as 1950 but still continues. Initially, knowledge work gained increasing relevance in an effort of making companies more flexible towards the market (Beniger, 1989), then being part of a global shift of material work to low-wage countries (Castells, 2009*a*). In the global shift, knowledge workers coordinate the globally distributed processes, with people and increasingly automation technology realizing the material work. The latest transformation is the transition towards full automation and digitalization. Material work is increasingly done by fully automated systems. Industrial robotics is a prominent example of automation replacing routine jobs, having consecutive annual growth of 10 to 15%[1].

While the roles of the knowledge workforce change, the knowledge workforce itself is continuously growing. The world development report 2019 shows this (Stromquist, 2019). There is a global decrease in material processing positions. In parallel the workforce in knowledge-intensive areas grows, at least in the western society.

Knowledge Work Skills and Learning. The workforce for the knowledge society requires an appropriate skillset. Identification of this skillset and preparing educational systems to provide it has gained a lot of attention in multiple initiatives, like the

[1] World Robotics Report 2018, https://ifr.org/downloads/press2018/Executive_Summary_WR_2018_Industrial_Robots.pdf (accessed 18.12.2019)

21st-century skills (Pellegrino and Hilton, 2012) or projects like NextSkills (Ehlers and Kellermann, 2019).

Reports from these initiatives have in common that self-directed learning or autonomous learning skills are mentioned. In other words, the ability to identify new information and learn for the purpose of self-development is considered to be a part of the knowledge worker as a modern professional. In other words, the knowledge economy goes together with an ongoing need for learning. The work of (Conceição et al., 2001, p. 4) proposes that "in a learning society, individuals, firms, and organizations are not merely consumers but actively and continuously seek to nurture, manage, and harvest their knowledge assets".

One of the reasons for this is the fast pace of innovation (David and Foray, 2003), which goes together with a permanent increase in information. Fuller's knowledge doubling curve indicates this. Up until the 19th-century, knowledge doubled every century, while today, knowledge doubling is assumed to be field-specific with times like 12 months for nanotechnology or 18 months for medicine (Buckminster, 1981). The knowledge term is misleading. It is more likely that Fuller refers to a doubling of work-related information in different domains. Even with this adaptation, it is the professional who needs to reason about the vast amount of information. The increasing amount of information goes together with a continuous modification of organizational structures and targets. Knowledge workers face the resulting modifications. A jobs report from the world economic forum 2018 states that 54% of all employees require reskilling or upskilling (Van Holm, 2018). Similarly, a Deloitte study in 2019 stresses that 90% of the study respondents are changing the job structure in their organization; for 32%, the transformation happens on an essential level (Volini et al., 2019). In most cases, this results in redesigning work processes and altered skill-requirements towards the workforce.

Organizational Ownership of Learning. In some cases, the responsibility for assuring that the required learning takes place is given to the organization. In a well-known statement (Drucker, 1994*a*, p. 83) emphasizes:

> Productivity in knowledge work and service work demands that we build continuous learning into the job and into the organization. Knowledge demands continuous learning because it is constantly changing. But service work, even of the purely clerical kind, also demands continuous self-improvement, continuous learning. The best way for people to learn how to be more productive is for them to teach. To obtain the improvement in productivity, which the post-capitalist society now needs, the organization has to become both a learning and a teaching organization.

In other words, the company has to teach people the necessary information. This perspective is lived today. Following a McKinsey study targeting learning in companies, 58% of respondents said that building employee capabilities is across the top 3 company priorities, for 90% of the respondents, it is in the top 10 (Gryger et al., 2010).

Overall, the global training market has a size of 366 billion dollars per year[2].

The same McKinsey study reports that only a quarter of the companies assumed that trainings are *extremely effective* or *very effective*. The considered trainings are mainly on-the-job teaching (59% report this as exclusive or extensively used), other forms like coaching, online learning courses are mentioned with 30% to be used extensively. Group learning online is reported only by 12% to be used widely. In the last three years, it seems to have changed. The LinkedIn study shows a shift in the budget for online training programs (Chelovechkov and Spar, 2019). Fifty-nine percent of the participants stated that their company spends more on online training, while 39% spend less on instructor-led training. The used content is in 85% of the cases internally created for their own employees.

One of the reasons for the lack of effectiveness provided by the respondents was that 67% of the respondents do not think that the training programs focus on the most important capabilities. This is supported by a 2019 LinkedIn study across 1200 learning and development professionals and 2100 learners. The study showed that skill gap identification is considered the number one priority for learning development (74%, an increase of 32% compared to 2018) (Chelovechkov and Spar, 2019).

This suggests that the relevance of learning increases if organizations have a better knowledge of the learning needs of professionals. This is supported by another section of the McKinsey study. A positive influence is identified if senior executives are responsible for the training agenda. In contrast, if the HR department generates the training agenda, the perceived performance increase due to training is smaller.

A study across users of an online learning community (24x7 learning) of 250 learners from 12 countries supports the findings, more from a professional perspective[3]. Only 11% of participants report that they can make full use of the learning content because their job requirements are not met by the training. Sixty nine percent of the participants see customization of training content as relevant, with 59% being interested in social and collaborative learning approaches. In other words, the scoping of learning offerings does not meet actual requirements.

It is noteworthy that none of the considered studies mentioned that professionals were involved in the decision for development domains or learning agendas.

Individual Ownership of Learning. An alternative perspective towards learning ownership is to target the workforce and workplace learning (Billett, 2002; Billett et al., 2006; Billett, 2001*b*, 2004*b*). Workplace learning considers all the learning activities which happen during daily work. This not only includes reinforcement of learned abilities

[2]Statista. Spending in the global workplace training industry 2007-20, E. Mazareanu, status: Sep 12, 2019, https://www.statista.com/statistics/738399/size-of-the-global-workplace-training-market/ (accessed on 20.12.2019)

[3]The company conducting the study does not exist anymore. The actual report cannot be accessed. The numbers are taken from a press release accessible here: http://onlineprnews.com/news/634350-1444730231-report-on-workplace-learning-released-by-24x7-learning-inc.html and https://issuu.com/24x7learning/docs/workplace_learning_report_2015.pptx (date of access: 18.12.2019)

by just repeating them but also the generation of new abilities based on problem-solving or ad-hoc learning from colleagues.

The workplace is a learning environment (Moore et al., 2004) which is used in the work process. Learning needs in this setup show whenever the realization of a work task is hindered.

Workplace learning research mainly focuses on the types of learning that emerge in work processes. A deeper investigation of the relationship between the work process, learning needs, and individual decision for learning was not done yet. Moreover, there is currently little research that considers the knowledge workplace of today (referring to 2019). Gaining a deeper understanding of the work process in these environments, the learning need formulation, and the resulting learning would increase the knowledge about workplace learning. Furthermore, the information could be useful to improve the character of organizational learning support to be more oriented towards the requirements of the workforce.

1.3 Research Objectives and Scope

Based on the specified problem, the thesis has the goal to answer the following guiding question: *How do professionals in organizations learn in the work process?* This leads to three subgoals: 1) Theoretical research related to professional learning and organizational support, 2) Conducting empirical research with a focus on learning needs and learning in the work process, 3) Transfer of the results into the organizational domain.

There are constraints for the work. The focus is learning needs as they emerge for experienced professionals in the software industry. Experience means that someone has more than five years of on-the-job expertise and has been promoted to a senior-level position. The workers considered include topic experts as well as managers.

To investigate the work, a qualitative study is conducted in a software company. The study includes 50 participants. The study has a mixed-method design, integrating different data collection strategies, and combining qualitative and quantitative inductive methods in the data analysis. The study was performed over a period of one year and collected 800 hours of participant observation data in six countries.

1.4 Structure of Dissertation

The dissertation is composed of two main parts which cover the theoretical and empirical research. Chapters 2 to 8 contain the theoretical part. Chapters 9 to 11 contain empirical research. The theoretical part presents the background and foundation of the research activity. The empirical part includes research questions, study design, and results. Chapter 12 summarizes the results and draws conclusions from the findings.

Chapters 2 to 5 focus on the perspective of knowledge workers. The identification of a learning need and the decision for a way learning process are investigated.

Chapter 2 introduces the knowledge work concept and specifies the main characteristics of the knowledge worker. The relevance of learning for the knowledge worker is

investigated further. It gets obvious that the identification of concrete learning needs is difficult because they are very individual and not necessarily formulated. This guides the investigation of the work process. The work process is the only reliable manifestation of knowledge work and likely also a manifestation of learning needs.

Chapter 3 focuses on the relationship between the work process, learning needs, and the learning process. Action regulation theory is used to demonstrate how learning needs emerge in work processes based on a mismatch between goal anticipation and achievement. Based on this, learning is specified from an experience perspective, discussing Dewey's concept of reflective experience and Piaget's concept of accommodation and assimilation. Work, learning need identification, and learning can integrate closely, but only if the professional decides for this. The decision taken by the professional is to acknowledge a learning need and to decide on a way of tackling the need. This decision not only influences whether learning takes place but also the quality of the learning process.

Chapter 4 sets the insight from the previous chapter in the context of workplace learning. Then the learning decision of the previous chapter is investigated more closely. The valuation of different learning options is described using meta-cognition, learning goal specification, and motivation. Two broader decision domains are introduced, the personal approach via self-directed learning and the collaborative approach using the co-construction of knowledge.

The influence of environmental aspects on the learning process is presented in chapter 5. The concept of culture is discussed to derive how a learning culture can emerge in an organization and how it might influence the individual learning process. Especially the development of communities of practice is highlighted.

Chapters 6 to 8 deal with the organizational perspective of learning. Learning is described from a strategy-aligned competence development perspective. Different standard techniques to derive requirements and develop learning offerings are introduced.

The need for teaching people through an organization to align the organizational capabilities with the organizational strategy is specified in chapter 6.

Chapter 7 introduces competence as a category to specify the abilities of individual workers. The techniques organizations apply to derive competence requirements are sketched. It is shown that often competence requirements are defined in a top-down manner without considering the actual needs of the workforce.

The process of developing learning offerings is the focus of chapter 8. This includes the specification of different learning offering types (formal, non-formal, informal). Furthermore, instructional design is presented, including the ADDIE process for developing learning offerings.

The empirical part in **chapter 9** begins with a summary of the insights of the theoretical part. Based on this, research questions are identified. The empirical focus is on the validity of using the work process to investigate learning. Further, the relation between the work process, individual competence, and learning activities is investigated. Lastly, the influence factors on the learning processes are investigated (location and work profile).

Research design in **chapter 10** describes the mixed-method approach used for empirical research. The reasons for choosing the approach are discussed. The observation

technique applied in the research is presented in detail, together with the overall study setup and information about the data set.

Chapter 11 presents the results. Based on the theoretical assumptions, the results from the empirical study are discussed. Conclusions are drawn, and the first implications for the understanding of workplace learning and related needs are mentioned.

The overall discussion of the research is given in **chapter 12**. Options for using the results to inform about organizational learning need identification to improve the alignment of corporate learning offerings and workforce requirements are considered.

2 Knowledge Work and Learning Needs

The term knowledge worker captures a specific type of work, which is very prominent in many companies. Knowledge workers do the kind of work that is hard to automate or standardize. They organize work processes, do research and development activities, or do the marketing. Knowledge workers are professionals with deep insight into their domain and have a high degree of freedom when it comes to how they organize their work.

A fast pace of innovation has effects on the way how knowledge work is done. Organizational structure, as well as tool change and even the core knowledge in certain domains, tends to be outdated after a few years. Therefore, knowledge workers have to learn continuously to keep up with the requirements.

Supporting knowledge workers in doing this learning is the scope of this work. This chapter introduces the knowledge work concept in detail. First a historic summary is given (see section 2.1) and the characteristics of knowledge workers are described (see section 2.2). Then the development need is described with more focus on the work environment of the knowledge worker (see section 2.3). Finally, a core assumption of this thesis is introduced: The knowledge work process materializes decisions, problems, and solutions of the knowledge worker. The development needs of the knowledge worker materialize as part of the work process. To understand the limitations of a knowledge worker's abilities, it is important to understand the work process. This perspective is introduced in section 2.4.

2.1 Knowledge Work

The literature distinguishes material-based and knowledge-based work (Drucker, 1996). Material-based work focuses on the transformation of material from one form to the other. Knowledge-work focuses on the transformation of information from one form to the other. In this process, the application of knowledge to solve problems is important. The knowledge worker is "a knowledge executive who know[s] how to allocate knowledge to productive use" (Drucker, 1993, p. 7). Products can interact with the world, like speeches and discussions, as well as single semiotic pieces like documents, PowerPoint, or software code. These products are supposed to effect. The effect can be manifold. Examples are a) the modification of the way work is done (based on manuals or workflows as knowledge work products), but also b) opinions or shared mental models such as how a fact is considered (based on legal documents as knowledge work products) or c) how a society understands itself (like papers in the humanities as knowledge work product).

The strict separation of knowledge and material-based work has limitations. For pure information-focused professions in the legal domain or software domain, the knowledge work nature seems obvious. There is work with information based on existing knowledge to solve a problem. Manual work only happens for interaction with machines to persist information, like a word processor on a computer. For other professions, it isn't easy, as material-based work and knowledge work is blended. An example is a person working in a repair shop, on the one hand, analyzing problems to identify root causes and then applying manual work to solve the root cause.

Limiting knowledge work to the idea of information processing should be avoided as well. Many jobs are centered around information processing but based on stringent guidelines like work-flows. An example is case management, as a person in a call center, strictly following the dialog work-flow supported by a computer tool or treating contract data following a strict execution procedure. In such cases, people are not allowed to add individual thoughts to solving cases, which would harm the goal of standardized case processing. These persons should not be considered as knowledge workers. In this thesis, someone will be considered a knowledge worker if the obligation and freedom to apply their own knowledge to solve problems is a core characteristic of the job.

The existence of knowledge work is closely connected to the most basic idea of separation of labor and exists for thousands of years. Before the 20th century, the fraction of material-based labor by far outnumbered knowledge work. In the 20th century, the structure of labor changed, and the fraction of knowledge workers outnumbered the material-based labor in western society. In the following, the work of Drucker (1996) and Castells (2009*b*)[1] is used to sketch the transformation in more detail.

The increasing relevance of the knowledge work happens in the context of a societal transformation towards a so-called knowledge society (Drucker, 1996). The knowledge society considers the knowledge and the ability to apply knowledge as a core asset, in contrast to the industrialization-specific focus on operating resources. "The shift to the knowledge society [...] puts the person in the center. In doing so, it raises new challenges, new issues, new and quite unprecedented questions about the knowledge society's representative, the educated person" (Drucker, 1994*a*, p. 191). Individual problem-solving capabilities become part of the core business of companies. The organization of the knowledge worker and methods to improve his efficiency gain increasing relevance.

The idea of the knowledge society should not mistakenly be considered to state that material-based labor is disappearing. The concept helps to understand the knowledge worker as a profession with high relevance in some parts of the world. Castells provides a broader perspective. He considers the relevance of knowledge work in connection to global development: "Globalization [...] changes the labor markets and places multiculturalism at the forefront of social dynamics" (Castells, 2009*b*, p. 1972). The perceived relevance of knowledge work in some regions is a side-effect of a global separation of duties: "The structural conditions of a knowledge economy growing [...] within the context

[1] Castells (2009*b*) work on the *information society* analyzes the global economy of the 21st century as a result of these structural changes in the 20th century. For a discussion of earlier processes, consider the work on innovation and control relationships by Beniger (1989).

of a large economy of low-skill services" (Castells, 2009*b*, p. 1973). Castells describes knowledge workers as "self-programmable labour", so-called "talents" with flexibility and decision-making autonomy in the work process (Castells, 2009*b*, p. 1939). The increasing separation of duties on a global scale generates the need for organization and control solved by knowledge workers. These people perform work that organizes *generic labor*, or in other words, generic labor follows instructions imposed by a knowledge workforce.

For Castells, the global transformation of how work is done, including the relevance of knowledge work, results from "interaction between technological change, institutional environment, and the evolution of relationships between capital and labor in each specific social context" (Castells, 2009*b*, p. 1973). Castells' investigation considers flows and exchanges of information, capital, and cultural communication in the global economy. Based on this, he identifies transformations that affect the way knowledge work is executed. One aspect is the connection between companies and financial markets using information and communication technology with the internet as a global network structure. The results are complex interactions in global workforces of different organizational constructs that take place in real-time. The pace of work execution and the perception of respective effects across the globe increases dramatically. On the one hand, only this allows coordination and control on a global scale. A global production requires that every involved activity on every location on the world knows when to do what – coordinated by real-time communication. The resulting speed and complexity impose high requirements on the workforce. The assumption is that the required knowledge workforce needs be able to interact with the involved communication technologies like general communication (emails, meetings), resource planning (ERP), and manufacturing execution systems (MES) while understanding the cause and effect relationship of their activities. This seems to foster the need for a skilled knowledge workforce.

An industry for which the mentioned aspects are especially relevant is the high-tech industry. While spanning across various domains, the core of the high-tech industry is the use of innovation to generate new technologies and continuously improve products. The current process of *digital transformation* (Iansiti and Lakhani, 2016; Andal-Ancion et al., 2003) accelerates this even more. Companies must keep up with the speed of innovation without compromising product quality or quality of service. As an effect, high-tech companies typically manifest as knowledge-intensive: The core asset is a highly skilled workforce of knowledge workers. The workforce adapts to the high pace of innovation, learns new technologies for introducing and improving products and services. As a high tech industry, the software industry will serve as a relevant example in this thesis.

Definition: A knowledge worker is a professional, mainly working on transforming information to achieve a measurable effect in his work environment. The information transformation has problem-solving characteristics. Despite contextual conditions like time and resource constraints, the knowledge worker has high degrees of autonomy in deciding for an appropriate work process.

2.2 Knowledge Worker Characteristics

The main characteristics shared by most knowledge workers are described in the following. The fundamental understanding of a knowledge worker will be used in this thesis as a foundation for further investigations.

Several investigations of commonalities of knowledge workers exist with very different focal points. This includes work on psychological contracts (O'Donohue et al., 2007; Flood et al., 2010), work goals (Davenport et al., 1996; Quinn, 2005) or general aspects (Jemielniak, 2019; Pyöriä, 2005). Used methods include questionnaires, interviews, and observation (Antikainen and Lönnqvist, 2006; Reinhard et al., 2008; Grubliauskaite, 2017). As knowledge work spans across a large variety of domains, many investigations have been performed on specific labor groups. Investigation of the respective work shows strong commonalities. The following presentation only uses insights that did not show different opinions between different focal points or domains.

The foundation for doing knowledge work is typically a legal contract with an organization. The contract specifies a salary and roughly sketches the type of work done by the knowledge worker. Based on this, the knowledge worker is embedded in an organizational structure of teams and departments. Typically, the knowledge worker has a disciplinary supervisor and colleagues.

The disciplinary supervisor provides the actual goals of the knowledge worker. These goals can be specified in terms of key performance indicators to be fulfilled (e.g., number of leads to be generated, number of inventions and patents to be filed) or more abstract goals (e.g., changing the process of delivering products, developing a product). For these goals, no explicit solution pattern or process is given, but only resources, including time constraints, are provided.

A knowledge worker can work in a global setup. The work-peers can be in various locations, even different organizations only being related by belonging to a shared effort. The locations can be dedicated to office buildings but also home and arbitrary transient places such as trains or planes. In all cases, the relevant aspect is that people are doing knowledge work.

The knowledge worker typically has a high level of expertise (Davenport et al., 1996). This includes a good formal education combined with knowledge gained by applying it. The literature points out that there is no immediate need for formal education, but that in practice, it is difficult to get the required jobs without a good education (Pyöriä, 2005). Still, studies show that in many cases, a university degree is not necessarily required (Mládková, 2012).

Some research work was done on psychological contracts of knowledge workers towards the organization they work for (O'Donohue et al., 2007; Flood et al., 2010). This work gives some insight into the self-understanding of knowledge workers. Knowledge workers consider themselves as professionals in a particular domain, which goes together with having deep insight into their domain. People are proud of their expertise, their achievements, and the people network they have within and beyond their organization. This results in a mental obligation towards successful work execution, a personal promise to deliver results as needed.

2.3 Personal Development Need

The previous sections have described the expertise of the knowledge worker to be of high importance. It is not only the expertise which makes the knowledge worker able to do the work, but also an essential part of the self-understanding. In the following, the dynamics of maintaining expertise are described. This will show that knowledge work expertise can become outdated and that there is a personal development required to stay an expert.

The expertise of the knowledge worker might face transformations in the domain. Growing speed of industrial production, technology influences, and related organizational changes require an ongoing adaptation of the knowledge workforce – in terms of knowledge, skills, or, in other words, with respect to competences[2].

Machlup (1962) introduced the concept of knowledge half-life in 1962. Knowledge half-life is the time it takes until half of the knowledge in a domain is outdated. While the half-life knowledge concept uses a limited understanding of knowledge as a countable asset, it helps to describe that some domains and related methods or technologies change at a fast pace. Examples for this can be found in the engineering profession and the IT profession. Dubin and George (1972) highlighted that the half-life of engineering knowledge in 1940 was 12 years, it had shrunk to 5 years in 1972. In 2014 it was stated that in some domains, the half-life was only 3.3 years (Neimeyer et al., 2014). Similarly, for the IT domain, it was stated that the half-life for IT professionals was between 10-12 years in 2014 (Murugesan, 2014).

The knowledge worker needs to adapt to changes in the sense of "an incremental redirection of skills and knowledge" (Leonard-Barton, 1995, p. 334). Only if this process is successful, the knowledge worker will be able to solve problems on a contemporary professional level. Following Drucker, "with knowledge being universally accessible, there will be no excuses for nonperformance" (Drucker, 1994*b*, p. 4). This indicates the relevance of improving organizational performance in terms of enhancing workforce efficiency and productivity. Despite Drucker setting the knowledge worker only into the perspective of a person owning the company performance, there is the self-image that needs to be considered. Only if the knowledge worker keeps up-to-date with his expertise, he will be able to maintain his self-image of being a professional.

The assumption is that formal education and work experience are insufficient methods to maintain the expertise level of a knowledge worker. According to Drucker, "productivity in knowledge work and service work demands to build continuous learning into the job and the organization" (Drucker, 1994*a*, p. 83). While the underlying assumption can be easily derived, the actual process of personal development is difficult to identify.

Pointing out the general need for development is one aspect of knowledge work development. The other aspect is the specification of the development need and its similarities. The focus on autonomy and the related relevance of individual expertise makes the development need something individual. While there will be similarities in the trans-

[2]Here an intuitive understanding of these terms is sufficient. A more distinguished discussion of these terms is provided in chapter 7.

formation of expertise requirements for certain types of jobs, the relationship between requirements and individual expertise will differ.

In summary, the development requirement for knowledge work can be identified easily. The actual support requirements are more difficult to identify due to the highly individualized expertise and work execution strategies of knowledge workers. Furthermore, knowledge workers will use their expertise to address their needs, again in an individualized manner. In the following, the work process is considered as one option for analyzing the development needs and also the way how they are addressed.

2.4 Knowledge Work Process

The previous sections have described the characteristics of the knowledge worker and his orientation towards work goals. Then the knowledge worker's ongoing development needs are discussed, concluding that needs are different across knowledge workers. Therefore the identification of actual development needs is difficult.

While examples for the knowledge work products and the effect goal of the product have been given, it remains unclear how knowledge work is actually performed. In the following, the execution of knowledge work is described. It will be shown that the knowledge work process captures many facets of knowledge work. The assumption will be formulated that the actual development needs and individual means of addressing them manifest in the knowledge worker's work process.

The relation between goal and product complicates the analysis of knowledge work. If the work goal is the perception of the company as innovative by its customers, it might be measured by market studies. To reach the goal, the knowledge worker will generate knowledge work products like presentations and discussions at fairs and try to get news coverage of the company as being innovative. If increased orders are the work goal, then the knowledge worker will try to improve the customer base by visiting many customers and making convincing presentations of the products. The work goals of knowledge workers are only implicitly connected to the knowledge work product. Increasing sales in a time of growing demand, and few competitors might not require complex knowledge work activities but happens anyway. Due to this complicated relationship between knowledge work product and effect, the focus of this work is on the knowledge work process. The work process materializes the direct result of the knowledge workers' decisions for activities required to realize the work goal. In other words, the work process materializes decisions.

The work process of a knowledge worker targets the realization of a product. The process presents itself as an ongoing sequence of observable actions. Examples for such activities are talking to colleagues, opening doors, pushing keys on the keyboard, and interaction with track-pad, mouse, or large interactive walls to realize an effect. Observing a knowledge worker will capture hundreds and thousands of such actions that are performed by the knowledge worker in the broader context of work situations related to the work on knowledge work products.

Actions often involve interaction with digital devices, including computers, tablets, and mobile phones (González and Mark, 2004). They are used for accessing, transforming, and sharing information. The process has been described to be weakly structured, sometimes circular in the sense of combining information, doing something with it, revisiting it, and so on (Reinhard et al., 2008). The reasons for the actions and the sequence are not observable. It is the choice of the knowledge worker under consideration of negotiation with work-peers and personal planning activities.

The work process has especially been investigated in the context of developing computer-based support tools (Kaptelinin, 2003; Rattenbury and Canny, 2007), or psychological analysis of phenomena like interruptions (O'Conaill and Frohlich, 1995) or memory failures (Czerwinski et al., 2004). Work on interruptions shows that work sequence is subject to interruptions based on internal or external cues. Heerwagen et al. (2004) talks about less than 30 minutes without interruption, in some cases even less than 10 minutes. Later, people try to recall interrupted actions. It shows that people try to do very many things, having many work products in mind. The organization of the related tasks and the process of assuring a successful product realization is very challenging. It shows that the knowledge work process is dynamic, including a combination of ad-hoc decision making interwoven with habits and the realization of a specific obligation. In this process, obstacles manifest, partial results that are deleted, work processes that are stopped, and never continued.

Means to structure and analyze the work process are required. In this section, specific attention is given to classifying actions the work process is composed of (see section 2.4.1) and to collaboration in the work process (see section 2.4.2).

2.4.1 Work Process Components

The work process is considered to be composed of actions. Examples for actions are talking to colleagues or typing text using a keyboard. To gain a good understanding of the work process, a systematization of such actions would be necessary. If a finite number of different actions exist which make up the knowledge work process, it should be possible to identify them. Several attempts to such a systematization have been collected by Reinhard et al. (2008) and combined with empirical studies (questionnaires and recorded work activities). Based on these, Reinhard et al. created a typology of knowledge worker actions and roles. The typology has been adapted to different fields, like enterprise social network roles and activities (Hacker et al., 2017) or mobile knowledge work (Thomson and Jarrahi, 2015).

The core assumption is that the knowledge work process is a combination of various knowledge actions. Knowledge actions are practices that are combined to realize the goals of knowledge work. For achieving a work goal, the knowledge worker selects among different knowledge actions and combines them. The typology of knowledge actions includes actions like analyze, feedback, dissemination, listening, asking, conversation, update, expert search (Reinhard et al., 2008).

Knowledge worker roles are a goal-directed application of knowledge actions. The roles are understood as *expected behavior patterns*, which structure work (Reinhard et al.,

2008). The execution of a work task will require the knowledge worker to make use of different roles that implicitly have different objects and which themselves make use of different knowledge actions. The identified knowledge worker roles include organizer, retriever, controller, sharer, linker, solver, networker (Reinhard et al., 2008).

The two linked typologies of knowledge worker actions and roles have different limitations considering learning and collaborative activity:

- **Dimension of learning:** The role of *learners* stands by (Reinhard et al., 2008, p. 11) for "people who use information and practices to improve personal skills and competencies". However, due to the complexity of identifying individual learning activities in the workplace, it is hardly possible to characterize them without analysis and related differentiated consideration. There is a need for specifications. This is one of the focal points of this work.
- **Dimension of single knowledge roles and activities:** Reinhard et al. (2008) analyzes a classification of the work process considering the individual roles and activities of the knowledge workers. This makes it difficult to achieve a *sharply* separated description. A well-known example is a *conversation*, which is quite general as an activity but can have a focus on 1) *Feedback*, consisting of request, contribution, and distribution (Hädrich, 2008). In this case, one professional asks another for, e.g., an opinion on a particular issue. One of them listens, another gives an opinion; 2) *Update*, including access, network, administration, and distribution (Hädrich, 2008). In this case, both professionals are actively involved in the conversation/network and keep each other informed compared to feedback, where typically one speaks while the other listens.

Despite these limitations, knowledge worker roles and actions are the most integrative approach towards a typology of the work process related activities in knowledge work and the role individuals take over in the work process.

2.4.2 Collaborative Work Process Components

Collaboration plays an important role during the workday. Collaboration takes 20 to 30% of the overall time and typically happens unplanned (Heerwagen et al., 2004). People are exchanging information, not only by means of talking to each other face-to-face or via phones. There are other things like emails, instant messaging clients, and social media (Ellison et al., 2015). Often the collaboration focuses on the generation of information artifacts, being it collaboratively created software code, documents, presentations, or the like.

The introduction of this section highlighted the relevance of interaction for knowledge work execution. With frequent interactions, many of them unplanned, much information is exchanged between professionals. Heerwagen et al. (2004) distinguishes three types of collaboration: awareness, brief interaction, and collaboration. Awareness is related to visual and aural access to the environment and generates a general understanding of the surrounding. Brief interaction stands for short discussions taking less than one minute.

Following Roschelle and Teasley, collaboration is "a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem" (Roschelle and Teasley, 1995, p. 70).

Communication plays a central role in the work process of professionals. Communication can be defined as "a process in which participants create and share information with one another in order to reach a mutual understanding" (Rogers, 1986, p. 5). Sharing information stands here for the exchange process, which forms a basis for the development of meaning. Its realization requires the dissemination of information (information transmission) and individual processing of this information (information processing) (Dennis and Kinney, 1998). For a better understanding, Dennis and Kinney (1998) distinguished between:

- **Conveyance:** This refers to the collection and dissemination of information in combination with individual information processing to generate an individual understanding, e.g., information search on the web or reading a book individually.
- **Convergence:** This serves as a basis for a common (shared) understanding for evaluating the overlaps and similarities in the conclusions of others, e.g., integration-oriented consensus building.

Both – conveyance and convergence – show the relevance and necessity of understanding, developing, and exchanging information as a social construction/social institution (Berger and Luckmann, 1966) and as a cognitive process (Miranda and Saunders, 2003)). Communication processes involve both – the individual transmission of information and the individual processing of information. Both activities are essential to successfully *develop a shared understanding* that serves as an important result of successful communication (Dennis and Kinney, 1998).

The understanding of communication and its development and participation is rooted in the *theory of media richness* (Dennis and Kinney, 1998, p. 406), which argues that "performance improves when team members use richer media for equivocal tasks". Following Dennis and Kinney (1998), the theory of media richness is based on:

- **Immediacy of feedback:** The extent to which a medium enables users to give rapid feedback on the messages received (Lengel and Daft, 1988). According to Krauss and Weinheimer (1966), feedback can be divided into two main types, namely a) *Concurrent*, what occurs when the sender/transmitter and receiver act simultaneously, e.g., non-verbal gestures; b) *Sequential*, what occurs when the sender/transmitter pauses while the receiver communicates to confirm its understanding, e.g., rapid feedback, rapid consensus-building.

  According to (Dennis and Kinney, 1998, p. 260), "feedback is important to the speed and effectiveness of communication because it enables the sender to recognize the extent to which the receiver understands the message and to adjust the message presentation accordingly". This points to a strategic characteristic of self-regulation of feedback that has already been described above (see section 4.4).

- **Multiplicity of cues:** This refers to a multitude of ways of conveying information, such as text (e.g., spoken or written words), verbal cues (e.g., tone of voice), or non-verbal cues (e.g., physical gestures) (Lengel and Daft, 1988). Two main types of communication are essential for this work – verbal (spoken or written words) and media-based (e.g., computer-supported). On the base of *media synchronicity theory* (Dennis et al., 2008), computer-supported communication can be distinguished between a) *Synchronous*, when communication participants communicate simultaneously, i.e., information senders/transmitters and receivers can interact simultaneously, e.g., face-to-face, chat, audio, or video conferences; b) *Asynchronous*, if communication participants do not work together at the same time, i.e., there is a pause between sending and receiving information, e.g., fax, voice messages, e-mail. Both synchronous and asynchronous communication serve as important factors influencing interpersonal communication and thus teamwork (Burke and Chidambaram, 1999; Walther, 1996).

Due to the globalization and organizational changes described above, the way distributed work is communicated is influenced by the current process of digital transformation. This leads to an increasing digital alignment of communication channels between professionals around the world, e.g., e-mails, chat, video from audio conferences. According to (Panko et al., 1995, p. 1002), "managers spend a majority of their days in face-to-face meetings", with particular emphasis on the informal focus on so-called new media (e.g., e-mail, voice mail).

As Miranda et al. pointed out, a key outcome of communication is the development of the inter-subjective meaning of the information held by the participants: "meaning derives from interactive interpretation by multiple persons, not simply from the cognition of a single individual" (Miranda and Saunders, 2003, p. 88). Thus, to develop shared meanings, it is required that professionals as individuals not only understand the information they have but are aware that "information [...] can be interpreted differently by different people" (Dennis and Kinney, 1998, p. 271).

Thus, to understand how people use media and how this use affects successful and unsuccessful communication, it is necessary to consider both the need to transmit information among people as well as the individual cognition needed to process and understand that information (see chapter 11).

2.5 Summary

This chapter has given an introduction to the learning need of the knowledge worker. Based on an introduction of the knowledge work process and a characterization, two aspects have been highlighted. First, the relevance of autonomy for successful knowledge work. Knowledge workers are proud of their expertise and use it to decide how to approach a goal. Second, the ongoing transformation of tools and knowledge. Knowledge workers have to develop themselves permanently to fulfill their job and their self-understanding. Development needs are likely to be different across knowledge workers due to the very individual educational past and individual preferences.

Analyzing knowledge work is very difficult due to the complex relationship between goal and work products realized through autonomously selected work activities. The work process materializes individual decisions to a certain extent. Especially, the work process also materializes issues, decisions to stop pursuing certain goals. Therefore, the work process is a key option for how the work process can be analyzed. It also seems to be an option to analyze the development need of knowledge workers and the techniques they apply to address the development need.

3 Integration of Work Process, Need and Learning

The previous chapter 2 has specified core characteristics of the knowledge worker and derived learning need knowledge workers face. The work process has been considered to be a foundation for analyzing knowledge work. It has been highlighted that development needs materialize in the work process. The actual way the learning need emerges and how it is addressed remained unclear.

This chapter provides a theoretical foundation for this perspective. The relation between goal-directed work, need identification, and learning in the work process is specified using the action regulation theory. Then learning in the work process is described with a focus on the role of experience. Dewey's work on experiential learning and Piaget's work on experience-based knowledge adaptation are introduced. This will support a fundamental assumption of this thesis, that work goal achievement, learning need identification, and learning fall together in the work process.

Activity theory as the foundation of action regulation theory, the work of Dewey and Piaget share much similar consideration when it comes to the relation between the subject and the environment and the role of experience for knowledge building. Some consider all of them to be relevant roots of constructivist theory (Fosnot and Perry, 1996). Still, there are many differences in the approaches (Ertmer and Newby, 2013) when it comes to the understanding of the role of society or the nature of knowledge. The integration of the three perspectives in an eclectic process is not intended.

3.1 Learning Need Identification

The knowledge worker has goals. To realize the work goals, the knowledge worker decides on actions he performs, resulting in a work process (cf. section 2.4). The following introduces the action regulation theory as a framework that specifies the relationship between goals and actions. It shows that the work process is generated from a complex structure of goal anticipation, planning, and perceived effects of interactions. Tension emerges as a discrepancy between goal anticipation, plan, and execution. Tension represents learning needs. The relationship between the elements is specified in the following.

3.1.1 Action Regulation Theory

Action regulation theory (ART) is a theory from occupational psychology developed by Hacker and Sachse (1986). Action regulation theory explains behavior as the realization of plans to achieve goals. In the perspective of Hacker all work materializes in acting as

its core (Hacker, 2003). Action regulation theory emphasizes active, goal-directed behavior based on the cognitive regulation of work (Hacker and Sachse, 1986; Hacker, 2003; Hacker and Sachse, 2014; Hacker and Frese, 2016). For this purpose, the activity theory perspective is used, which assumes that human development results from interaction with the environment (cf. the work by Vygotsky (1978) and Leontyev (1978)).

From an action regulation theory perspective, the work process of knowledge workers is based on individual planning of the doing needed to realize goals. The plan should not be mistakenly considered to be a strict recipe. The plan is a concept that is enriched and modified while the individual is interacting with the world. Certainty and stability of the plan depend on the one hand on the expertise of the knowledge worker, on the other hand, on the degree of uncertainty inherent to the work task.

Planning, doing, perceiving, and replanning are interconnected. While this resembles a control cycle, it goes much further. A control cycle only adjusts actions based on perceived effects. Action regulation theory proposes that the whole plan and even the goal can be changed based on perceived effects, resulting in completely new goals or different plans with different actions. An example is the goal of drinking water with the decision to drink from a bottle that needs to be opened. If one takes a bottle, one implicitly estimates a force needed to open it – a purely experience-based estimation. If the force is insufficient and the bottle cap does not move, one starts to think about it, slowly increasing the force consciously. If the cap still does not move, there are many options. One might decide to alter the plan to open it manually and looks for a tool to open it. Alternatively, one might decide to drink tap water. Or one even decides to alter the plan of drinking now and postpones drinking for later. This basic example shows that regulation happens based on an initial goal and related plan – the manual bottle opening – is adjusted in given constraints – force increase – and might end up in a complete change of plan – tap water – or plan – drink later.

The foundation of the regulation process is cyclic control loops, so-called TOTE units (Test–Operate–Test–Exit) (Hacker, 2003). As mentioned, these TOTE units not only work for the relation between decision, plan, and interaction. It goes up a hierarchical relation of different types of individual commitments – the high-level goal of not being thirsty anymore, the decision to drink water, the decision for bottled water, and so on. A process that, in many stages, includes implicit assumptions and habits. This hierarchy is specified further in the action regulation theory. Action regulation theory uses several concepts from activity theory, including a hierarchical organization of the relation between motives and behavior in terms of activities, actions, and operations. Activities pursue the realization of motives. For the realization of motives, specific goals are identified, which are addressed at the action level. For the realization of action goals, constraints need to be fulfilled, which happens through operations. Operations are on a senso-motoric level, like moving a mouse cursor or applying manual force to the cap of a bottle. A specific aspect of operations is that training allows operations to be executed without thinking. Moving a bottle cap will not happen under conscious awareness. Only the failure of the anticipation will result in the described complex conscious control thoughts.

Taking the hierarchy seriously and recalling the work of a knowledge worker, it shows an extraordinary complexity. There are many motives, goals, and actions in parallel. The only certain thing is that the observable work process is sequential. Still, this work process might result from various goals and motives which are switched based on interruptions. TOTE units are interlocked in this structure resulting in dynamicity on all levels.

The result is an ongoing internal negotiation of motives and their priorities, the anticipation of results based on perceived status, assumption of plans with interaction requirements, decisions for means of realizing the requirements, and emotional interpretation of the resulting feedback (e.g., the experience of success).

In the following, this understanding of the work process is used to investigate the learning need in more detail.

3.1.2 Tensions as Learning Needs

The hierarchical structure of motives, goals, and conditions, resulting in activities, actions, and goals organized by TOTE units is an inherent part of action regulation theory (cf. Hacker (2003), Figure 2. Control loop of organization of work). Here, this will serve as a foundation for the investigation of the learning needs of professionals at work.

The knowledge worker interacts with the environment to realize goals based on goal anticipation and planning. Due to uncertainty, some parts of the work plan are vague, while other parts are more worked out. The perception of effects from interacting with the environment is used to reassure the plan progress and make it more concrete. Unfortunately, plans and related anticipated effects of interaction might mismatch with perceived actual effects of interaction. The bottle opening process mentioned above is an example of this. A more knowledge work-related example is the decision to add a feature to a software tool and then realizing that the anticipated way of realizing this feature is not accessible yet in the programming language, or that it works completely different from any earlier experience. Such mismatches between anticipation and perception are called tensions in the following. The application of *tension* as a concept follows the use of contradiction in activity theory. Especially Engeström (2014) (e.g., Chapter 2, Figure 2.10) uses the concept of contradiction as source of change and development. This is often identified in the analysis process of activity systems. Here, the term tension is preferred to focus on the individual goal-orientation in the active work process. The assumption is that in these situations, individuals do experience problems during work more as a tension. Tension is something the individual works with, to solve it. For a general overview of the application of contradiction, tension and similar terms, see Murphy and Rodriguez-Manzanares (2008).

Although the tensions seem to be strongly related to the complexity and dynamics of the task domain (Czerwinski et al., 2004), in all cases, they fall back on the knowledge worker. It is the knowledge worker who, at first hand, planned an endeavor that has not been considered properly. It is a lack of ability of the knowledge worker which shows a learning need. In other words, learning needs emerge in the work process based on tensions as a mismatch between anticipations and perceived effects of interactions.

While tensions are indicators of learning needs, their occurrence does not mean that learning needs are solved or ignored. Action regulation theory introduces the concept of regulation to describe how discrepancies between anticipation and perception are handled in TOTE units (Hacker, 2003). The way regulation works has been sketched using the example of the bottle opening. Regulation is a decision that can affect every level of the activity, action, operation hierarchy. For the knowledge worker this means that a decision is made under consideration of the given constraints. The decision for a way of addressing a tension will especially consider constraints like resource limitations. If the feature implementation does not work in the typical known way, it might result in the decision to learn how to implement the specific type of feature. This being a learning goal of its own, consuming time and postponing the solution of the task at hand. The decision can also be to avoid the feature by asking a colleague to take care of it, or by asking whether the feature should be part of the product at all. It shows that learning needs can be considered in the context of situative decision making under consideration of priorities and needs.

Learning needs can be addressed in various ways. For example, when dealing with tensions, the knowledge worker can choose between simple avoidance, community-based support, or planning a learning activity. A combination of several options is also possible. The knowledge worker might decide to avoid the chosen way for the time being and parallel decide to improve his knowledge in the future. A discussion of this individual agency is provided in (Billett, 2004*b*, p. 6).

Every decision for a regulation somehow addresses the learning need and will also be some kind of learning. It is the quality of the learning which is different across the different options. Pure avoidance might mean that the knowledge worker learns to avoid similar tasks in the future. Learning can happen immediately in the work process, probably without understanding the abstract concepts and only focusing on a duct tape solution at hand. Or learning can be a serious activity on its own with the goal of having an in-depth understanding of underlying concepts to handle related problems easily in the future. In this sense, every planning resulting in a tension that is regulated, generates learning. Still, the effectiveness and efficiency of the learning will be different.

In the context of this work, the main insight taken from the action regulation theory focuses on the manifestation of the learning need. Learning needs are understood as tensions in the work process that trigger regulations. Tension will not necessarily be visible in the work process. The regulation will take care of tension and handle the tension as part of the work process. The valuation of the quality of how the individual addresses the learning need is not subject to action regulation theory and depends on the subjective perception of the need as well as the will and conditions to address it. Before it is possible to investigate the options, the next section will investigate learning in the work process in more detail.

3.2 Learning Process

The previous section has used action regulation theory as a framework to describe how learning needs emerge in the work process, based on the concept of tensions. The decision of the knowledge worker of how to address tensions has been highlighted. The knowledge worker has the freedom to decide how to address the tension, while every decision will result in another handling process, all having different qualities with respect to how the learning need is addressed. Yet, the way the learning need is actually addressed has not yet been considered at all. This is done in the following, based on an experience-centric perspective using the work of Dewey (1938*a*) and Piaget (1982). This perspective integrates well with the focus on the work process of knowledge-workers. The work process, which essentially consists of experience, triggers knowledge from previous experience and – in case of tension – makes it necessary to reflect on the experience.

3.2.1 Learning Through Reflective Experience

The actual way learning in the regulation process happens has not been considered in the previous section. In the following, the work of Dewey is used to address learning in the work process in more detail. Using Dewey's work on reflective experience gives an explanation how experience and learning are closely interlinked in the work process through reflection. This section follows the treatment of Dewey's understanding of experience provided in various articles (Muhit, 2013; Johnston, 2002).

Experience is the core element of Dewey's philosophy of the relationship between humans and nature. Experience is the main link between humans and nature: "In its broadest sense, the experience is defined by Dewey as the result of the interconnection of a person with environment" (Johnston, 2002, p. 5). The human interacts with the world, which generates the experience of being part of the world. This results in a complex relationship between humans and nature with experience as "a patterned structure in which undergoing and doing occur not in mere alternation, but in a far more integral way" (Muhit, 2013, p. 18). The process is "double-barrelled" (Muhit, 2013, p. 11) in diminishing the difference between the individual and the objects of the world in the experience.

The concept makes every knowledge experience-based. This is a foundation of Dewey's experiential learning theory, stating that "[...] everything occurs within a social environment. Knowledge is socially constructed and based on experiences. This knowledge should be organized in real-life experiences that provide a context for the information" (Grady, 2003, p. 9). This does not mean that knowledge is limited to first-hand experience without any further development option. The second type of experience introduced in the following allows for learning beyond the first-hand experience. The following passage translated from an introduction to Dewey's experience concept clarifies the relation of both experience types:

> For Dewey, *experience* does not mean the mere subjective experience of an objectively given reality that is independent of the experience in principle,

> nor is it a primarily passive process, e.g., the recording of sensory impressions. Rather, experience for Dewey is characterized by the two criteria of continuity and interaction (cf. (Dewey, 1938*a*, p. 13, 17)). The basic unit of his concept of experience is acting as a connection between doing and suffering, in the course of which meanings are actively constructed. Here, *primary experience* means the initially unproblematic course of action in largely habitualized contexts of experience, in which no distinction is made between experience and object, subject and object, because both are, to a certain extent, suspended in an unanalyzed wholeness (cf. (Dewey, 1938*a*, p. 1, 10)). However, this immediate wholeness of experience is always partially broken up when we find ourselves in a so-called problem situation in which the previously proven patterns of action and implicit interpretation fail. This leads to reflection on possible consequences of action in an ambiguous and open to the future situation and thus to the construction of new meanings of behavior, objects, and experiences. With regard to this second level, Dewey speaks of secondary or reflective experience. It is the level of knowledge acquisition and theory formation, from the solution of everyday conflict situations to scientific research and philosophical reflection.
>
> *(Hickman et al., 2004)*

The two types of experience are of specific relevance for this work. Primary-experience requires a match between expectation and perception. In contrast, if a mismatch happens, there is "the necessity of solving problems faced in habitual ways of action" (Miettinen, 2000, p. 61). This reflective experience is a learning process (Miettinen, 2000). The overall process is comparable to the tension term of action regulation theory described in the previous section. A tension triggering a regulative action shows the characteristics of an experience, which becomes a reflective experience.

The idea of applying reflection to experience is broad. "Experience is not a rigid and closed thing; it is vital, and hence growing" (Dewey, 1910, p. 156). Reflection enables the transfer of knowledge from one situation to another, like reflection, with the aim of discovering new insights. The resulting understanding of reflection goes beyond the typical understanding of the term. The following aspects are part of the reflection concept (Rodgers, 2002)[1]:

- *Reflection is a meaning-making process* that brings learners from one experience into the next with a deeper understanding of its relationships and thus enables them to link them to other experiences.
- *Reflection is a systematic, rigorous, disciplined way of thinking*, which has its roots in scientific research.
- *Reflection is interactive*, which means that reflection needs to happen in the community, in interaction with others.

[1]For more details, see "How we think" (Dewey, 1910).

- *Reflection requires attitudes*, which is related to the value of "the personal and intellectual growth of oneself and others" (Rodgers, 2002, p. 245).

The key is that reflection works with experience. The first-hand experience is modified through thinking. Dewey explains this in *Experience and Nature* (Dewey, 1910) using Einstein's thought experiments. Thought experiments are rooted in the primary experience, which develops into a secondary object based on reflection (Muhit, 2013). An example is the thought experiment used to investigate the Lorentz transformation – the speed of light is similar in every reference system. The thought experiment is as follows. A train passes by a train station at a fixed speed with the passenger on the train, making an observation and the people at the train station making observations. In this thought experiment, the primary experience of a train passing by a train station is activated and then investigated closely. In the observation process, insights beyond the experience are generated, which is a kind of new knowledge.

The process of how knowledge is generated from reflection is captured in Dewey's model of reflective thought and action (Dewey, 1910, 1938*b*,*a*). The model consists of the following phases: *Investigating* the conditions, resources, aids (tools) and barriers (hurdles) of an action; *Defining* the problem (*intellectualization* in Dewey's words); *Studying* the conditions of the situation and formation of a working hypothesis; *Reasoning* in a narrower sense; *Testing* the hypothesis by action. Following Dewey, reflection generated hypotheses can only be tested in an experimental activity to be able to solve a problem.

Applying the concept of reflective experience to the tension situation of the knowledge worker gives insights into the learning which can happen in the work process. The tension triggers a regulation as a problem-solving situation. As an effect, the situation is not just experienced but is consciously treated as reflective experience using the model of reflective thought and action. Based on the situation (investigating) and awareness of a tension (defining), knowledge from other experiences guides the investigation (studying) and generates anticipation of probable outcome options (reasoning). The hypothesis is then translated into action (testing). In this process, new knowledge is built up, immediately applied and is tested in the work process.

In summary, the relation between experience and reflective experience can be applied to the learning process of knowledge workers based on tensions and regulated actions.

3.2.2 Learning as Adaptation and Accomodation

The previous two sections have investigated the work process and its relationship to need identification and learning. Action regulation theory and the concept of reflective experience embed learning needs and learning immediately in the work process. Both approaches indicate that development relies on the given experience of the subject, which is limiting and enabling factors at the same time. The actual process of how these limits materialize and how knowledge is integrated has not yet been considered. In the following, it is specified how new experience interacts with existing knowledge based on an alignment process.

Piaget considers knowledge development to build on adjusting the experience to existing knowledge. This makes knowledge development a constraint-based adaptation with the main purpose of allowing the subject to accept and understand the world (Glasersfeld, 1982). Every act of knowledge-building happens in relation to experience and existing knowledge. The new knowledge building is a new experience of the subject working on the existing knowledge to fit into a consistent understanding of the world.

Experience-based knowledge building and knowledge adaptation are learning. As a result, learning is not static, but builds on individual processes of negotiation between knowledge of the world and experiencing the world and its reaction to interaction. The two essential processes for this are (Piaget, 1952):

Assimilation: A process of how people perceive and adapt to new information. For this, the scheme concept is required. According to (Piaget, 1952, p. 7), a scheme can be understood as a set of linked mental representations of the world, which individuals use to understand and respond to specific situations. They are "a cohesive, repeatable action sequence possessing component actions that are tightly interconnected and governed by a core meaning" (Piaget, 1952, p. 7). Individuals understand new information on the basis of an existing cognitive scheme and then integrate the new information into the scheme. Assimilation illustrates "more a quantitative aspect of individual learning" (Cress and Kimmerle, 2008, p. 161). In the process of assimilation, the individual acquires additional concepts that fit to the existing schemes of individuals.

Accommodation: This process illustrates taking new information in one's environment and adjusting existing schemes in order to fit in the new information (Piaget, 1952). Due to that, an individual does not simply integrate new information into an existing cognitive scheme but changes this scheme in order to better understand the environment. This happens when the existing schemes (knowledge) do not work and need to be changed to deal with a new object or situation. Accordingly, the creation of new schemes can serve as "an indicator of learning in a more qualitative manner" (Cress and Kimmerle, 2008, p. 161).

Both processes of assimilation and accommodation indicate that professional's work-based learning serves as *intelligent adaption* (Piaget, 1952, 1982) resulting from a balanced tension between these two processes. This dual process enables to form schemes, which are the result of learning processes[2]. Learning takes place by assimilation or by accommodation, respectively: Individuals acquire new information without changing their cognitive schemes, or by modifying schemes or by creating new schemes. These processes depend on the effects of individual interaction with the environment. This also shows that interaction with the environment triggers different learning processes. On the one hand, there is learning as a reinforcement of existing schemes based on assimilation. On the other hand, tension-based learning by accommodation, which requires an adaptation of the acquired schemes.

With knowledge being organized in schemes, there are different types of knowledge in Piaget's theory. "All knowledge is tied to action, and knowing an object or an event is

[2]While Piaget's focus is child development; the applicability to adults is still given. For a discussion, see Long et al. (1979).

to use it by assimilating it to an action scheme [....]. This is true on the most elementary sensory-motor level and all the way up to the highest logical-mathematical operations" (Piaget and Walsh, 1974, p. 14,15; 17)[3]. The different forms of knowledge result from different cognitive development stages. The highest stage is formal operations performed on mental objects. According to Piaget (1964), to be able to understand the development of knowledge, it is first necessary to understand the role of operation on an object. When Piaget states that "to know an object is to act on it" (Piaget, 1964, p. 8) he refers to a scheme as a mental representation of something. Operations are the transformation performed on such an object. As Piaget stated, "to know is to modify, to transform the object, and to understand the process of transformation, and as a consequence to understand the way the object is constructed" (Piaget, 1964, p. 8). An operation serves here as *the essence of knowledge* (Piaget, 1964). An operation is an interiorized and reversible action. An example is a mathematical operation. Other examples provided by Piaget are constructing, classifying, ordering, or measuring. An operation thus always happens in reference to the object, therefore "an operation is never isolated" (Piaget, 1964, p. 177). The operation is always in reference to all other existing operations possible on the object. Schemes for formal operations allow for an understanding of complex problem solving based on abstract thinking as it occurs in knowledge work. It is noteworthy that the formal operation is nothing immediate or simple. Work on formal operations assumes that only 40 – 60% college students fail at formal tasks (Keating, 1988) or argue that only one-third of all adults reach the formal operational stage at all (Dasen, 1994).

According to Piaget, experience is integrated into existing knowledge by overcoming a disequilibrium through assimilation and accommodation. Still, it is important to consider limitations. An individual might fail in transforming experience into knowledge, just as it is not understandable for the individual. The activity theory describes the zone of proximal development to indicate that learning can only happen in relation to the individual knowledge of the world. This indicates that personal development history affects learning abilities. Learning something new will always be learned under consideration of the existing knowledge. Similarly, the relevance of experience as a source of development specified by Dewey. Only if there is an experience someone can relate to, certain derivations will be possible. For the knowledge worker who decides during the work process how to handle tension and the related learning need, all reasoning happens based on his experience. In certain cases, it might not be possible to learn, as there is a knowledge gap.

Despite these limitations, Piaget provides a mechanism for the integration of new experience into knowledge. For the knowledge worker, this shows how the ongoing goal-oriented work execution works on the present knowledge. Treatment of tensions and reflective experience will be subject to the processes of accommodation and assimilation.

[3]The term operation has been implicitly treated as it mainly focuses on physical interactions. It is important to denote that operations can also be mental operations. In the activity theory, this is indicated by the treatment of cognitive tools – mathematics, as used by Piaget, is another example. Still, Piaget's operation term is broader and more formalized, as the section shows.

3.3 Summary

This chapter has investigated the relationship between the work process, learning needs, and learning processes. Based on the action regulation theory, the identification of learning needs in terms of tensions has been described. Knowledge workers decide on actions to address the tensions and the related learning need. There are many ways to address the tension, and although all have learning characteristics, the quality of learning differs.

Dewey's work on experiential learning has been used to characterize the learning process. Tension resolution triggers reflective experience based on Dewey's model of reflective thought, and action generates knowledge. The integration of this new knowledge into existing knowledge has been specified based on Piaget's processes of assimilation and accommodation. It might result in new cognitive schemes, or adjust existing schemes. Not every experience can necessarily generate new knowledge. The zone of proximal development and the explanation of experience based on earlier experience have been discussed as mechanisms which frame the ability to gain new knowledge.

The gained insight gives a better understanding of knowledge work, learning needs identification and learning-based activities. The chapter has focused on tension-based learning, as this is considered to be most relevant for learning. Two other types of learning have not been considered. First, learning as a work goal of its own. An individual has the goal to learn something and structures his activities towards learning, which can include using formal or non-formal offerings or individual research for material to structure learning activities. A second type considers that individual work execution includes routines to a large extent. From basic aspects such as the ability to give a presentation or interact with a computer, to more complex aspects such as the repetitive discussion of similar topics of controlling a budget within a company. In all cases, professionals are likely to adjust the ability to do a certain type of task to the novel situation. In such a case, one might talk about Dewey's primary experience, which does not generate additional cognitive burden. Even closer is Piaget's application of knowledge schemes which are used and which assimilate the novel situation of successful scheme application. The experience which is aligned with the cognitive capabilities reinforces the cognitive processes in place. Therefore, a reinforcement type of learning is very likely to happen during typical work execution.

Tension-based learning is interesting, as it stands for unforeseen development needs. The close interconnection between the work process, need identification and learning-related activities is a main insight of the chapter. Furthermore, the quality difference of the selected action to address tension is interesting. While autonomy and constrain-based reasoning allow the knowledge worker to select an action, it is not necessarily a good choice to avoid similar tensions in the future.

The choice of how to address a learning need will be considered in the following two chapters. The knowledge worker is in an environment that offers different ways of addressing learning needs. First, the concept of self-directed learning will be investigated, standing for individual means of addressing a learning need. Second, the role of the community in addressing learning needs will be considered. The third type of learning,

namely formal learning provided by the organization of the knowledge worker, will be considered last.

A side note on the perspective of this section. While three different theoretical perspectives have been presented and discussed side-by-side, this does not show an eclectic understanding. All three theoretical domains build on a set of assumptions and investigations which are not immediately compatible. One example is the logical operation of Piaget, which is similar to the mental tools of Vygotsky (1978). Despite such a similarity, Piaget's idea of schemes and developmental stages explains development very differently than activity theory, its specific role in the social environment, the integration of language, thinking, and aspects such as *the zone of proximal development* (Vygotsky, 1978). Similarly, the consideration of experience by Dewey and action regulation theory with a different perspective on the relevance of cultural knowledge systems or the observer role in the theory (Cobb et al., 1996).

4 Addressing Learning Needs in the Work Process

The previous chapter 3 has specified how learning needs emerge and trigger learning. Learning needs emerge as tensions in the work process. A large variety of different options for addressing a learning need in the work process exist. These include simple avoidance, a modification of the work process to address the learning need, or the generation of future learning goals, to address separately. Knowledge building has been specified as experience-based. This chapter focuses on the selection process among different means to address learning and the organization of the learning process.

The experience-based learning perspective has an important influence on the understanding of work execution for the knowledge worker. The workplace can be considered a learning environment which shapes a complex interaction between subject and work execution in a social and largely regulated context. Every interaction generates experience and reassessment of previous experience. Experiencing the work process realizes learning (Boud and Walker, 1991; Cell, 1984; Brookfield, 1986; Welton, 1991; Boud et al., 1993; Boud and Garrick, 1999), making "learning in and through work experience essential" (Cell, 1984, p. 29).

The professional might face problems during the work process. Solving these problems will trigger new learning processes that often rely on experience. This perspective shows the actual complexity of work-based learning (Billett, 1996*a*,*b*, 2002, 2004*b*, 2010*a*,*b*). Work-based learning is a combination of all learning results which happen as a combination of learning activities during the work process.

It is important to highlight that this does not mean that learning becomes something automatic. It is still the individual who decides on the actual process and the assessment of the experience. Tensions are judged by the individual and the way they are addressed is an individual decision, which can result in learning of different qualities. Individual agency shapes engagement in work practice and what is learned (Billett and Boud, 2001). Thus, workplace learning can be understood as "workplace participation and sustaining practice" (Billett, 2002, p. 56). As Boud et al. stated, "learning is embedded in work" (Boud and Garrick, 1999, p. 32) but "work is not necessarily a site of learning at the individual level" (Boud and Garrick, 1999, p. 33). This highlights the agency of the subject, as learning success relies to a large extent on the subject.

The workplace can act as "a learning environment" (Welton, 1991, p. 7). This perspective is intuitive if one considers that work execution is an ongoing practice of capabilities required by the job. This can be the skill of assembling parts in a structured production environment or decisions towards certain execution processes in a more autonomous setup like knowledge work. Basically, work is the core learning process, or as Billet

stated, "the most common sites and settings for learning which occur throughout everyday thinking and acting largely sit outside courses" (Billett, 2010*b*, p. 401). This results in goal-directed activities generating workplace experiences and consequently leads to the situative learning process. This is a very generic perspective and it will be the task of this section to provide a more differentiated understanding of this. This understanding of learning is used as a possibility of the work process based on individual decision. A direct effect of this perspective is that the professional can be a lifelong learner, subject to "an inevitable and ongoing process of development that occurs through individuals' engagement in conscious and non-conscious thinking and acting throughout their lives" (Billett, 2010*a*, p. 3).

In the following, the decision process is investigated further. For this purpose, the learning goals, learning goal commitment, and meta-cognition are introduced. All elements are relevant to understand the decision-process, which influences learning in the work process. Given a tension, a knowledge worker might identify a learning need based on assessing the personal ability and the required state (see section 4.1). Based on this, an understanding of a learning goal can be generated (see section 4.2), and motivation towards the learning process can be developed (see section 4.3).

In the process of setting learning goals and commitment, the individual will choose from a range of possible means. Given the importance of autonomy and collaboration in the work process, this chapter presents two outstanding ways of learning. Self-directed learning with self-regulation (see section 4.4) and collaborative knowledge construction (see section 4.5). Both aspects assume that learning need is consciously perceived. They can happen as part of the work process, but can also exist as activities of their own. This addresses the cases mentioned in the previous chapter. Based on the learning need, the knowledge worker can decide to address the need immediately or to follow the need up later in a separated form. In all cases, the way the learning need is addressed is an individual decision of the knowledge worker.

4.1 Meta-cognition

The concept of meta-cognition makes it possible to understand how the knowledge worker makes an assessment across the different options he has to address a learning need. In basic terms, meta-cognition is the knowledge about the knowledge one has. In other words, the knowledge worker can assess how difficult it will be to address the learning need under consideration of current knowledge.

The concept was initiated by Flavell (1979) and later extended further (Zimmerman, 1989; Sperling et al., 2004). Meta-cognition is "stable knowledge or beliefs about one's own cognitive system and knowledge about factors influencing the functioning of the system; regulation and awareness of the current state of knowledge; and assessment of the meaning of thoughts and memories" (Flavell, 1979, p. 906). In other words, meta-cognition addresses the individual process of doing "the appraisal of the content of thought or appraisal of cognitive processes" (Flavell, 1979, p. 910). Flavell does not

consider meta-cognition to be fundamentally different from other types of cognition. The core difference is the target of the cognition, which for meta-cognition are the abilities.

A very similar concept has been introduced by Gagné as a cognitive strategy. From the perspective of self-management, the cognitive strategy can be understood as "a cognitive skill that selects and guides the internal process involved in learning and thinking" (Gagne et al., 2005, p. 29) and thus serves as *an initially directed control process* regulating and moderating other learning processes .

Flavell distinguished between meta-cognitive knowledge and meta-cognitive experiences. Meta-cognitive knowledge includes persons as *cognitive processors* (Flavell, 1979), tasks referring to information and strategies that relate to the effective achievement of goals. There exists an interactive relation between these three types of variables (persons, tasks, strategies). Meta-cognitive knowledge can be affected by meta-cognitive experiences. Meta-cognitive experience refers to the content and can be described as "items of meta-cognitive knowledge that have entered consciousness" (Flavell, 1979, p. 908), e.g., when a person can suddenly remember another problem while solving it. Meta-cognitive experiences serve here as "any conscious cognitive or affective experience" (Flavell, 1979, p. 906), such as the sudden feeling that someone does not understand something that another person has just said. Meta-cognitive knowledge and meta-cognitive experience partly overlap, e.g., specific knowledge can serve as the content of some experiences made.

Meta-cognition of the individual will influence all goal-oriented activities of the individual. For the situation of the knowledge worker assessing a tension and considering different ways of addressing the connected learning need, meta-cognition will be important. Based on the perceived distance between personal knowledge and the required knowledge state to solve the tension, the knowledge worker will investigate the options as learning strategies. A likelihood of success under consideration of required effort and task constraints and habits will influence the commitment to a learning goal, which is then addressed.

Observation of meta-cognition in the work process is unlikely. While meta-cognition influences the decision for actions, it is only a cognitive process.

4.2 Learning Goals and Processes

Meta-cognition allows the knowledge worker to assess the learning need and initiate the decision-process towards handling it. A decision on how to address the learning need follows. The conscious decision for learning is one option that triggers the decision for a learning goal. The learning goal will become part of the work activity. Learning goals can be different, and their form will influence the way learning takes place. This section investigates the learning goal and shows that learning goals influence goal achievement. Two streams of research are discussed, both of which consider the anticipated effect of learning. First, performance and mastery to be able to discuss the learning effect based on intrinsic or extrinsic standards. These performance and mastery goals are limited to conscious states, and their observation in the work process is unlikely. Second, learning

goals that consider the type of knowledge developed through learning are discussed. Work by Anderson et al. (2001) and Gagne et al. (2005) from the domain of *instructional learning* is presented and discussed with respect to its utility to the domain of learning in the work process. A core insight is that a verb-based technique to test learning goal realization can be applied to the work process – this can provide insight into realized learning and into novel learning goals.

Extrinsic and Intrinsic Standards: Performance and Mastery Goals. To distinguish learning goals, related work in the domain of individual learning can be considered. For individual learning, goals are related to the reasons or purposes individuals are pursuing when approaching and engaging in a task (Pintrich, 2000). Typically two-goal dimensions are distinguished: mastery and performance goals (Archer and Ames, 1988). The mastery goals of individuals aim at developing new skills or improve competences. They are about setting an individual standard to be achieved based on self-improvement. This is related to mastery-oriented patterns that involve searching for challenging tasks and creating effective strategies against barriers (Dweck and Leggett, 1988). Performance goals are extrinsic or relative, like pleasing others, getting a grade, doing better than others and demonstration of the ability to others (Pintrich, 2000). This is related to gaining positive judgments by avoiding negative competence judgments (Dweck and Leggett, 1988). For the performance goal, the external feedback is in focus.

Mastery goals will focus on the skill or competence the individual wants to achieve. Therefore the organization of learning activities will center around the skill. Errors are perceived as part of the learning process. In contrast, the performance goal is likely to consider performance being equal to skill or capability. This especially can have an impact on selecting tasks that are likely to support performance with less focus on the skill or competence themselves (Bouffard et al., 1995). On this basis, learners must strive to improve the perception of their competence in a particular work-related task.

Performance goals aim to focus on the ability and self-worth of professionals (Ames, 1992) in order to contribute to superior performance. For this reason, the factors that influence target selection are similar to the factors that influence target commitment. According to Locke et al. (1984), people with high self-efficacy are more likely to choose difficult goals than those with low self-efficacy. Self-efficacy is a key concept of the theory of social learning which can be understood as "judging how well one can perform the actions necessary to deal with future situations" (Bandura, 1982, p. 122). This indicates that self-efficacy is strongly related to the actual or future-based task performance and not to the past. According to Bandura (1986), self-efficiency has a direct impact on performance, e.g., of professionals in their work.

None of the goal types exist exclusively, but typically, goal setting is a mixture of both (Bouffard et al., 1995). Considering goal setting in a work environment adds an important context factor to the goal-setting process of the individual. The professional selection of learning goals will consider mastery and performance aspects in the work context. This makes goals being related to the environment and the individual position towards the environment. In the work process, it is likely that the work goal at hand will influence the learning goal decision. The performance goal of gaining knowledge to solve the problem with a required quality seems to be more important. Here, a

pragmatic influence of the work goal can be assumed. With work goals oriented towards the realization of extrinsic goals, this can support performance goals. On the other hand, the self-understanding of the knowledge worker as an expert has a tendency towards mastery goals.

Like meta-cognition, the mastery and performance goals will influence the behavior of the knowledge worker, but it will not be possible to observe them directly.

Taxonomies of Learning Outcome. Learning goals guide the learner to reach a certain ability. While mastery and performance goals hint to the constraints which guide the ability selection, there is no specification of the different abilities the learning goal can target. Treatment of learning in the domain of instruction-based learning specifies the ability resulting from the learning process. In the following, two taxonomies from instruction-based learning are considered in the context of work-process embedded learning. Bloom's taxonomy of learning objectives and its modification and extension by Gagné.

Bloom's taxonomy (Bloom, 1956) is a hierarchical structure that classifies educational learning objectives into levels of complexity and specificity (Gagne et al., 2005). The taxonomy distinguishes three learning domains: cognitive, affective, and psycho-motor (Anderson et al., 2001; Gagne et al., 2005). For the knowledge work domain, the focus in the following is the cognitive learning domain. Bloom's taxonomy follows the understanding that learning can be understood as a cognitive process consisting of different dimensions. As a result, cognitive ability results from the learning process. Such an ability covers different cognitive levels. Learning objectives covered by Bloom in the cognitive domain include lower-order learning skills, such as knowledge, comprehension, application as well as higher-order skills, including analysis, synthesis, and evaluation. In the following, the different levels are presented in detail. Furthermore, the level names from a revised version of the taxonomy are added, improving the self-explain ability of the names (Anderson et al., 2001). For every type of learning objective, different verbs are provided, which specify how the learning objective can be applied or tested[1]. These verbs are of specific interest, as they link to abilities which are realized by learning on the respective level.

Knowledge / Remember: The objective is to have the ability to recall facts in specific contexts. Several active verbs can be used, such as know, define, memorize, repeat, record, list, recall, name, relate, review, tell.

Comprehension / Understand: The objective is to recall facts and understand the facts well enough to restate or summarize them. This can include aspects like comparing and differentiating from other facts and explaining from the cause-and effect-view. This level aims at interpreting the information available and on that base predict what could happen next. Comprehension examples in active verbs are: restate, discuss, describe, recognize, explain, express, identify, locate, report, operate, schedule, shop, sketch.

Application / Apply: The objective is to transform information based on dedicated methods. An example is the application of a specific process to solve a given problem

[1]The verbs are taken from the Washington State Board of Vocational Education. URL: https://kaneb.nd.edu/assets/137952/bloom.pdf (accessed: 06.01.2020)

to new information. An example is applying mathematical rules of differentiation. This level aims to classify the characteristics of a problem, select methods, and create a plan for the next steps. Active verb examples for application are: translate, interpret, apply, employ, use, demonstrate, dramatize, practice, illustrate, criticize, diagram, inspect, debate, inventory, question, relate, solve, examine.

Analysis / Analyze: The objective is to be able to decompose a problem or information into different parts. Examples for parts can be a distinction of facts from opinions. In other words: Analysis can be described as the ability to break down information into its components, e.g., to search for connections and ideas. Active verb examples for the analysis are: distinguish, analyze, differentiate, appraise, calculate, experiment, test, compare, contrast, create, design, setup, organize, manage, prepare.

Evaluation / Evaluate: The objective is to be able to decompose a problem or information into different parts. For the parts, a judgment considering categories like correctness, value, quality, can be given. Active verb examples for the evaluation are judge, appraise, evaluate, rate, compare, value, revise, score, select.

Synthesis / Create: The objective is to be able to combine information to generate something new out of it. Active verb examples for the synthesis are: compose, plan, propose, design, formulate, arrange, assemble, collect, construct, choose, assess, estimate, measure.

For every level of the learning objectives, it is necessary to consider that it involves a domain or a topic. For a certain domain and certain information, a learning process targets the ability to repeat the information in the sense of remembering, or it is required that the information is used as a recipe for a process to be applied. The transfer of information from one domain to another will be challenging. If someone is able to apply his problem-solving skills to a computer science problem, the same technique will not work for a business problem. Even for computer science, the transfer of some information between programming languages can be difficult. Knowledge on higher levels could support such transfer. If a concept is learned enabling synthesis, the person might be – in limits – enabled to do the required transfer.

The hierarchy does not develop a relationship between the different levels. Gagne et al. (2005) elaborated Bloom's taxonomy with a more practical orientation by adapting the theory of information processing to the theory of learning (see table 4.1). For Gagne learning outcomes belong to five categories: intellectual skills as know-how, cognitive strategy as know-how to learn, verbal information as knowing facts, motor skills as physical abilities and attitudes as emotional states.

Gagné characterized Bloom's taxonomy as *intellectual abilities*, as "a class of learned capabilities that allows an individual to respond to the environment and describe it by symbols" (Gagne et al., 2005, p. 48). A mapping of Gagés concepts and Bloom's taxonomy is shown in table 4.1. Following Gagne et al. (2005), the lower-level elements in hierarchy serve as prerequisites for performance at the higher-level skills. To give an example, problem-solving involves the use of rules.

Beyond this relation between knowledge, Gagné also specified the type of knowledge. For intellectual skills, cognitive strategy, and verbal information as being relevant for knowledge work, two types of knowledge can be distinguished. First, declarative knowl-

BLOOM (1956)	Gagné (1995)
Synthesis	Problem solving
Evaluation	Cognitive strategy, problem solving, rule using
Analysis	Rule using
Application	Rule using
Comprehension	Defined concepts, concrete concepts, discriminations
Knowledge	Verbal information

Table 4.1: A Comparison of Bloom's Taxonomy and Gagné's Types of Learning for the Cognitive Domain, (Gagne et al., 2005)

edge is knowing that something exists. Second, procedural knowledge as *knowing-how* (Anderson, 2009), or *the capability to do something* (Gagne et al., 2005).

Gagné's focus was on the structure of knowledge by distinguishing between the abovementioned declarative knowledge (recall) and procedural knowledge. Gagné's work considered declarative knowledge as part of the hierarchy of learning outcomes, but his main attention focused on procedural knowledge. The know-how of intellectual abilities includes distinction as the ability to distinguish things, a concrete concept as the understanding of the underlying similarity of things, the application of rules as knowledge of the process to apply them to things, problem-solving as the ability to apply rules to completely new topics. Cognitive strategy as a special kind of intellectual skill stands for procedural knowledge of control processes in which learners choose and change the way they participate, learn, remember and think, which is a kind of meta-cognition (Gagne, 1985).

Bloom and Gagné set learning goals in relation to the ability achieved by the learning process. Considering the domain of knowledge work, especially the generation of procedural knowledge, seems to be relevant, as it targets the application in the work process.

Insight 1: Preference of Application-Level Knowledge Goals. Beyond the mentioned application of learned abilities in the work process with resulting learning on its own, there is a learning form with more awareness. The mentioned tension-based decision to address a learning need as a regulative activity. In this case, the knowledge worker is aware of learning and needs to decide on a work objective. Here, it is most likely that the decision for the learning objective is governed by the work objective. Following the initial perspective on learning goals, a performance goal is generated. The influence of the knowledge work goal on the learning goal selection has already been mentioned. Given the hierarchy, the previously formulated options of the knowledge worker regarding the decision on how to treat a learning need can be described in more detail. Gagné specifies that every level of the knowledge hierarchy requires all levels below. In other words, to reach the level of *synthesis* or *creation* will require substantial effort. In many cases, this will also be true for a knowledge worker with advanced knowledge in the field. If the work goal leads to a learning need that is addressed with a focus on a performance goal, the knowledge worker only requires learning to the exact

degree enabling him to address the performance goal. This level typically is reached on the application level of the hierarchy. In other words, if a solution on a lower level in the hierarchy is sufficient, the knowledge worker probably will just go with this approach without considering a more generalized solution, which will solve similar problems more easily in the future. Studies of workplace learning have observed the mentioned behavior (Billett, 2001*a*).

Insight 2: Work-Process Materialization of Learning Goals. To investigate the learning processes of knowledge workers, this chapter considers the ability to observe learning in the work process. The decision for a learning goal under consideration of Bloom and Gagné is a cognitive process, just like the mastery and performance goal. Nevertheless, the work process materializes the realization of learning goals. Given the workplace learning perspective, the whole work process can be considered to be a combination of applied learning outcomes and learning. Every operation of the knowledge worker is a result of earlier learning. At the same time, the application of these applied learning outcomes generates new learning outcomes. This type of learning in the work process is not necessarily perceived by the knowledge worker. A knowledge worker who writes 30 emails per day is likely to improve the involved techniques of conveying information. At the same time, it will depend to a certain degree on the individual decision towards improvement. Studies in the workplace-learning domain support this perspective (Garrick, 1998).

Given the perspective of the work process as a materialized process of learning outcomes and learning, learning goals manifest too. Bloom offers a taxonomy of verbs which represent the activities that result from successful learning. Furthermore, these activities will be part of learning higher hierarchy levels, following Gagné's assumption that every level includes all earlier levels. Despite the initial assumption that learning goals do not manifest, the work process can be considered to be a materialization of learning outcomes and learning goals. Bloom's taxonomy, with its focus on activity verbs, enables an outcome and learning goal-oriented analysis of the work process.

In the following, first, the role of motivation (see section 4.3) is introduced. Then, two ways of addressing the learning goal are considered in more detail: 1) An individual-focused strategy, namely self-directed learning (see section 4.4), 2) A collaboration focused strategy, namely, collaborative knowledge construction (see section 4.5).

4.3 Motivation

The previous section has investigated the process of learning in the work process. Specific attention has been given to conscious learning-based on tensions. In these cases, metacognition allows an understanding of the learning need and enables goal setting. In all cases, individual decisions guide the way how the learning need is addressed, which is likely to be constrained by the work goal and the environment. Another factor influencing the success of the learning process is motivation. Motivation supports or hinders personal involvement in the learning process. Therefore, individual performance in the learning of professionals is influenced by motivation (Weiner, 1985).

Bandura (1993) assumes that human motivations are cognitively generated. A selection of motivators is presented in the following and subsequently discussed for the knowledge worker:

- **Causal attributions** as a source of motivation. A causal attribution happens if someone makes a causal explanation for an outcome of an endeavor (Kelley, 1973). Attribution theory suggests that individuals are motivated to understand the causal structure of the environment in which they find themselves in order to know why something happened (Kelley and John, 1980). People explain outcomes based on internal and external causes. This does not happen in a scientific manner, based on proven fact, but based on an attitude. Therefore, the assumed contributions are influenced by individual convictions. One direction is the assumption that success happens due to the internal and controllable factors of training effort and personal ability, while failure happens due to external factors out of individual control. The alternative extreme is the assumption that success happens due to external out of control factors like luck, while failure results from the personal inability to deliver performance. Obviously, such convictions influence motivation and individual performance, as well as affective responses by believing in self-efficacy (Bandura, 1998).
- **Outcome expectancies** as a source of motivation targets a personal assumption towards the outcome of an endeavor, following expectation value theory (Wigfield, 1994; Wigfield and Eccles, 2000). The belief in behavior to produce a certain result produces motivation (Bandura, 1993). A kind of self-determination arises, which is based on these things. First, interest values like intrinsic motivation (Deci et al., 1991). The assumption that personal skill-set is very good and that this will make the result good is intrinsic motivation. Second, utility values as extrinsic motivation (Ryan and Deci, 2000). The assumption that something is very important and must, therefore, be successful is extrinsic motivation. Similarly, negative assumptions can generate a kind of motivation. In both cases, motivation will influence performance.
- **Cognized goals** as a source of motivation. The goal-setting theory assumes that high or complex goals have a positive effect on task performance (Locke et al., 1990; Locke and Latham, 2006; Bandura, 1989). According to Lathan and Locke (1991), challenging goals increase and maintain motivation. Locke et al. stated that "goals are related to affect in that goals set the primary standard for self-satisfaction with performance" (Locke and Latham, 2006, p. 265). Goals work through self-influencing processes instead of directly regulating motivation and action. Motivation, with emphasis on goals or standards, is controlled by three types of self-influence, including 1) Affective reaction to one-time performance; 2) Perceived self-efficacy for goal attainment; 3) Adjustment of personal goals based on one-time progress. From a temporal perspective, the behavior is motivated and guided by recognized goals operating in the present, rather than being pulled by an unrealized future state (Bandura, 1993).

It is difficult to assess the motivation of the knowledge worker, taking into account the motivators presented. On the one hand, a number of aspects should result in a high degree of motivation. First of all, the autonomy and the related complexity of goals followed-up by the knowledge worker in the learning process should generate motivation following goal-setting theory. Considering the self-perception as an expert (cf. section 2.2), causal attribution of the knowledge worker is likely to produce motivation, which allows personal involvement. At the same time, the perception of outdated knowledge can also result in frustration and support causal attribution to having lost control of the domain. The same is for outcome expectations. While the work goal should be perceived as something relevant and having a high utility value, the dynamic structure of organizations and instability of long term goals can produce a negative effect on the motivation of the knowledge worker.

4.4 Self-directed and Self-regulated Learning

The presented concepts in this chapter support the investigation of learning in the work process. Given that the subject has decided for a learning goal under consideration of meta-cognitive processes and has developed the motivation to involve in this learning, the process decision is made. Two prominent process types are self-directed learning and collaborative learning. This section focuses on the self-directed learning process. Self-directed learning is a type of learning which requires awareness of a learning goal as well as individual freedom with respect to how the learning goal is realized.

Before introducing self-directed learning in detail, it is useful to introduce the broader idea of autonomous learning. Autonomous learning relates to learning which is not curriculum-based but happens in an autonomous, learner-directed manner. The assumption is that this type of learning is crucial in the work process. In a study in the 1990s, Carré investigated autonomous learning techniques existing in literature and identified 15 different forms, including autonomous learning, independent learning, self-directed learning, self-managed learning, self-organized learning, self-regulated learning, self-determined learning, self-planned learning, self-initiated learning, self-learning, self-education, self-instruction, self-teaching, and auto-didactic learning (Carre, 1992). Among these techniques, the two most prominent types were self-directed learning and self-regulated learning. It will be shown that self-directed learning applies self-regulation as an organizing mechanism.

Both concepts, self-directed learning, and self-regulated learning show many similarities. Some work exists which treats both as synonyms (for an overview, see Cosnefroy and Carré (2014)). Here the direction of treating them as related is followed. In this sense, the following argumentation is based on the related discussions in (Loyens et al., 2008; Cosnefroy and Carré, 2014; Saks and Leijen, 2014). Self-directed learning mainly emerged from the domain of adult education and explicitly did not require a teacher or instructor to set high-level learning goals. It is about planning and executing learning trajectories. In contrast, self-regulated learning emerged from typical educational environments like schools. Here a learning goal can be provided by a teacher, and it is up

to the learner to structure the individual execution of achieving the broader learning goal by self-regulated learning activities. Self-regulated learning can appear in environments with explicit teachers or in environments without a teacher. In the second case, the learning goal is identified by the individual, and it can be considered a self-directed learning process. In other words, self-directed learning requires self-regulation to be successful, while self-regulated learning does not necessarily happen in a self-directed manner. The focus of the work process of knowledge workers on self-directed learning is relevant. Whenever the knowledge worker perceives the need to learn something and plans for this on a broader scale, he applies self-directed learning. The actual execution of the self-directed learning then applies self-regulated learning. After all, self-regulated learning relies heavily on a variety of cognitive processes that realize the regulation process. These will be introduced in the following.

Knowles characterizes self-directed learning as "a process [in] which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing, and implementing appropriate learning strategies, and evaluating learning outcomes" (Knowles, 1975, p. 18). He further stressed that people "who take the initiative in learning learn more things, and learn better than do people who sit at the feet of teachers passively waiting to be taught" (Knowles, 1975, p. 14). Similarly, Long specified self-directed learning as "a personally directed purposive mental process usually accompanied and supported by behavioral activities involved in the identification and searching out of information" (Long, 1991, p. 15). In that way, people "enter into learning more purposefully and with greater motivation" (Knowles, 1975, p. 14). The self-directed model by Garrison (1997) consists of three overlapping dimensions: 1) *Self-management*, related to work task control; 2) *Self-monitoring*, related to cognitive responsibility; 3) *Motivation*.

Self-regulated learning is the process of how individuals actually pursue a learning goal. Zimmerman especially stresses the process characteristic:

> Self-regulation is not a mental ability or performance skill. It is the self-directive process by which learners transform their mental abilities into skills. Learning is viewed as an activity that learners do for themselves in a proactive way, rather than as a covert event that happens to them in reaction to teaching. Self-regulation refers to self-generated thoughts, feelings, and behaviors that are oriented to attaining goals (Zimmerman and Schunk, 2000, p. 1).

Pintrich (2000) analyzes different models of self-regulation. He identifies the following core characteristics of self-regulated learning: First, an active dimension, suggesting that the learner is an active participant in the learning process; Second, control potential in terms of integrating monitoring with control and regulation of one's own learning processes; Third, the goal-oriented assumption with a cognitive standard against which progress comparisons are made; Fourth, self-regulation as mediator between personal, contextual characteristics and performance or achievement. He concludes that self-regulated learning can be understood as an active, constructive process in which

learners are setting their learning goals and build on that attempt to monitor, regulate, and control their cognition, motivation, and behavior (Pintrich, 2000).

From the social-cognitive point of view, self-regulated learning is an individual process that is influenced "by environmental and behavioral events in reciprocal fashion" (Zimmerman, 1989, p. 330). Here, learners must be understood as self-regulated to the extent that they are metacognitively, motivatively and behaviorally involved in their own learning processes (Zimmerman, 1989). This suggests that self-regulated learners must include the use of specific strategies to achieve their own learning goals on the basis of self-efficacy perceptions. Self-regulated learning strategy stands here for actions aimed at acquiring information or skills that include learners' self-awareness, e.g., self-assessment, goal setting and planning, information search, recording and monitoring, environmental structuring, and others (Zimmerman, 1989). Self-efficacy refers to the perception of the unique ability to organize and perform actions necessary to achieve a particular performance of ability for particular tasks (Bandura, 1986). So self-efficacy serves here as a key variable in affecting self-regulated learning (Bandura, 1986; Zimmerman and Martinez-pons, 1986). Schunk characterized self-regulated learning as "learning that results from self-generated thoughts and behaviors of students that are systematically oriented towards achieving their learning goals" (Schunk, 2001, p. 631). According to Pintrich, most models of self-regulation assume that self-regulating activities are "directly linked to outcomes such as performance and achievement" (Pintrich, 2000, p. 176).

For the understanding of self-regulation, it is important to consider the interaction of different cognitive processes, especially self-monitoring, metacognition, and motivation. In the following, the process of self-regulation is discussed, and the mentioned processes are presented.

Bandura described self-regulation as "a multifaceted phenomenon operating through a number of subsidiary cognitive processes" (Bandura, 1991, p. 282). He introduces the processes of self-monitoring, standard-setting, an evaluative judgment, self-appraisal, and affective self-reaction. This combines mechanisms for realistic goal setting, but also self-diagnostic functions and self-motivating functions. Considering self-regulation only based on the considered processes is not sufficient. Motivation is another factor to be taken into account to understand the successful application of self-regulation using the discussed processes. According to Bandura and Jourden (1991), self-beliefs of efficacy play a key role in the self-regulation of motivation. The interplay of these processes allows the subject to target a goal and work towards its realization. Slightly different types of self-regulation models exist in the literature, while monitoring and reaction in relation to motivation and goal are core components.

Self-monitoring. A core aspect of the mentioned models is the self-monitoring process phase. Self-monitoring is a cognitive process involved in self-regulated learning. Monitoring generates feedback, which serves as an inherent catalyst for self-regulated activities (Butler and Winne, 1995). Butler specifies that "as learners monitor their engagement with tasks, feedback is generated by the monitoring process" (Butler and Winne, 1995, p. 246). Typically this refers to internal feedback mechanisms. The individual has an understanding of the anticipated outcome and monitors the process of achieving it in terms of cognitive feedback (Butler and Winne, 1995). A different as-

pect is external feedback. External feedback typically only emerges once an activity is finalized, therefore it is less important for the case considered in this thesis.

Judgement. The judgmental sub-function introduced by Banduras stands for the relation of the individual towards the activity. Personal standards based on earlier valuations of others, social referential comparisons based on information about others are two core components. Furthermore, the individual valuation of the activity and perceived performance determinants are used to judge the activity. The interplay of monitoring and the judgmental function in relation to standard setting and self-appraisal can have two results. Firstly, a result can be positive in the sense that the current pursuit of the activity is fully in line with the anticipation and personal relationship with the activity. In this sense, no interference in the course of action is required. Secondly, a result may be the identification of a discrepancy between the pursue of the activity and the anticipation. In this case, something is wrong, and the individual is forced to change the procedure in order to bring the processes back into alignment.

The described mechanisms show many similarities to the more generic structure of goal setting and realization provided by action regulation theory (cf. section 3.1). Here the focus is more on following-up a learning goal, giving self-monitoring based on meta-cognition more importance throughout the overall process. Questioning whether the learning process is likely to address the learning need and the related knowledge work goal is likely to guide the overall process.

Assuming that self-regulated learning is part of the work process of individuals, the cognitive motivators described above are essential for the success of these learning activities. An example is low self-motivation. If low self-motivation is given, it will lead to unreactive self-observations. The open question is how self-regulated learning is related to individual goals and the earlier discussed learning types. This will be considered in the following.

4.5 Collaborative Learning Co-construction of Knowledge

The decision to realize a learning goal does not necessarily lead to an individual learning process. Another likely option is addressing the learning goal in a community. This can happen based on the situation at hand - the tension in action attainment might just emerge during interaction with colleagues, resulting automatically in a collective effort for regulation to address the tension. Alternatively, it can also be the case that the knowledge worker decides to rely on colleagues to address the tension.

Following Coleman et al. (1997), learning is a social-cultural process, and due to that, learning is more effective in groups as a collaborative activity. Work-related learning activities of professionals in their work, such as problem-solving situations can be addressed based on the processes of argumentative knowledge construction. During argumentative knowledge construction, learners acquire knowledge through the elaboration of learning material through the construction of arguments. Argumentative scenarios of knowledge construction are based on collaborative learning tasks (Leitão, 2000).

The work process-based learning types identified earlier can all emerge in a collaborative setup. Especially learning as goal and tension or problem-solving activities are likely to rely on brief interaction and collaboration. People try to get information that helps them in pursuing a learning goal or understanding a problem. This creates collaborative situations that are not necessarily perceived by all involved persons as learning, while the underlying process and the goal is learning for at least one participant.

Roschelle et al. highlighted that learning as a social activity has been addressed by various researchers (Dewey, 1932; Mead and Morris, 1934; Piaget, 1932; Vygotsky, 1978), and investigated those concepts in the domain of computer-supported collaborative learning (Roschelle and Teasley, 1995). This section maps the perspective to the collaboration of knowledge workers, which can happen in a computer-mediated setup, but also as face to face interaction.

Convergence is a central concept. The idea is that the different ideas of the persons in the collaborative process converge over time (Ickes and Gonzalez, 1996). In this sense, the learning process happens based on the continuous interaction, which is the discussion of utterances, their meaning in an ongoing process to come to a common understanding. The work focuses on transactivity, which stands for the process, how participants create, extend and acknowledge the ideas of other's (Hogan et al., 2000). Along this line, Teasley (1997) introduced the transactivity of the discourse. One of the outcomes is terminology for different degrees of transactive building on Teasley's scale of transactivity:

- **Epistemic dimension**, which emphasizes the analysis of the content of learners' contributions. This consists of on-task discourses that refer to individual knowledge acquisition and epistemic activities, to describe how learners deal with the learning tasks, e.g., how they categorize or define new concepts with the aim of (re-)constructing knowledge (Fischer et al., 2002). Epistemic dimensions can be distinguished between the following three types: 1) Construction of problem spaces, requiring an understanding of the problem; 2) Construction of a conceptual space that requires an understanding of the theoretical concepts consisting of summaries or discussions of the concepts; 3) Establishing relationships between conceptual and problem spaces that indicate the application of knowledge, such as the ability to analyze a problem.

- **Argument dimension**, which consists of the construction of single arguments and argumentation sequences (Toulmin, 1999). This includes arguments, counter-arguments, and answers with the aim of acquiring several perspectives on a problem and thus contributing to future-oriented problems.

- **Dimensions of social modes of co-construction of knowledge**, which focus on how learners interact with each other, e.g., how they relate their contributions to contributions of their learning partners in performing the epistemic activities (Weinberger et al., 2005). Examples include asking other concrete questions or critically negotiating different perspectives – with the aim of making people aware of the contradictions in their own individual conceptual models. These contradictions, which arise in the discourse, can be solved by the learners through the

construction of new knowledge (Weinberger et al., 2005). These dimensions of social modes of co-construction of knowledge include:

- *Externalization*, which occurs when learners contribute to discourse without referring to the contributions of other learners, e.g., explaining something to others.
- *Elicitation*, which occurs when learners use other learning partners as resources to obtain specific information from them, e.g., ask questions.
- *Quick consensus building*, which takes place when learners accept the contributions of their learning partners, not because they are convinced, but because they want to continue the discourse (Clark and Brennan, 1991). Thus, it is possible to continue with the next steps, e.g., during a project.
- *Integration-oriented consensus building*, which (in contrast to quick consensus building) takes place through the adoption of perspectives. This means that integration takes place when learners work on the basis of the argumentation of their learning partners. An indicator of this mode is when learners show a willingness to revise or change their own views to respond to convincing arguments from other learners.
- *Conflict-oriented consensus building*, which is important for collaborative learning from a social-cognitive perspective (Doise and Mugny, 1984; Teasley, 1997). This happens when learners have different perspectives but are willing to find a consensus for all in the end. This mode emphasizes the assumption that learners can find better arguments in criticism.

These five dimensions of social modes of co-construction of knowledge – namely externalization, elicitation, integration-oriented consensus building, conflict-oriented consensus building, and quick consensus building – are process steps in collaborative processes with different degrees of transactivity. To give examples: externalization is a social mode with a low transactivity while conflict-oriented consensus building has a very high transactivity (Teasley, 1997; Weinberger and Fischer, 2006).

While the origin of the transactivity dimension focuses on computer-supported collaborative learning, the different steps are useful to consider collaborative knowledge-exchange with learning characteristics as such. Professionals acquire knowledge when they are exposed to different perspectives and have to refine or restructure their own perspectives. The basis for argumentative knowledge construction in general knowledge work is the assumption that professionals are actively involved in discourse activities that are linked to knowledge acquisition. The five dimensions of the social forms of the co-construction of knowledge provide insights for a better understanding of the concrete activities of individuals in collaborative action during the knowledge-building process with their different intentions, such as externalizing to exchange information with others (e.g., explain something), triggering searches and educational actions of information from others (e.g., ask colleagues), or certain types of consensus building with the aim of finding a particular solution together within a group/community of individuals – quickly

(e.g., agreement on the next steps), integrative (e.g., joint decision within a group of different views) or conflict-oriented (e.g., differences of opinion, different opinions in the decision-making process).

Like self-directed learning sketches a process for attaining a learning goal in an individual manner, the co-construction of knowledge sketches phases of a collaborative process of attaining learning goals. In this process, individual perspectives are followed-up, and different valuations of the contributions of others are made. These components cover a broad range of learning-oriented interaction which are likely to be found in knowledge work processes. From the simple asking for answers to longer discussions with a variety of phases, very different learning situations can be addressed.

4.6 Summary

Different types of learning emerge in the work process. One of these is the continuous application of learning outcomes in the work process, which leads to new learning (cf. section 4.2). On the other hand, learning activities aim at satisfying a learning need that has arisen in the work process. In this case, there is a conscious awareness of a learning need, and the knowledge worker decides on a way of addressing it. Basically, meta-cognition is applied to analyze the learning need (see section 4.1) and to specify a learning goal (see section 4.2), resulting in development of motivation towards achieving the learning goal (see section 4.3). Based on these aspects, a decision for a learning process is made. While the option to do a separate training is an obvious option, the focus has been given to work-embedded learning. Prominent options for work-embedded learning are self-directed learning with application of self-regulation (see section 4.4) and collaborative knowledge building (see section 4.5). For all aspects, the decision is taken by the knowledge worker, under consideration of constraints like the environment and the resources available to realize the work goal.

The goal of the thesis is to investigate learning needs and how they are addressed. The chapter has given indications that at least some of the processes materialize in the work process and are observable.

5 Learning Culture

Viewing the workplace as a place of learning and the individual work process as a generator of learning inhibits the danger to sound subject-focused. The work on learning shows the contrary. For formal processes, Lave and Engeström show how groups of experts are able to generate ubiquitous learning experiences (Lave, 1991; Lave and Wenger, 1991; Engestrom, 2001). The work process does not take place in isolation but is embedded in an organizational structure that is inherently social. It is, therefore, important to consider work-based learning as a social process embedded in an environment. The individual work execution must be understood based on the social setting the work activity takes place in. Relationships between the action of individuals and social practice are the foundation of performance (Billett, 2001*a*). Following (Billett, 2004*a*, p. 116), "rather than being unintentional, the activities of participants in social practices and their learning are often central to their continuity". These practices are strongly structured and formalized by the norms and practices of the community. Such structured working procedures are *necessarily situated* (Lave and Wenger, 1991) and *institution-specific* (Boud and Garrick, 1999). The social structure as well as the norms and practices structure the participation of the individual and his or her way of working.

The concept of culture works on connections between the individual (micro-level) and social (macro-level) phenomena (Wan and Chew, 2013). This chapter will introduce the concept of culture and investigate learning from a cultural perspective. This perspective will guide the idea of a learning culture that is shared within a group. The learning culture is composed of motives, means, understandings of learning to be shared within a group. The learning culture is not assumed to be something static but something which is applied and shaped in social interactions. While acknowledging the complexity of the culture concept, the goal for this work will be the investigation of the systematic of a learning culture. Later in this thesis, this will support the investigation of learning culture and the groups which share learning cultures.

This chapter 5 is structured as follows: Firstly, culture is introduced as a concept (see section 5.1) and secondly, the subject of culture is discussed (see section 5.2). Investigation of culture shows typical ways of performing culture research and highlights the comparative approach (see section 5.3). The chapter closes with an investigation into the relationship between culture and learning and establishes the idea of a learning culture rooted in communities of practice (see section 5.4).

5.1 Concept of Culture

There are several different perspectives on culture. A selection will be presented in the following to establish an understanding of culture used in this work, which focuses on

culture as a non-static thing which is shared in groups, which influences goals and actions while shaping and being shaped by individuals through their social interaction. Culture is the central concept of anthropology (White, 1959*a*). Following a classical anthropological definition, culture is "a system of shared beliefs, values, customs, behaviors, and artifacts that the members of society use to cope with their world and with one another, and that are transmitted from generation to generation through learning" (Bates and Plog, 1990, p. 7). Similarly, Matsumoto characterizes it as "a meaning and information system, shared by a group and transmitted across generations" (Matsumoto, 2007, p. 1293). First of all, the shared aspect of culture is necessary to consider. Following the theory of cultural consensus (Romney et al., 1986), culture is an agreement of people. Next, the system characteristic of culture is important. Mental concepts that manifest in interaction with the environment and which are related in a system. Then dissemination of culture which happens based on learning between generations. The classic definition hints at culture as a collective phenomenon that is composed of meanings (ideas, beliefs) and scripted behavior patterns (practices, tasks, conventions) (Kitayama and Tompson, 2010). A perspective which is supported by classic research (Kroeber and Kluckhohn, 1953; Shweder and Bourne, 1982) and more current research (Bruner, 1990; Kitayama and Tompson, 2010) as well. This makes culture a concept that is used to understand groups, their processes, and their interaction (Young, 2014).

Culture between Individual and Group. Kroeber and Kluckhohn (1953) and Shweder and Bourne (1982) stressed that culture could best be defined at the macroeconomic and social levels in terms of values (general states of purpose) and practices (behavioral routines often designed to achieve values) that are collectively distributed and to some extent shared. Researchers Cohen (1998), Kitayama and Markus (1997) and Markus and Kitayama (2003) shared a similar perspective in explaining that culture is basically collective. This is rooted in a cultural-psychological perspective, which assumes that "individualism and collectivism are constructs that summarize fundamental differences in the way in which the relationship between individuals and societies is interpreted and whether individuals or groups are seen as fundamental units of analysis" (Oyserman and Lee, 2008, p. 311). The core unit of collectivism is the group (Oyserman and Lee, 2008). This establishes the understanding of culture as individual and social at the same time. This is also used by Busch (2009*b*), who investigates two perspectives of culture: 1) the *primordalist* perspective by viewing culture as something that exists (as given), which is rooted in individuals, and 2) the *constructivist* perspective by looking at culture as a constructed perspective on knowledge (as produced by individuals and between them in groups).

Culture between Values and Knowledge. From the above-described characteristics, culture manifests as a system of knowledge shared by a group (Reyes-García et al., 2003; Kroeber and Kluckhohn, 1953; D'Andrade, 1995). In this context, Oyserman and Lee (2008) used a situated cognition approach to conceptualize culture as a set of references that effectively activate independent or interdependent social orientations. In other words, culture activates cognitive representations and, thus, judgments and activities. This approach is rooted in the theory of situated cognition, which assumes that knowledge is inextricably linked to action and the associated environment. For a more

focused perspective, knowledge and value are to be distinguished (Busch, 2009*b*). The knowledge perspective on culture stands for stable and learnable knowledge. This is in contrast to values which have a guiding character and thus influence actions.

Culture between Static and Dynamic. In many cases, culture might appear as something static. Examples for this is referencing culture as "the collective programming of the mind" (Hofstede et al., 2010, p. 6) by psychologist and anthropologist Hofstede or the work by Matsumoto (2009). Here, the perspective is taken that culture is more than just static which is enabled through the general ability of learning. The learning is a central aspect with cultures as being "shared by people and groups who have learned behaviors" (Young, 2014, p. 350). If behaviors are learned, they are influenced by and influence culture. This makes it possible to view cultures as adaptable, never static, and – to distinguish different cultures – as relational to one another. It is not necessary to deny the static perspective completely, in favor of the dynamic perspective. Gurung (2009) follows an integrative perspective stating that culture can be seen as both – static by capturing common/shared group's attitudes and goals, and dynamic by constantly changing due to individual beliefs within groups. Individual changes cause changes within a group, and the groups' associated culture affects the individual again. In this sense, culture is constructive and constructed. This underlines culture as collectively distributed and partially shared system of values (general states of purpose) and practices (behavioral routines often aiming at achieving values). Despite the mentioned dynamic characteristics of culture, cultural influences are present. In this perspective, the actions of the individual cannot be seen isolated, but "as members of society and call the sum total of these modes of behavior culture" (Kroeber and Kluckhohn, 1953, p. 86). Accordingly, it is important to consider culture as a social process. This perspective has many advantages compared to a stable perspective on culture. The social process makes it possible to permanently renegotiate the consideration of culture in society. Culture as a system of mental knowledge shared by a cultural community refers to interpretative anthropology that assumes that "individuals actively produce meaning to interpret their surroundings and that, by doing this, they create culture" (Busch, 2009*a*, p. 3).

Manifestation of Culture. Schwartz (2013) characterizes culture as a latent, hypothetical variable that can only be measured by its manifestation. This perspective expands the view of cultural creation: it is a construct that can only be observed in manifest actions and is shaped by external stimuli. In other words, only the effect of culture can be observed. Observable manifestations are the products and the actions of groups and individuals. This includes the attribution of immanent meaning to objects and actions, going to the domain of rituals and symbol systems. One of the observable manifestations of culture is language and its exchange through media. Bruner (1990) referred to canonical cultural writings as a source of meanings deeply rooted in all human actions, i.e., how human experiences and actions are shaped by intentional states manifested by the symbolic system of cultures, such as modes of language and discourse.

Internalization of Culture. Viewing the internalization of culture, the work of Shweder and Kitayama can be considered. Shweder (1991) investigated the relationship between culture and mind, observing that culture and psyche constitute each other. An interface of anthropology, psychology, and linguistics, referred to as cultural psychol-

ogy, aims to examine "ethnic and cultural sources of psychological diversity in relation to emotional and somatic (health) functioning, self-organization, moral assessment, social cognition and human development" (Shweder, 1991, p. 497). Cultural psychology thus stands for the characterization of a comparative study of the interrelation between culture and the human psyche and thus for the consideration of methods and approaches for their implementation. "The major goals then of cultural psychology are to spell out the implicit meanings that shape psychological processes, to examine the distribution of these meanings across cultural groups, and to identify the manner of their social acquisition" (Shweder, 1991, p. 507). Accordingly, Shweder et al. assume that experiential concepts are the right analytical unit for cultural psychology. This is especially linked to the disciplinary context of anthropology, emphasizing the person-centered ethnography and the discourse between people with a related focus on psychology (representation of the experiential concepts that organize psychological functioning) and linguistics (representation of the symbolical system through language). Following Shweder (1991), it is misleading to believe that cultural conceptions must be either outside the person or inside the person. In an authentic culture, cultural ideas are likely to be collected or reproduced simultaneously in both places for good psychological reasons. Gibson's account of *affordances* seems relevant here (Gibson, 1977). Culture and psyche *afford* each other, which is another way of saying that they invent each other. The associated perspective of Kitayama and Tompson (2010) stresses that culturally prescribed means manifest as independence (e.g., self-representation, self-expression) and interdependence (e.g., sensitivity to the feelings of others), which are related to individualism (= independence) and collectivism (= interdependence) (Triandis, 1989, 1995). In this context, Kitayama and Tompson (2010) developed a model, the so-called neuro-culture interaction model, which represents the interaction between culture and brain. This model suggests that "repeated participation in a series of independent (individual) or interdependent (collective) cultural tasks leads to the corresponding patterns of brain activation and psychological tendencies [and aims] to specify the processes by which a series of cultural practices are made accessible in a particular cultural context" (Kitayama and Uskul, 2011, p. 432). This leads to the assumption that it is necessary to consider both perspectives – within individuals (tacit-implicit) and outside individuals (explicit-visible) – in order to understand the core of culture within a group. Such a group in the context of this work can also be organizations or units of the organization.

In summary, the perspectives presented on the concept of culture provide only a limited insight into a topic that has been discussed in anthropology, linguistics, psychology and many other fields. The perspectives described above are highly relevant to this work. Culture allows investigating the learning process of knowledge workers in organizations. The core question is whether there are cultural aspects in this learning process as it is situated in a social environment within the organization. It is, therefore, important to consider the interaction between the individual and the social dimension.

Accordingly, from an anthropological and psychological point of view, there are relevant key characteristics of culture (Kroeber and Kluckhohn, 1953): *1) Culture is learned*, by being composed of habits such as learned reaction tendencies, which each individual acquires through individual experiences; *2) Culture is social*, taking into account habits

that are shared between people in groups which thus constitute the culture of this group; *3) Culture is adaptive*, under consideration of cultural changes through adaptation processes, in particular with regard to the geographical and social environment; *4) Culture is integrative*, considering culture as "one product of the adaptive process, the elements of a given culture tend to form a consistent and integrated whole" (Kroeber and Kluckhohn, 1953, p. 88), instead of characterizing it as an integrative system with their "several parts in perfect equilibrium" (Kroeber and Kluckhohn, 1953, p. 89).

Following the above-described basic culture characteristics, culture is nothing static and isolated but manifests as an active, constructive, adaptive, and integrative process (Kroeber and Kluckhohn, 1953). This leads to an important perspective for this work – culture is a social process which is shared in groups and which shapes and is being shaped by individuals and groups. This perspective allows considering culture as permanently being renegotiated in society.

5.2 Subject of Culture

The given specification of culture as dynamic, shared within groups, and influencing actions does not explain the actual subject of culture. The relation between behavior has been mentioned in the previous section, also considering aspects like knowledge and value. If knowledge or value influences action, the question is how this happens and how strong the effect of culture is. In an extreme case, culture would control individual actions completely. Another option would be a very weak effect without relevance. This section investigates these questions using the work of Swidler on action strategies (Swidler, 1986). Swidler investigates the influence of culture. Culture is considered to influence the repertoire of actions individuals have for achieving goals and constraints on action selection. Swidler's perspective covers various degrees of influence of culture on behavior, and various degrees of influence individuals have on changing culture. The influence degree depends on the historical situation, which is more or less permeable for change. This consideration of Swidler allocates the subject of culture. The subject of culture is the system of culture, action strategies, and individual freedom to change in different groups. This makes the subject of culture the goal-directed action culture establishes, their stability, and their transformation over time within groups. It is important to note that Swindler does not support the consideration of culture as value. Swidler considers culture as a knowledge direction. This aspect will be discussed at the end of the section.

Swidler (1986) follows Weber's perspective on culture, which assumes that people are motivated by ideals, material interests, and ideal interests that directly guide their behavior. The process is sketched as follows. Ideas generate interest-related goals. Accordingly, interests are the engine of action that drives them forward, but ideas define the goal that people want to achieve and the means to get there. Swidler rejects Parson's perspective on culture affecting human action by values. The reason for the rejection is that she considers values to be shared across different cultures, but that the inability to formulate required actions due to cultural limitations denies the goal achievement for some cultures. The example is the culture of poverty with poor people sharing the same

goals for wealth like middle-class people but being incapable of generating the required actions. Swidler argues that "a culture has enduring effects on those who hold it, not by shaping the ends they pursue, but by providing the characteristic repertoire from which they build lines of action" (Swidler, 1986, p. 284). Action is not determined by one's own values. Rather, measures and values are organized to make use of cultural competence. Culture, in this sense, is more like a style or a set of skills and habits than a set of preferences or wants (Swidler, 1986). The term habit builds on the habitus introduced by sociologist Bourdieu, who described it as *scheme of action* (Bourdieu, 1977, 1990), which can also be understood as a way how people perceive the social world around them and react to it. In this understanding, the freedom of the individual is limited. It is not possible to easily adjust to a different culture, not due to different value systems, but due to a lack of capabilities to realize required actions. Switching culture is not about superficial adaptations, like speaking in the appropriate local style (Swidler, 1986), which is only a small part of behavioral adaptation in different cultures. Rather, the tacit aspects are of high relevance that cannot easily be consumed and reproduced, such as specific skills related to cognitive processes like aspects of interaction (Robbins and Aydede, 2009).

The skills required to adopt certain types of behavior are complex. To be able to adopt a behavior, people need to get an idea of the world in which they are trying to act, a sense that they can read reasonably (through their own feelings or through the reactions of others) how they are behaving, and the ability to choose between alternative options for action. This is related to Piaget's assimilation and accommodation action schemes. The lack of this can be recognized in the form of "culture shock" (Swidler, 1986, p. 275) when people move from one cultural community to another. Culture does not influence the goals, but it gives a tool-box that allows the individual to trigger actions towards goals. To specify this, Swidler (1986) introduces *strategies of action*. Culture shapes the capacities from which such strategies of action are constructed. The term strategy stands for "the way of organizing action" (Swidler, 1986, p. 285). Strategies of action incorporate and thus depend on habits, moods, sensibilities, and views of the world (Geertz, 1973). This indicates that "people do not build lines of action from scratch, choosing actions one at a time as efficient means to given ends. Instead, they construct chains of action, beginning with at least some pre-fabricated links. Culture influences action through the shape and organization of those links, not by determining the ends to which they are put" (Swidler, 1986, p. 276). In a basic example, a strategy could be to earn a living by working in a business as opposed to earning a living by starting a business as opposed to earning a living by relying on social welfare.

Culture interacts with a social structure in the sense of shaping and constraining action. This interaction varies over time. Swidler (1986) discusses settled and unsettled periods. Settled periods automatically define common sense based on the stable life situation and lived interaction. This limits the cultural repertoire from which the individual derives his action strategies. In contrast, unsettled times cannot rely on this automatic sharing of culture. Much more articulation and meanings need explicit articulation and generate new strategies of action in a less guided way.

Swidler (1986) follows the formal perspective of interpretive anthropology, in contrast to the tradition of cognitive anthropology. Interpretive focuses on the practices of the individual and neglects the consideration of possible underlying beliefs or values (Schondelmayer, 2008). In that context, Busch stressed that "most authors still rather tend to focus on one single perspective, either on people's minds or on their action" (Busch, 2009*b*, p. 8). For the consideration of the subject of culture in this section, it is not the focus of attention to argue for a specific perspective. Still, the support of an integrative approach that considers culture to be both, knowledge and value, is supported in general – neither a discussion of culture from knowledge, nor from values seems to be able to cover all observable culture-related scenarios. Both perspectives (cognitive and interpretive anthropology) show that culture influences people's actions in their everyday lives. As (Busch, 2012, p. 10) stated, "if we see culture as a system of knowledge that people internalize, we tend to take culture as a given that preexists a situation under analysis. If we see culture as what people practically do, the culture will rather be conceived as being produced by people's actions". This suggests a dual perspective of culture as knowledge and as value. Busch (2012) pointed out that it is very difficult to find a researcher who combines both perspectives.

The goal of this section is to derive a subject of culture. The focus on Swidler (1986) is not so much for the discussion between knowledge or value orientation. Far more, the discussion sketches the subject of culture. The subject is the cultural knowledge and values of people, the freedom they have in deciding for this, and the transformation of this over time. In this respect, looking at culture is about the capacity of culture to enable individuals to reach goals and the goals prescribed by culture – not to be seen as something static, but as something that is dynamic only in terms of the social discourse that accepts or rejects transformation. For further consideration of culture in this thesis, it will be important to understand how organizational culture influences learning and which role the workforce plays in changing and modifying it. Learning in an organization is also about aligning with an existing culture, perhaps even about supporting the transformation of a culture.

5.3 Investigation of Culture

The previous sections have introduced the concept of culture and its subject. Specific attention has been given to culture as something shared in communities that influence goals and actions. The being and influence of culture have been specified to be dynamic, but only as far as the social discourse will allow its transformation. This shows that the investigation of culture brings enormous values as it can help to understand how social groups are organized and how the decisions for goals and actions might be influenced by an underlying culture. This section will focus on the actual investigation of culture. The goal is an understanding of the typical design of culture-oriented studies.

Every investigation of culture needs representation to be used as an observation. This observation can focus on the materialization of culture in products or in actions through a human observer. Alternatively, it can trigger statements of individuals to topics that

are set in a relation of culture, e.g., in interviews or questionnaires. Another option is using already existing objects or information (e.g., statistical data like a number of people living below a poverty level), relate and interpret it from a cultural perspective. In all cases, a limited number of persons will be used to generate observations that are then transferred in the sense of aggregation, generalization, or other types of sense-making to make one or a couple of culture-related statements. In other words, the observation itself might be prone to errors, and the following transfer process to meaning might be obfuscated due to a biased interpretation of the observation. While acknowledging those limitations, it is still considered of value to investigate culture.

To explore culture, it is necessary to identify the dimensions of values and practices appropriate to the culture and enable this purpose to be fulfilled. It is assumed that culture generates a boundary for a group, which leads to one of the essential aspects that culture can only be investigated in delimitation. The investigation of specific types of culture in this sense is about comparing specific aspects of culture. A central assumption for doing research on culture is that culture examination is supported in its demarcation. This means that in order to understand the culture of individuals and groups, it is useful to examine different subgroups in which individuals act and thus shape the culture of these subgroups. The approach is to decide on different groups and investigate the difference in culture that they show. Comparative research generates such difference-based insights. Techniques can be multiple-choice questionnaires to measure the similarities between persons and use the responses to derive groups or to test earlier hypothesis (Reyes-García et al., 2003). In general, there is a variety of possible types of research to conduct comparative studies on culture, such as questionnaires (Hofstede, 1980), ethnographic methods (Young, 2014), or experiments (Kitayama and Tompson, 2010).

Possible investigation levels can be macro, ecological, and societal levels (Kroeber and Kluckhohn, 1953). Shweder and Bourne (1982) used variables like regions (Varnum et al., 2010), subsistence systems (Uskul et al., 2008), social class (Uskul et al., 2008), residential mobility (Oishi and Schimmack, 2010). Obviously, comparative studies can also come to the conclusion that certain differences between groups do not exist.

Kroeber and Kluckhohn (1953) have undertaken a critical review of culture-based concepts and definitions, stressing that the analysis of culture must include both the explicit (social dimension) and the implicit (individual dimension). Oyserman and Lee (2008) conducted a meta-analysis of the individualism and collectivism priming literature, followed by moderator analyzes, and found that a variety of primes of social orientation can induce corresponding changes in cognition. In that context, Uskul et al. (2008) examined holistic cognitive trends in attention, categorization, and reasoning in three types of communities (agriculture, fisheries, and animal husbandry) belonging to the same national, geographical, ethnic and linguistic regions and yet differing in their degree of social interdependence. Subsequently, Varnum et al. (2010) emphasized that cultures that differ in social orientation also differ in cognitive styles, i.e., cultural differences in cognition result from social orientation differences. Based on this, there are several questions which, according to Varnum et al., have not yet been answered by research, e.g., *Is the relationship between social orientation and cognition purely unidirectional?*

Could the foundation of the cognitive style reveal different ways of relating to others? Why are these social and cognitive constructs coherent at the group level – but not at the individual level? (Varnum et al., 2010, p. 12).

Hofstede serves in this context as a classic example of cultural research through a comparative study. Hofstede characterized culture as "the collective programming of the mind which distinguishes the members of one human group from another" (Hofstede et al., 2010, p. 5), i.e., the collective mental programming of people in an environment, which does not characterize an individual, but the belonging of a number of people to a group with their common experiences. This builds on Hofstede's theory of cultural dimensions, which consist of six (initially four) dimensions that are theoretical constructs to enable generalization, namely: power distance, avoidance of uncertainty, individualism versus collectivism, masculinity versus femininity, and long-term versus short-term orientation. Hofstede's theory of cultural dimensions is a framework for *cross-cultural communication* that describes the impact of a society's culture on the values of its members and their relationship to behavior, using a structure derived from *factor analysis* (Hofstede, 1980). Hofstede's aim was to carry out comparative research – to compare different nationalities. This investigation builds on the data from over 116.000 morale surveys from over 88.000 employees from 72 countries (reduced to 40 countries that had more than 50 responses each) in 20 languages at IBM between 1967 and 1969 and again between 1971 and 1973. Building on these conceptual culture dimensions, Hofstede has equated nation and culture, which refers to the general understanding of culture as a value (Busch, 2012).

It is important to note that Hofstede's work follows the idea that the people he considered in his study share many similarities based on the organization they work for. Therefore the analysis followed the hunch that a generalization of the insights with a focus on national culture is possible without being obfuscated by other cultural differences. In other words, the most striking difference between the employees is the national culture. Later studies supported his findings and thus supported the assumption.

The first study of Hofstede focused on national culture, but later work considered other factor distinguishing groups, like organization, occupation level and gender level. Especially the activities on *organizational culture* (Hofstede et al., 1990) is interesting in the context of this work. To investigate organizations, Hofstede focused on ten different organizations and considered overall twenty subgroups. This follows his insight that the data he collected from IBM did not allow to make any conclusions about the corporate culture, due to the high stability of the corporate culture. Still, already his work on organizations includes the note that there might be inhomogeneous organizational cultures (Hofstede et al., 1990). Furthermore, there is no published work that investigated the IBM data on a subgroup level for an organizational culture, which would anyway have been difficult due to the types of questions that were different from those questions used to investigate organizational culture. For organizational cultures, Hofstede did not focus on values. Following Hofstede, organisational cultures are embedded in practice and are therefore quantitatively measured. Six dimensions of practice have been identified by Hofstede: Process-Oriented vs. results-oriented, employee-oriented vs. job-oriented,

parochial vs. professional, open system vs. closed system, loose control vs. tight control, pragmatic vs. normative.

Hofstede's work has been criticized for different reasons. In the following, the perspective of Sivakumar and Nakata (2001) is provided. This includes a reduction of culture to an overly simplistic six (four) dimension concept. Furthermore, a limitation of the sample to a single multinational corporation. The failure to capture the malleability of culture over time. For ignoring within-country cultural heterogeneity that exists in the same country.

Despite the criticism, this kind of subgroup-based investigation of culture is highly relevant for this work. The research perspective supports Swidler's view, that "strategies of action are cultural products" (Swidler, 1986, p. 284). This suggests that the way people organize themselves and their activities are not influenced by culture as a factor, but are manifested through culture. From this point of view, culture should be seen both as given (individual dimension) and constructed (individual-social dimension). Particularly relevant is the perspective of culture as a construct within different subgroups, in which the individual creates a common subgroup culture with his unique cultures. Due to this, it is relevant to focus attention on "how culture shapes or constrains action, and more generally, how culture interacts with social structure" (Swidler, 1986, p. 284). Later in this work, the focus will also be on comparative cultural studies, also following Hofstede's approach to assume that the organizational culture of a single company generates enough homogeneity to allow for specific cultural subgroup investigations.

5.4 Analyzing Learning Culture

Looking at culture in the context of organizational learning requires an investigation of the relationship between culture and learning. This section investigates this relationship by considering different perspectives. Initially, work is discussed, which focuses on a one-directional influence, considering culture as an influencing factor of the learning. The limitations of this perspective are discussed under consideration of the more differentiated perspective of culture conveyed in this chapter. This chapter describes culture as *integrative* and *adaptive* (Kroeber and Kluckhohn, 1953) and as *given* and *construct* (Busch, 2009*b*). Therefore, culture cannot only be seen as an influencing factor. Rather, culture manifests as a process and product at the same time, which can be both – individual and social. This process is captured by the idea of a scholarly habitus (Watkins, 2005), which relies on practices and can be explained using *communities of practices* (Wenger, 2000). This practice orientation introduces the understanding of a learning culture that shapes and is shaped by the members of communities of practice. Following a social constructivist perspective, it will be considered that learning in communities of practice might obstruct the institutionalization processes of the learning organization (Huysman, 2002). Therefore, the scope of any analysis of learning culture should focus on practices.

Investigations of culture and learning often focus on the consideration of culture as an influencing factor of the learning. In this sense, culture often is understood as ethnic-

ity, and the investigation focuses on identifying differences and similarities in learning-related topics across different ethnicities. Topics like prejudices or the relation of the educational system to different ethnicities are considered. An example is the investigation of the relationship between ethnicity and educational success (Boykin et al., 2005). Boykin investigates the attitude towards high achievers and the preferred learning orientation of children at school with learning orientation as individualism, competition, communalism, and verve. The considered cultures are European-American and African-American students. Comparably Ellison et al. (2005) investigate classroom learning preferences of elementary students considering African-American and European-American students. Preferences are distinguished between cooperative, individualistic, and competitive learning. The conclusion is that African-American students have a higher preference for cooperative learning than European-American students. Another learning aspect that has been considered is the influence of culture on learning styles. Charlesworth (2008) investigated 113 students from Chinese, Indonesian, French origin with respect to the learning styles activist, reflector, theorist, and pragmatist[1]. They identify strong support for a connection between culture and learning style (Charlesworth, 2008). The example papers address stereotypes or prejudices. The rather static approach and the basic concept of ethnicity (e.g., skin color, nationality, country of birth) support a simplified understanding of culture and might not generate particularly new insights into the complex relationships they investigate. An example of a negative effect of this kind of research is discussed by Grimshaw (2007). For the case of Chinese students, Grimshaw shows that literature studies support stereotypes like "[them being] passive, uncritical and over-reliant on the instructor" (Grimshaw, 2007, p. 299). Similar problems are pointed out by Watkins and Noble (2008).

Along this line of thought, Watkins (2005) discusses the challenge of doing culture-oriented studies of learning. While acknowledging the relevance of culture-oriented research in the learning domain, they highlight that frequently a simplistic understanding of culture is used with a preference for ethnicity as a combination of cultural, linguistic, social class, and gender backgrounds. For Watkins there are popular myths treating "[...] ethnicity as referring to fixed and bounded *groups*, and see[ing] educational achievement as a result of the inherent psychological and even biological qualities of these *groups*" (Watkins, 2014, p. 1). Watkins argues that a more differentiated understanding of culture and its creation is required. The idea is closely aligned with the cultural understanding presented in this chapter, with culture as practices that manifest and develop over time, are individual, social and strongly depend on the interaction of individuals with the world. In investigating these practices, Watkins (2005) follows Bourdieu's understanding of habitus from an educational point of view. More specifically, they build on their own earlier work on a scholarly habitus (Watkins, 2005). To investigate this, they focus on Chinese, Pasifika[2] and Anglo[3] students and consider ethnicity, scholarly habitus, and academic success. As they point out, this design also uses culture as ethnic-

[1] Learning styles were introduced by Honey and Mumford (1986).
[2] Students with parents from Samoan, Tongan, Cook Islander, Maori, Fijian or Tokelauan.
[3] Long-time Australians with English speaking background.

ity, and at first glimpse seems to support existing stereotypes. The difference is that the mediating aspect of a scholarly habitus is considered additionally. They investigate the practices of the investigated ethnicities and especially identify differences within these groups. This leads to the insight that inside and outside school practices generate a culture that is more or less prone to succeed in the academic system under investigation. In this sense, other aspects generate the practices, like 1) the individual motivation, 2) the personal perception of education as being relevant, and 3) the assumed and experienced external feedback to be someone who is capable or incapable. This influences the development of scholarly habits.

The practice-oriented perspective towards investigating culture intrinsically covers an understanding of culture as the result of individual and social exchange processes. Culture is contextualized, and without neglecting the individual aspects, the process of creation and the adaptation from interaction with the world enable to consider culture as a non-static concept. With a focus on the learning aspect, culture provides practice and generates collaborative communities.

Here the work of Lave and Wenger on *communities of practice* provides a rich source for understanding the relationship better. In their perspective, learning in the workplace can be characterized as *legitimate peripheral participation in practice communities* (Lave, 1991). It is *situated learning* (Lave and Wenger, 1991) with the goal, to illustrate, how the process of *legitimate peripheral participation* in communities of practice enables individuals to acquire their own knowledge, skill and develop their understanding through communicating with other individuals. A community of practice is "a group of people who share an interest in a domain of human endeavor and engage in the process of collective learning that creates bonds between them" (Wenger, 2000, p. 2).

Communities of practice are characterized by 1) Addressing a domain of shared interest and access limitation based on competence; 2) Joint interaction, and learning by doing activities together, esp. sharing information, realizing goals; 3) Creating a shared collection of experiences. Lave and Wenger (1991) used ethnographic studies to investigate communities of practice. Here initially, face-to-face situations were focused. Among others, the considered communities were apprenticeships among Yucatec Mayan midwives, work-learning of US Navy quartermasters, or the claims processing unit of an insurance company. Later work also considered communities of practice which emerge without local presence but builds on technology-mediated communication (Wenger et al., 2002).

Lave and Wenger (1991) suggest that the motivation for learning is based on participation in culturally valuable collaborative practices in which something useful is produced. Lave and Wenger (1991) called it as legitimate peripheral participation (replaced by cognitive apprenticeship). This refers to a learner's opportunities to participate meaningfully as a member of a community of practices, "rather than the social designation of a learner than that of an apprentice" (Robbins and Aydede, 2009, p. 348). This is specified in the legitimate-peripheral-participation framework (Lave and Wenger, 1991). This refers to learning as "one-way movement from incompetence to competence, with little serious analysis devoted to horizontal movement and hybridization" (Engeström and Sannino, 2010, p. 2). This indicates expertise in shaping and being shaped by the

community of practice of professionals emphasizing the ability to transform it. Understanding this interplay of the individual and the community in the organization is the goal of this section.

Especially in organizational setup, it is important that the community of practice goals and values are aligned with the organizational goals and values, otherwise the misalignment will create tension. Following Lave and Wenger's communities of practice, there are three key dimensions: mutual engagement, joint enterprise, shared repertoire (Lave, 1991). They are going briefly through these terms. Mutual engagement refers to actual interactions of persons belonging to the same community of practice. It is the interaction that shapes the community of practice, making the community not being something specified by any instance, but something that emerges based on interaction. Joint enterprise basically means that the community members have common goals that guide their interactions and actions. The shared repertoire finally is a collection of all the habits and behaviors which are shared in the group, which is broad enough to include aspects like jargon or symbols as well as techniques and tools.

With a practice-oriented perspective towards culture, one can consider the existence of a learning culture that exists in such a community. The basic question is whether this learning culture becomes part of the organization. If the organization institutionalizes the learning culture of its communities of practice, it would be sufficient to consider the learning culture at the organizational level to identify a stable learning culture relevant to the organization as a whole. For this purpose, it would be necessary that the learning culture of the communities is institutionalized in an organizational learning process. This type of process has been discussed in the context of the learning organization (March and Cyert, 1963; Senge, 1990). While communities of practice at first seem to align with the learning organization (March and Cyert, 1963), it has been pointed out that they actually even complicate the required processes of institutionalization (Huysman, 2002). In other words, communities support social learning processes in the organization, but following Huysman (2002) social constructivist perspective, they also complicate institutionalization. This suggests that the communities of practice within a company establish learning processes that are not identifiable on an organizational level. Furthermore, it is likely to identify various types of learning processes. This highlights that the investigation of learning culture should focus on the community level or the practices of individuals. It is important to note that the lack of representation of the learning processes on an institutional level does not limit the influence of the organization on the practices. Beauregard et al. (2015) points out that organizational learning practices are embedded in political, normative, and semantic dynamics, which themselves are shaped by the organization. In other words, it is likely to identify a learning culture on the level of communities of practice. Learning culture is influenced by various factors; among them are also organizational factors. It is unlikely that the institution represents the learning culture of the communities of practice or even has a good understanding of it.

Various research on practice level exists. An example is the investigation of innovation processes by Hildreth and Kimble (2004). Gray has investigated informal learning in an online community of practice (Gray, 2004). Gray's study involved 43 coordinators of a

learning council who used an online community for a year, with the author acting both as a moderator of the community and as an observer. The community was analyzed on the basis of Wenger's community of practice framework (mutual engagement, joint enterprise, shared repertoire) (Wenger, 2000; Wenger et al., 2002) – using a mixed approach that included a qualitative method, postings, interview transcripts, e-mails, and a survey. Gray's work is interesting from the perspective of learning culture. While Gray can show that remote interaction enables the development of a community of practice, a comparative statement is not considered. The comparison of how different remote practice communities are established was made in the work of Usman and Yennita (2018), which is explicitly based on Gray (2004). An example worth mentioning is Hofstede's work on organizational culture, which investigated twenty units of ten companies (Hofstede et al., 1990). For investigating organizations, Hofstede concentrated on practice and explicitly avoided the national cultural orientation of his earlier work. Regarding methods, Hofstede used questionnaires. Due to the year of work, Hofstede also does not refer to the Lave and Wenger's practice groups (nor does he refer to them in later work). Although Hofstede focuses only on business units. He also mentioned that in some cases, there are doubts about a homogeneous organizational culture.

For the methods to investigate a practice-oriented analysis of learning and culture, Young focuses on ethnography: "Capturing the culture of learning requires an ethnographic analysis of individuals or groups as they engage in their culture or society" (Young, 2014, p. 351). In reference to Subramony, she underlines that ethnography becomes commonplace for culture-based analysis (Subramony, 2009). Young further points out:

> Whether it is determined through cultural practices, cultures of participation, cultures of learning, or genres of participation, the learner is engaged in a semiotic relationship with their culture and this in turn influences human learning and the acquisition of knowledge. Ethnography can be the method of measurement to understand better the learner and how knowledge is acquired (Young, 2014, p. 351)

.

In summary, learning culture likely exists in organizations, with culture being a complex factor being influenced and influencing social interaction. This is addressed well by the concept of communities of practice. The learning culture is influenced by the organization, which is part of the context, but this is only one aspect among many which shapes the community of practice. A possible assumption that the learning culture manifests in the institutionalization as one static factor is unlikely. Therefore an investigation of the culture with a focus on practices is suitable. Ethnographic research and comparative studies seem to be appropriate ways of approaching this.

5.5 Summary

This chapter has discussed the concept of culture and its relationship to learning. The goal of the discussion here was to provide a basic understanding of the concept of culture and its subject. The conveyed understanding of the concept of culture emphasizes knowledge and values, which influence the way people act. Furthermore, culture is not considered to be a static influence factor. Even the individual perception of culture might already change it. The change of culture has been set in relation to the social surrounding. There is no absolute freedom to change the personal culture, as every modification of culture will trigger a social discussion with an unknown outcome.

These processes of establishing a culture, the way culture influences the way people think and makes it especially interesting to investigate these processes for different topics. In this work, obviously, the question goes into how people learn in a company, which also triggered the discussion of a learning company.

The investigation of culture was discussed with a specific focus on comparative analysis. These insights prepared the alignment of the culture topic with the direction of this work. The perspective of a learning culture is established. Assuming a learning culture in companies means that a shared way of learning within companies might exist.

For investigating culture, the mentioned approach of comparative cultural studies will be of specific relevance for this work. An investigation of learning culture might provide relevant insight into the idea of learning offering design. Most notably, an offering might be in conflict with the learning culture and thus might be ignored. An example has been discussed by Schultze and Boland (2000), focusing on a knowledge retrieval tool that was not adopted by an analyst workforce because it was in contradiction to the expert culture they had.

This type of investigation can build on the work of Hofstede et al. (1990), which was conducted in an organizational environment. Especially his direction of focusing on a single company to avoid extreme heterogeneity in his analysis, to avoid that those cultural aspects under consideration are overshadowed by other, more relevant cultural differences. Another relevant insight is the recommendation of ethnography in the investigation of learning studies (Young, 2014). Despite the increased effort, it seems to be an appropriate means to explore an unknown culture without excluding certain aspects a priori.

Such an investigation should focus on communities of practice, as those communities are the likely place for company learning. Most notably, it might even be the case that the learning within these communities of practice is very different from the learning method institutionalized in the company. Therefore, the scope of analysis for the learning culture should be the communities themselves, not so much the organization.

These insights will be used later in this work to design a study on the learning culture within companies.

6 Organizational Perspective on Workforce Development

The previous chapters 2, 3, 4 and 5 have considered workplace learning from an individual perspective. In the following chapters 6, 7 and 8, the organizational perspective towards workplace learning will be considered further.

This chapter provides the foundation for this analysis by specifying the role of people's development for the organization. It is shown that organizations rely on the mixed abilities of the workforce, realizing core competences that provide performance (see section 6.1). To adjust to the fast pace of innovation, organizations are in an ongoing process of transformation, affecting core aspects like structure and strategy. As a result, the organization not only needs to have operational capabilities to realize routine business but also dynamic capabilities to execute the transformation (see section 6.2).

Competence as characteristic of the organization has been discussed with a focus on two terminologies, core competences and capabilities. The distinction between organizational core competences and capabilities has been considered vague (Wright et al., 2001). Here the following distinction will be used. Core competences especially focus on the strategic perspective of gaining competitive advantages. Under the term core competences, the focus is on value creation processes. Core capabilities allow understanding the idea of continuous transformation of an organization based on the capability to transform its routines.

The mentioned core competences and capabilities allow the company to provide performance. Performance is, therefore, not the result of a stable set of organizational abilities, but rather the result of a rapidly changing set of multiple competences and capabilities. In the end, these abilities result from the joint workforce. Therefore, individual abilities are important for companies. The employee abilities accumulate and combine towards organizational abilities and performance. This is a specific characteristic for knowledge-intensive organizations, which is addressed by specifically focusing on the abilities of the workforce.

There are various ways to handle this. A change of personnel is an immediate option, which, despite the obvious ethical difficulties, would not be possible in many cases due to legal requirements and lack of resources. Furthermore, the integration of new employees into a company is a demanding and complex process that does not only concern the competences of the individual. In contrast, organizational learning aims to support employees in aligning themselves with the competence requirements for organizational performance.

The most tangible result is a specific approach to human resources (HR) and the establishment of dedicated departments responsible for people development and learning development in an organization (see section 6.3).

In sum, companies want and need to influence the workforce and its capabilities and competences, which includes such aspects as a) Control to ensure that strategy can be implemented the company needs a mix of required abilities in the workforce; b) Efficiency, to ensure that people learn fast enough and that the needs of the company are taken into account; c) Taking a perspective to ensure that a learning path supported by the company is chosen when a decision is to be made in a tension.

6.1 Organizational Performance

Organizational performance relies on the core competence of a company. Core competence can be understood as collective learning in an organization towards production skills, the environment and the technologies (Javidan, 1998). Core competences have a strategic value for the organization. They must be derived from the product or service spectrum of a company. Starting from the products and services of a company, the core competences necessary to ensure business operations are identified.

Core competences lead to the more operational core capabilities which focus on the value creation processes. Capabilities can be considered as the *core* if "they differentiate a company strategically" (Leonard-Barton, 1992, p. 111). Core capabilities make it possible to understand the idea of the continuous transformation of a company, based on the ability to transform its *routines* (Nelson and Winter, 1982).

Accordingly, core competences serve as "a harmonized combination of multiple resources and skills that distinguish a firm in the marketplace" (Prahalad and Hamel, 1990, p. 117). These resources include the workforce, but also production facilities and other things that also belong to the company. The interaction of these aspects is important, as is the ability of employees to create value as a collaborative operation with the organizational facilities. In this sense, core competences can also be understood as "the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies" (Prahalad and Hamel, 1990, p. 82).

The following four main dimensions of knowledge set as core capabilities can be distinguished (Leonard-Barton, 1992):

- *Knowledge and skills*, embodied in individuals (professionals), typically associated with core capabilities (Leonard-Barton, 1992).
- *Technical systems*, that are embedded in a company and result from the collection, coding and structuring of knowledge as information (e.g., database of a product) and as procedures (e.g., application of security rules).
- *Knowledge creation and control* which is guided by management systems (e.g., the human resources department and its services), represent both formal and informal ways of knowledge creation (e.g., virtual/classroom training, mentoring/coaching, a discussion between colleagues) and knowledge control (e.g., reporting tools).

- *Values and norms/standards*, that *combine* the dimensions mentioned. They are associated with a variety of knowledge types, embodied in people and embedded in an organization. Values are "assigned to the content and structure of knowledge" (Leonard-Barton, 1992, p. 114) and are often separated or ignored from the other three above.

Core capabilities can be understood as *institutionalized* (Zucker, 1977) due to their interrelations between them within an organization and their implication on the organization. These dimensions "reflect accumulated behaviors and beliefs based on corporate success" (Leonard-Barton, 1992, p. 114).

Thus, core capability serves as "an interrelated, interdependent knowledge system" (Leonard-Barton, 1992, p. 114). If knowledge serves as a *strategically* important resource of the company, then organizational capability can be understood as knowledge integration (Grant, 2008). This suggests that organizational capability builds on individual capability in terms of several different types of individual knowledge of professionals.

Following Leonard-Barton (1992), core capabilities can become core rigidities if they are not modified, combined with different equipment or extended for a new use, such as to produce new product lines. On that base, core capabilities refer to the ability of a company to achieve a result with a performance above a certain threshold and to maintain the level of performance (Helfat and Peteraf, 2003).

Many capability definitions focus on the organizational interactions which realize work, with a capability being a collection of routines (Winter, 2000). The concept of organizational routines was initially developed by Nelson and Winter (1982). Zack elaborates on their routine concept as "regular and predictable patterns of activity which are made up by a sequence of coordinated actions by individuals" (Zack, 1999, p. 10). Beyond individuals, the routine concept considers organizations as a set of interdependent operational and administrative routines. In the perspective of Grant, this makes the organization "a huge network of routines" (Grant, 1991, p. 122). The whole concept allows understanding the collective activity of the workforce to be interlinked by routines in providing organizational performance. With the link to performance, the close relationship of the competence concept becomes obvious.

A general distinction between operational capabilities and dynamic capabilities is relevant when considering the ability to change (Helfat and Winter, 2011). This is described in the following section 6.2.

6.2 Dynamic and Operational Capabilities

Based on the previous section, it can be concluded that by focusing on routines, it is possible to analyze the company's ability to change. Employees must do both during their work in a company: On the one hand, they must perform familiar, repetitive, stable work activities, and on the other hand, they must be prepared to adapt their existing knowledge to new work situations and experiences. This is essentially caused by changes in business processes that directly generate new work orders and tasks for employees as

a result. To better understand it, operational and dynamic capabilities are described below.

Operational capabilities are all those routines that realize the normal operations. In contrast, dynamic capabilities explicitly address the capability of the organization to change. Dynamic capabilities can be understood as "the capacity to renew competences so as to achieve congruence with the changing business environment [by] adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences" (Teece et al., 1997, p. 515).

Dynamic capabilities stand for "learned and stable patterns of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness" (Zollo and Winter, 2002, p. 344). Learning not only targets dynamic capabilities but operational capabilities in the sense of routines as well. Jashapara elaborates on their work, specifying "routines [to] reflect experiential wisdom in that they are the outcome of trial and error learning and the selection and retention of past behaviors" (Jashapara, 2004, p. 79).

Dynamic capabilities result from an organization's internal experience. Zollo and Winter (2002) mentioned that the actual trigger for the generation of dynamic capabilities can be outside the organization. They can be learned. One of the examples is the Engestroms cycle of expansive learning (Engestrom, 2001; Engeström, 2008; Engeström and Sannino, 2010). Engestrom stresses that in expansive learning that "learners learn something that is not yet there" (Engestrom, 2001, p. 2). This shows the unforeseen situations in the daily work of professionals, who often do not know what problems and challenges they will face (e.g., in product or service development) until these problems and challenges suddenly arise in their daily work. The driving force for the process of knowledge creation in expansive learning is *the reduction of contradictions* (Engeström, 1999). The contradictions serve here as "driving force of change in activity" (Engestrom, 2001, p. 133), and expansive cycles – as "a possible form of transformation in activity" (Engestrom, 2001, p. 133). Thus, the key trigger in the expansive learning process is "the conflictual questioning of the existing standard practice" (Engestrom, 2001, p. 152). Based on the conflict, dynamic capabilities are learned, and change is created.

Another source of dynamic capabilities can be external triggers. It shows *absorptive capacity* with the premise that "the organization needs prior related knowledge to assimilate and use new knowledge" (Cohen and Levinthal, 1990, p. 129). *Prior knowledge* aims to facilitate the learning of new related knowledge, which can result in a set of learning skills. In contrast to the view of Nelson and Winter (1982), Cohen and Levinthal stressed the relevance of the individuals within organizations: "An organization's absorptive capacity depends on the absorptive capacities of its individual members" (Cohen and Levinthal, 1990, p. 131). This indicates that the development of organizational absorptive capacity builds on individual absorptive capacities. Still, the organization's absorptive capacity is "not simply the sum of the absorptive capacities of its employees" (Cohen and Levinthal, 1990, p. 131). It goes beyond the individual capabilities as the combined activities in combination and exchange materialize in an unexpected way beyond the sum of individual capabilities. This indicates the dependency of knowledge transfer within organizations and between its units.

In that context, learning serves as a dynamic capability, as "a process by which repetition and experimentation enable tasks to be performed better and quicker" (Teece et al., 1997, p. 520). This leads to the process of knowledge integration by the workforce.

The integration of a certain knowledge into the performance of tasks is the essence of organizational capability, which can be described as the ability to repeatedly perform a productive task (Grant, 2008). For the organization, this focuses on the integration of knowledge databases of several individuals. Due to that, organizational capability serves here as *knowledge integration* (Grant, 2008).

Along this line, Zollo and Winter (2002) argues that dynamic capabilities are learned best based on dedicated learning processes. They acknowledge that learning happens based on individual reflection and adaption, but consider this process to be very slow. They propose a process consisting of three steps: 1) Tacit accumulation of past experiences, 2) Articulation and 3) Codification. They state that it is most important to focus on things that are infrequent, do not often happen because learning will not take place on its own for these activities. This underlines the relevance of the individual experiences of the employees. Dynamic capabilities are considered to "emerge from the co-evolution of tacit experience accumulation processes with explicit knowledge articulation and codification activities" (Zollo and Winter, 2002, p. 344).

In summary, it can be said that in a knowledge-intensive company, both operational and dynamic capabilities are of great importance for the achievement of corporate goals. Company goals and strategies are realized by the employees with their different competences, knowledge, and experience, which serve as organizational resources. The work performance refers to the situational application of low and high cognitive levels of the workforce, depending on the complexity of the task and the level of knowledge of the employees in coping with these tasks.

6.3 Resource Based View and Strategic Human Resource Management

Human resource departments (HR) and the associated strategic human management (SHRM) process in companies serve as a control instance to maintain and control the performance of employees. This aims at a smooth achievement of company goals. Execution of daily work activities of the workforce has the overall goal to contribute to the achievement of the organizational goals. Therefore, HR is intended to balance between a company's goals and requirements (organizational dimension, top-down), and workforce work process-related needs (individual dimension, bottom-up).

The overall objective of this section is twofold: 1) A better understanding of why people and their competences are so important to the company in terms of the Resource-Based Perspective (RBV), the company's strategy, and the implementation in the company structure through resources; 2) An understanding of HR as an organizational unit from the RBV perspective, leading to a strategic process of human resource management to enable organizational performance through workforce performance. It shows that ded-

icated departments are responsible for specifying the required competences, monitoring them, and working on development opportunities to address perceived limitations.

Organizations Strategy Execution through Resource Based View. The Resource Based View (RBV) is a strategy framework which triggers a transformation of human resources towards an increased valuation of the workforce (Wernerfelt, 1984; Barney, 1991; Barney and Arikan, 2001; Wright et al., 2001; Barney and Clark, 2007; Wernerfelt, 1995). RBV has its roots in the firm's strategy and strategic management (Wernerfelt, 1984).

From the point of view of the RBV, the resources of a company are "all assets, abilities, organizational processes, company attributes, information, knowledge, etc., which are controlled by a company and which enable the company to develop and implement strategies which improve its efficiency and effectiveness" (Barney, 1991, p. 101)[1]. RBV follows the economic theories of Ricardo, Schumpeter, and Penrose (Wright and Mcwilliams, 1994), who, according to Barney, stress "little or no role for managers as possible sources of superior performance" (Barney and Arikan, 2001, p. 127). In contrast, resources are the actual source of corporate performance, including the workforce (people) themselves. In other words, resources within companies can serve as *strategically relevant* if they are sources of competitive advantage, which is based on a company's product market position (Barney and Arikan, 2001).

According to Barney, a resource in a company has a competitive advantage, if four attributes are met. These are: "1) It must be valuable, in the sense that they exploit opportunities and/or neutralizes threats in a firm's environment; 2) It must be rare among the firm's current and potential competition; 3) They must be imperfectly imitable; 4) It cannot be strategically equivalent substitutes for this resource that are valuable but neither rare of imperfectly imitable" (Barney, 1991, p. 105).

This goes hand in hand with the corporate culture: "A firm's culture can be a source of sustainable competitive advantage if that culture is valuable, rare, and imperfectly imitable" (Barney and Clark, 2007, p. 90). This leads to a dependency relationship between tangible and intangible assets: People as intangible assets and their created corporate culture must create a basis for a tangible asset and the associated sustainable competitive advantages of the company. All this underlines the relevance of the individual employees as resources controlled by the organization to achieve the company's goals. People development-oriented departments such as the HR and related organizational learning based units aim to contribute to the achievement of these business goals by a) continuously monitoring the competences and knowledge set of employees who need to successfully perform their work tasks, and b) supporting employee competence development and its continuous optimization through such measures as suitable learning opportunities on a particular topic. This is described in more detail in the following.

Resource Based View Effect: From Human Resources to Strategic Human Resource Management. From the point of view of the RBV (Wernerfelt, 1984; Barney, 1991; Barney and Arikan, 2001; Wright et al., 2001; Barney and Clark, 2007; Wernerfelt, 1995), the people development departments such as HR go hand in hand

[1]Firm needs to be understood as organization or company.

with the corporate strategy, i.e., the human resources department's assessment of the workforce as a resource pool should help to achieve competitive advantage.

Wernerfelt (1984) and Rumelt (1984) consider the relationship between two types of resource, namely tangible and intangible assets. Tangible assets are the products and services of the organization, while examples for intangible assets are skills, knowledge, and competences. This relationship is a cause-effect-relationship in the sense that the intangible assets enable the materialization of tangible assets. An understanding of inter-relations between tangible and intangible assets as organizational and individual resources becomes important. The individual capabilities become part of the intangible assets of the organization, and it is the goal of human resources to maintain the intangible resources. It is noteworthy to mention that the RBV does not go together with an increased valuation of the subject. The result is more valuation of capabilities, which are expected to generate a competitive value from a strategic point of view. Intangible assets are considered with respect to the value they generate for the organization.

Following Wright, "growing acceptance of internal resources as sources of competitive advantage brought legitimacy to HR assertion that people are strategically important to firm success" (Wright et al., 2001, p. 702). This led to a change in the understanding of HR within an organization. The role of HR as "a set of processes and activities jointly shared by human resources and line managers to solve people-related business problems" (Schuler and Walker, 1990, p. 7) was changed to the goal of maintaining a strategically relevant resource. Sometimes this shift is addressed as strategic human resource management (SHRM), "pattern of planned human resource deployments and activities intended to enable an organization to achieve the goals" (Wright and McMahan, 1992, p. 298). In this role, SHRM must address two relationships, frequently addressed as vertical and horizontal *fit* (Wright and McMahan, 1992). The vertical fit categorizes how well the human resource management practices and the strategic management process of the organization are aligned (Schuler and Jackson, 1987). The horizontal fit considers "the coordination or congruence among the various HR practices through a pattern of planned action" (Wright and McMahan, 1992, p. 315). Differentiation between *vertical* and *horizontal* directions illustrate an interactive and interdependent process between SHRM and business development, which is related to the organizational system and strategy perspectives (Darwish, 2013) with the workforce having not only a supportive function but being part of the business itself (Holbeche, 2009).

The first use of human resources (HR) in its modern form was by Bakke (1958) in the report *The Human Resources Function.* Bakke described the human resource function as task management with the goal "to use resources effectively for an organizational objective" (Bakke, 1958, p. 5). This is related to the resources of materials (production), money (financing, budgeting), ideas (research, design, development), market (marketing, promotion), and people. Bakke characterized the function of human resource (HR) management as "discovery, understanding, maintenance, development, effective employment and integration of all people and their work at all levels" (Bakke, 1958, p. 21). This perspective is originally rooted in Taylorism, striving to improve economic efficiency in manufacturing jobs. Taylor highlighted, that "almost every act of the workman should be preceded by one or more preparatory acts of the management which enable him to

do his work better and quicker than he otherwise could" (Taylor, 1914, p. 26). Taylor stressed that "a close, intimate, personal cooperation between the management and the men[2] is of the essence of modern scientific or task management" (Taylor, 1914, p. 26).

HR services in companies act operationally and strategically at the same time – with the aim of measuring organizational effectiveness, i.e., by monitoring and supporting the continuous development of the company's workforce. Thus, HR serves as the enabler of performance. These activities happen under consideration that "HR contributes directly to the implementation of the operating and strategic objectives of the firm" (Becker and Barry, 1996, p. 780). Accordingly, HR serves as "a set of difficult to trade and imitate, scarce, appropriable, and specialized resources and capabilities that bestow the firm's competitive advantage" (Amit and Schoemaker, 1993, p. 36). This points to the difficult nature of HR as an invisible asset that needs to be mobilized within an organization to create "value when it is so embedded in the operational systems of an organization that it enhances the firm's capabilities" (Itami, 1987, p. 36).

The key function of SHRM is to continuously maintain, control, and develop the competences of the employees that go hand in hand with the strategic competences that the company needs in view of the changing business processes. Thus, successful workforce performance enables organizational performance in terms of achieving company goals.

This results in a dynamic process that requires observations of trends and changes in the way business is made, going far beyond employing the right resources. Given the changing needs of an organization over time, it is necessary to maintain a learning-based workforce. This process is also affected by organizational changes. One example is the influence of digitalization. A Deloitte report entitled *changing role of people management in the digital age* (Durou et al., 2017) emphasizes two impact areas of such changes. On the one hand, the way SHRM is done needs to be reconsidered. On the other hand, the workforce is affected, and it must be assured that competences required by the transformation exist in the workforce. For the digitization, this means that job roles are adjusted to change, related abilities are reconsidered, and acquisition of required skills for the workforce is supported.

In this context, Drucker (1996) stressed the relevance of improving professionals' performance. As Davenport stated, for Drucker this is "the most important economic issue of the age" (Davenport, 2005, p. 8). The worker resource and the enhancement of the productivity of the worker become an increasingly relevant factor (Davenport, 2005). Although this is not limited to learning, learning must be seen as a relevant aspect.

The example of digital transformation aims to provide an understanding of how RBV integrates business and operating models to develop the knowledge, skills, and competences of professionals in organizations.

6.4 Summary

The workforce of a company works cooperatively on identifying and realizing business goals. For this purpose, the workforce needs abilities like knowledge and skills, which are

[2]In this context, the term *men* stands for the workforce and task management for the function of HR.

brought into action in the work process. It does not seem implausible to consider those specific abilities that are beneficial for business goal achievement. As a consequence, two things are important for an organization. First, the identification of abilities to achieve the goals. Second, workforce with the identified abilities. This perspective follows the idea of the strategic alignment of the workforce introduced by RBV and SHRM.

Abilities relevant for goal realization will be considered in the following in terms of competence. Competence is a concept that allows linking intent-driven behavior with performance on an individual (see section 6.1). The identification and development of relevant competences will be discussed in the following chapter 7.

7 Competence Development in Organizations

The previous chapter 6 has discussed the role of the individual for organizational success. Organizational effectiveness results from organizational performance, which builds on the individual performance of professionals (Richard et al., 2009). Professional performance again results from what a person knows and how well this knowledge can be applied at work. To consider this ability, typically, the term competence is used, which is the main topic of this chapter. Therefore, the first section 7.1 focuses on the competence term. Wright et al. (2001) argued that work success does not depend on individual intelligence but is related to competence in the sense of efficient goal-oriented activities. This allows considering competence as *a critical differentiator of performance* (McClelland, 1973; Boyatzis, 2008). Spencer considers performance as "an underlying characteristic of an individual that is causally related to criterion-referenced effective or superior performance in a job or situation" (Spencer and Spencer, 1993, p. 7). The second section 7.2 discusses the organizational competence models. The third section 7.3 concentrates on competence measurement and management.

The competence perspective influenced HR significantly with competence development becoming an important activity (Gangani et al., 2006), often addressed in dedicated departments for people development. For this reason, organizations need a competence evaluation of their employees by HR in order to be able to control and optimally increase the performance of the employees. Still, work on this shows that HR faces difficulties in accessing and measuring individual performance. Therefore the focus is typically on measuring organizational rather than individual performance (Sonnentag, 2002; Richard et al., 2009).

7.1 Competence as Individual Characteristic

Considering competence as an individual characteristic focuses on the individual ability of successful job execution. Along this line, Boyatzis (1982); Spencer and Spencer (1993) consider competence about behavior towards successful performance. Boyatzis stressed that to be able to define a competence, it is necessary to "determinate what the actions were and their place in a system and sequence of behavior and what the results or effects were and what the intent or meaning of the action and results were" (Boyatzis, 1982, p. 22).

Competence is considered to be a combination of intent and behavior. More explicitly, behavior realizes an intent that may or may not be successful. The success of behavior towards an intent is performance. This has been captured by Spencer and Spencer (1993)

in the causal flow model: Personal characteristics generate behavior that realizes job performance. Here the intent is actually guided towards an explicit object. Krogh and Roos bring knowledge and task as objects together. One can only talk about competence where the behavior meets a task (Roos and Krogh, 1992). In general, it is related to knowledge about the tasks and the individual capabilities to meet this task in behavior for successful performance.

Early competence approaches in a Tayloristic context consider competence as a collection of skills and knowledge. In the 1950s, another approach to occupational competence was created with the involvement of White and McClelland. White focused on the link between successful task execution, competence, and motivation (White, 1959*b*). He first pointed to the organizational relevance of supporting competence. McClelland extended the concept by connecting competence with a notion of task and a more specific performance understanding. Performance results from the ability of successful task execution. To realize successful task execution it is necessary to have the right knowledge and skills. This identification process is the actual challenge, which knowledge and skills are required for a task (McClelland, 1973).

In this context, McClelland distinguished competences like reading, writing, or arithmetic and explicitly integrated characteristics like personality traits. This extended the earlier understanding of competence largely. Competence is composed of knowledge, skills, and attitudes, which remains relevant in modern reflections: "[competence is] more than just knowledge or skill. It involves the ability to meet complex demands, by drawing on and mobilizing psychosocial resources (including skills and attitudes) in a particular context" (Rychen and Salganik, 2003, p. 4).

From the perspective of competence as an individual characteristic, competence models by Boyatzis (1982) and Spencer and Spencer (1993) are relevant to consider. These are described in the following.

Model of Effective Specific Job Performance (Boyatzis 1982). Boyatzis (1982) derived the individual competence characteristics of managers within a company (see figure 7.1). "A person in a management job contributes to the achievement of organizational goals through planning, coordination, supervision, and decision making regarding the investment and use of corporate human resources" (Boyatzis, 1982, p. 16). Boyatzis (1982) considers interactions with others, to be characterizing for the management job role. In simple words, all activities of a manager contribute to getting things done through people (Appley, 1969). Respective competences are management group processes, self-confidence, self-control or expertise as a usable fact and concept package.

The dynamic interaction model of work performance components and competence levels (Boyatzis, 1982) gives more insight into the relationship between competence and performance (see figure 7.2). Effective performance is described as "the attainment of specific results required by the job through specific actions while maintaining or being consistent with policies, procedures, and conditions of the organizational environment" (Boyatzis, 1982, p. 12). This follows a basic contingency theory. Maximum performance is achieved if job demands and the organizational environment are consistent. According to (Boyatzis, 1982, p. 97), individual competence is "an underlying characteristic[s] of a person in that it may be a motive, trait, skill, aspect of one's self-image or social role,

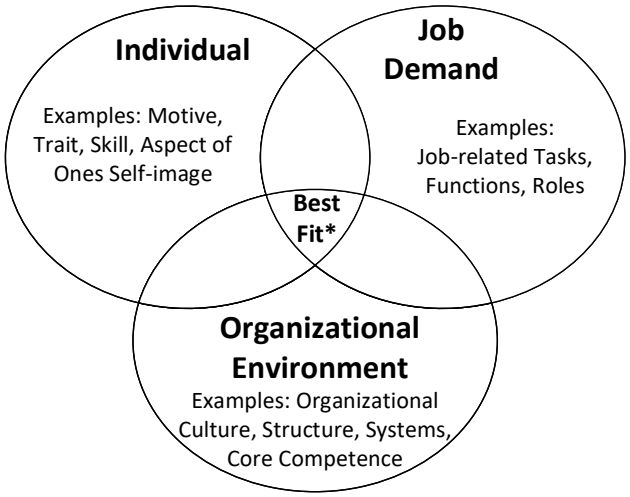

Figure 7.1: Model of Effective Specific Job Performance (Boyatzis, 1982)

or body of knowledge which he or she uses". Job demands illustrate what a person in the job is expected to do. The organizational environment situates the individual and the job role by introducing contextual factors like organizational culture.

Competence itself is a complex concept that has been specified as a collection of different individual characteristics. These approaches share that they have a composite approach to competence, being a combination of 1) expertise and experience, 2) knowledge (declarative, procedural, functional), 3) assortment of basic cognitive competences (Boyatzis, 2008). Many theories which focus competence as individual characteristic go beyond a pure knowledge or skill-oriented perspective. Trait theory and dispositional theory are also considered relevant aspects of competence, including respective systematization like central traits (individual core characteristics), common traits (cultural aspects), and cardinal traits (performative aspects) (Allport and Odbert, 1936). As a consequence of such a combination, the perspective of Birdir and Pearson is to assume that certain aspects of competence are more observable than others (Birdir and Pearson, 2000). Things like skills belong to the more observable aspects. Aspects like self-image, trait, or motives are less observable. The interrelation of these aspects with the environment is captured in the conceptual model of dynamic interactions of job performance components and competence levels (Boyatzis, 1982). The model specifies and connects the following components (see figure 7.2):

- *Traits and motives:* A *trait* can be understood as a characteristic in which the person responds to an equivalent set of stimuli, such as learning style. A *motive* includes thoughts that are related to a goal state or theme. Motives and traits

exist at both the unconscious and conscious levels within people. Both motives and traits have the most direct impact on the self-image and social role level of competence.

- *Self-image and social role:* This refers to a person's "perception of himself/herself and the evaluation of this image" (Boyatzis, 1982, p. 29). This definition of self-image incorporates the constructs of both self-concept and self-esteem. A social role is determined by the interaction of the person with others in the group. Self-image and social role aspects of competences are "mediators of motives and traits in determining actual behavior" (Boyatzis, 1982, p. 31).

- *Skills:* They can be understood as "the ability to demonstrate a system and sequence of behavior that functionally relate to attaining a performance goal" (Boyatzis, 1982, p. 33). Thus, using a skill is not a single action. It is also important to differentiate between the terms skills, tasks, and functions. For example, a function such as organizing resources or performing an organizing function requires a person to use different sets of multiple skills to perform it effectively.

- *Specific action or behavior demonstrated:* This illustrates the interface at which feedback takes place between the functional and situational demands of the job and the specific actions of the individuals. Job demand directly influences the specific actions and how they are demonstrated. Each action demonstrated has a direct effect on functional and situational job demands.

- *Functional and situational demands of specific jobs:* This illustrates the interface at which feedback takes place between the functional and situational demands of the job and the specific actions of the individuals. Job demand directly influences the specific actions and how there are demonstrated. Each action demonstrated has a direct effect on functional and situational job demands.

- *Organizational and cultural environments:* Organizational environment is the environment in which the job exists. The cultural environment is broader and stands for the environment in which professionals, as well as the organization, are located. The organizational and cultural environment "set the stage as to what appropriate actions are, but exert their impact on individual action through affecting the functional and situational job demands" (Boyatzis, 1982, p. 35).

Each of the above-described components is related to work performance in organizations and are interconnected (Boyatzis, 1982). This interconnection is difficult to investigate in detail. Still, the relationship is plausible and highlights a bidirectional influence on individual behavior. On the one hand, the individual aspects influence the action; on the other hand, the environment. Here it is noteworthy that neither the individual aspects nor the environmental factors are stable. The environment, as well as individual aspects, can change. Environmental factors are organizational factors as they emerge from the company as a legal entity composed of collaborating individuals. Therefore, the modification of those aspects and the influence of the subject is hard to

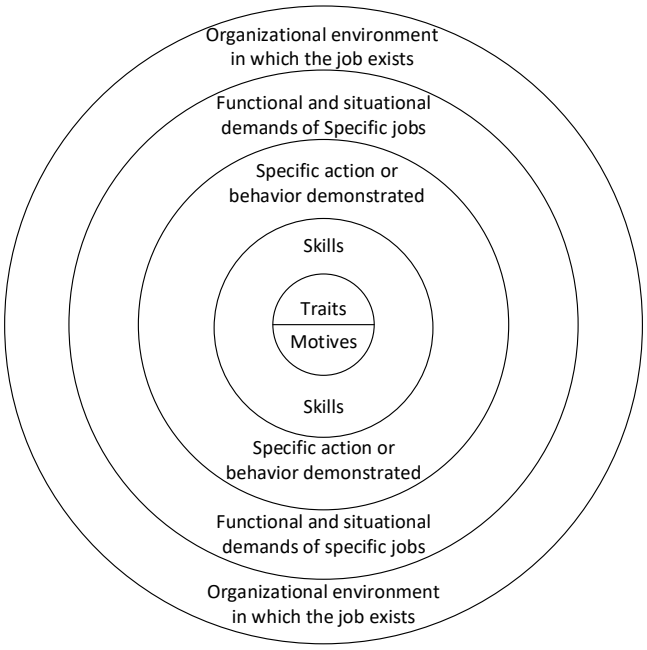

Figure 7.2: Dynamic Interaction of Work Performance Components and Competence Levels (Boyatzis, 1982)

evaluate. The individual factors can be subject to change based on personal decisions in combination with environmental processes the subject is exposed to. When it comes to the learning and optimization of competence, an opinion is that competence cannot be learned but *only be developed* (Garavan and Mcguire, 2001)[1].

In contrast, others highlight the *trainability* dimension, which, according to Eraut (1994) and Fletcher (1997), together with the potential of workplace learning, can contribute to the competence development of professionals in organizations. Given the different aspects of competence, both perspectives have their relevance. While – following the iceberg idea – some of the lower-level aspects of competence might be very challenging to change by learning (e.g., traits), others might be easier to learn. Furthermore, the learning term can be interpreted differently. Learning can be considered to take place coincidentally based on the exposition to an environment, or it can be considered with respect to conscious learning activities. Conscious learning activities refer to learning following the personal intent of learning something by a sequence of activities.

Pearson's view of scope and quality of competence through "knowing how to do something [...] and knowing how to do something competently" (Pearson, 1984, p. 32) is understood by Eraut as a stage of expertise development (Eraut, 1994, p. 167). (Eraut, 1994, p. 134) follows the argumentation of Schmidt et al. that expertise can be understood as "availability of knowledge representations in various forms" (Schmidt et al.,

[1]Garavan refers to the work of Klink et al. (2000) for this statement.

1990, p. 618). Knowledge and competences are interdependent. Both are related to learning during their work. Knowledge as a state and learning as a process (Eraut, 2007) leads to competence as a kind of qualification to perform at work (Sanghi, 2007). Because of the interdependence between the work process and professionals as knowledge workers, learning activities in the workplace become so knowledge-intensive and fluid that they become an integral and inseparable part of the work process (Boud and Garrick, 1999).

Competence Causal Flow Model – Relation to Job Performance (Spencer and Spencer 1993). An extensive analysis of competence models has been performed by Spencer and Spencer (1993). They gathered data from 286 competence models identified 760 different types of behavior. Based on this, they derived 21 mostly behavioral competences, which according to Spencer and Spencer (1993), account for 80 – 98% of the competences listed in the observed models. Their basic understanding of the competence application process, which is consistent with Boyatzis' perspective, is shown in the competence causal flow model provided in figure 7.3.

The 21 competences are 1) Achievement orientation, 2) Analytical thinking, 3) Conceptual thinking, 4) Concern for order, quality and accuracy, 5) Customer service orientation, 6) Developing others, 7) Directedness, assertiveness and use of positional power, 8) Flexibility, 9) Impact and influence, 10) Information seeking, 11) Initiative, 12) Interpersonal understanding, 13) Organizational awareness, 14) Organizational commitment, 15) Relationship building, 16) Self-confidence, 17) Self-control, 18) Team leadership, 19) Teamwork and cooperation, 20) Technical-Professional-Managerial expertise, 21) Other personal characteristics and competences. From this list, it can be deduced that essential competences are personal and interpersonal competences. Technical, business management competences are among the last on the list. This indicates a high relevance of the individual dimension of people in relation to individual performance at work in organizations.

The competences derived from Spencer and Spencer (1993) have already shown a relation to problem-solving and considered autonomy in the sense of a self-directed organization towards goals.

In that context, it is relevant to point out that competence characteristics are causally related to effective job performance, but they are not causally related to superior job performance (Spencer and Spencer, 1993). The work of Sanghi (2007) underlines this by considering competence as a necessary, not a sufficient condition. Therefore, competence is a kind of qualification to perform (Sanghi, 2007).

Spencer et al. stated that competences as underlying characteristics of people indicate "ways of behaving or thinking, generalizing across situations, and enduring for a reasonably long period of time" (Spencer and Spencer, 1993, p. 9). They distinguish between the five types of competence characteristics consisting of motives, traits, self-concept, knowledge, and skill (see figure 7.3).

The given specification gives a good idea of competence. Nevertheless, the discourse on competence remains, in many respects, vague. While the benefit of the concept for organizations has been acknowledged (Garavan and Mcguire, 2001), a lack of integration of terms and concepts has been criticized (Collin, 1989; Jubb and Robotham, 1997).

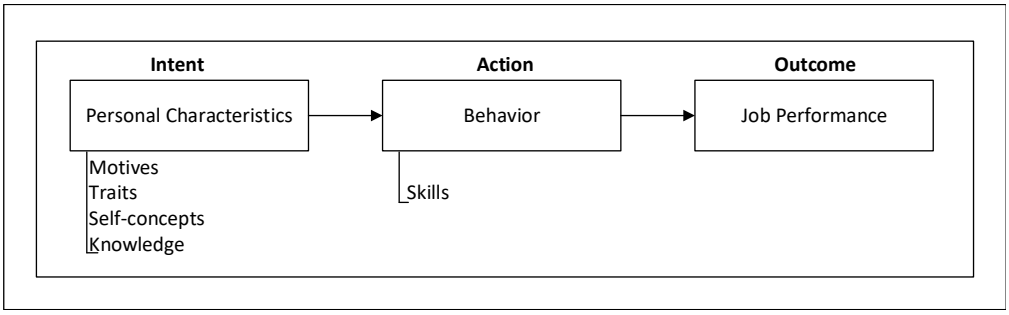

Figure 7.3: Competence Causal Flow Model (Spencer and Spencer, 1993)

The most basic distinction is to consider competence from the worker perspective. In this input-based approach, competence is based on the abilities of the worker. The quasi-opposite perspective is an output-based competence understanding which considers organizational requirements being a primary source of competence definition. Beyond the mentioned separation, another distinction of the competence term exists with a focus on the nature and application of competence. Here a frequently used distinction has been proposed by Hondeghem and Vandermeulen (2000). They distinguish three perspectives: Competences as characteristics of individuals, as characteristics of organizations, and as a discourse between education and the labour market.

The different perspectives on organizational competence, dynamic and operational capability discuss how the workforce applies competence as individual characteristics in the work process of the organization. In this cooperative activity, the ongoing application and transformation of knowledge not only realizes work execution but also realizes transformation as a kind of learning process. Collins et al. (1989) specify competence as tacit knowledge. This specification seems to be in conflict with competence as an abstract concept, which includes knowledge. The confusion arises from different perspectives on knowledge. The competence definition followed here focuses on competence as information and know-how, which is complemented by concepts like skills and traits. In Collins's knowledge definition, these aspects would be considered to be competence. The sketched discussion about the role of learning in the context of dynamic and operational capabilities has been related to the topics of learning and knowledge. Learning appears as a process that allows optimizing not only the ability to perform operational capabilities but also to question them and improve them in terms of operational capabilities.

The result is that competence is something which exists and which can be developed. It remains a decision of the organization how competence and its treatment are institutionalized.

7.2 Competence Models in Organizations

The previous section 7.1 has discussed the concept of competence. For the actual treatment of competence in the organization, the institutionalization of the concept is relevant. It is a decision of an organization how competence is considered, treated, and

developed. One way of realizing it is competence management. An important aspect of competence management is the development of a competence model for the organization. This section introduces different competence models and provides a critical discussion of static model types.

To realize successful competence management, the goal of a competence model is the integration of organizational (business) and individual (professionals) needs. To develop such a model, first, a list of requirements is needed – building on organizational, individual, and non-functional aspects. Typically competence management is understood from an organizational perspective. Individual competences must satisfy the organizational strategy. This can be seen by the work of Leonard et al. (2014), who compared competence models for business. Goal is to position skills as enablers for proficiency in work roles. This allows individuals to fill a predefined, strategy aligned role.

Global Competence Models. Competence models often come to an organized collection of skills or abilities. In the following, a collection of such skill lists is presented. The examples have been chosen to address the domain of modern knowledge work. In all cases, the goal was to develop competence models that capture the requirements of a modern knowledge workforce.

A broader US research effort focused on 21st-century skills (Pellegrino and Hilton, 2012). The model is based on the knowledge groups used in Bloom's taxonomy (cf. section 4.2). Pellegrino and Hilton (2012) list the following two key cluster groups for the 21st-century skills and competences: 1) *Cognitive competences*, containing clusters of a) Cognitive processes and strategies, b) Knowledge, c) Creativity. 2) *Interpersonal competences*, containing clusters of a) Intellectual openness, b) Work ethic/conscientiousness, c) Positive core self-evaluation, d) Team-work and e) Collaboration, f) Leadership. This list clearly indicates the huge relevance of personal competences compared to a three years older report, which emphasizes information and communication dimensions provided by Ananiadou and Claro (2009). They introduced a framework for 21st-century skills and competences consisting of the following two dimensions:

- *Information dimension.* The flood of information triggered by ICT requires new capabilities for accessing, evaluating, and organizing information in digital environments, caused by the process of digital transformation. The information has here a twofold role: *as source* (knowing how), such as searching, selecting, evaluating, and organizing and *as a product* (knowing what), such as restructuring, modeling, developing. Problem-solving and related decision making serve as an example for both in the daily work of professionals within organizations, involving activities as searching, evaluating, selecting, organizing, analyzing, reconstructing, interpreting.

- *Communication dimension.* This consists of two sub-dimensions 1) *Effective communication*, aiming to share and transmit the results/outputs of information, e.g., collaboration through virtual interaction; 2) *Ethics and social impact.* On the one hand, this includes *social responsibility* which "refers to the ability to apply criteria for its responsible use at personal and social levels" (Ananiadou and Claro, 2009,

p. 11), e.g., critical thinking, responsibility, decision making. On the other hand, this also includes *social impact*, which relates to the development of an awareness of the challenges.

The European reference framework characterizes competences as "a combination of knowledge, skills, and attitudes appropriate to the context" (Fontelles and Enestam, 2006, p. 14). In that context, eight key competences are defined with a key competence being required for "all individual needs for personal fulfillment and development, active citizenship, social inclusion, and employment" (Fontelles and Enestam, 2006, p. 13). Five of these key competences are:

- *Digital competence*, which involves the use of Information Society Technology (IST) during work activities and communication. e.g., using computers to retrieve, assess, store, produce, present, and exchange information, also to communicate and participate in collaborative networks via the internet.
- *Learning to learn*, which can be understood as "the ability to pursue and persist in learning, to organize one's own learning, including through effective management of time and information, both individually and in groups" (Fontelles and Enestam, 2006, p. 16). This competence includes awareness of one's learning process and needs, identifying available opportunities to learn successfully. Examples for this are gaining, processing, and assimilating new knowledge and skills, also seeking and making use of guidance (instructions). This competence engages professionals as learners to build on prior learning and own experiences to use and apply knowledge and skills in various contexts, such as training within organizations. Motivation and confidence are essential individual competences of professionals.
- *Social and civil competences*, which include personal, interpersonal, and intercultural characteristics and "cover all forms of behavior that equip individuals to participate in an effective and constructive way in social and working life" (Fontelles and Enestam, 2006, p. 16), e.g., solving work-based problems through active participation.
- *Sense of initiative and entrepreneurship*, which refers to "an individual's ability to turn ideas into action" (Fontelles and Enestam, 2006, p. 17), including creativity, innovation, and risk-taking, as well as the ability to plan and manage projects to achieve organizational goals. This should help professionals during their daily work by being aware of the context of their work and being able to seize opportunities.
- *Cultural awareness and expression*, which emphasizes the creative expression of ideas, experiences, and emotions in a range of media, e.g., performing or visual arts.

In sum, the understanding of lifelong competences of professionals within organizations is related to a variety of dimensions and types. The above-described strategic key competences emphasize the key characteristics of digital/IST.

The provided example reports hint to other related studies that share the overall approach of grouping lists of competences. This type of competence model is often used in companies. According to Boon and Van der Klink (2001), "many organizations possess very fixed and rather global listings of competences and do not engage in efforts to produce a set of firm-specific descriptions or take proactive steps to develop these competences" (Garavan and Mcguire, 2001, p. 150). This activity "manifests itself in prescriptive comments about how possession of specific competences can lead to high performance irrespective of the organizational context within which they are utilized" (Garavan and Mcguire, 2001, p. 146). In this sense, the competencies are defined and valid across persons and organizations. Following Garavan at al., "[competence descriptions] either come as lists with very broadly defined competences or they are so detailed and reductive as to be of limited pragmatic value" (Garavan and Mcguire, 2001, p. 151). This indicates a context-agnostic perspective on competence.

Various competence models are presented below, including synthesized competence models, competence models with a more societal scope, and organization-specific lists. The insights gained will be used to discuss the scope of these competence models and to argue for a contextualized understanding of competence in organizations.

Analysis of Competence Models in Organizations. In the following, different competence models that are used in organizations are analyzed. Erpenbeck et al. (2013) is one of the few works analyzing competence models in today's knowledge-intensive companies such as Audi, Daimler, Porsche and other industries.

Here, the competence models are analyzed with respect to a number of requirements a competence model should have. These requirements have been specified based on two workshop sessions with 6 learning professionals. The goal was to identify properties that are relevant for the integration of the competence model into the organization. This considers how the competence model transforms competence needs into actual learning support. Further attention was given to the integration of learning requirements derived from organizational strategy and from the professionals on the other hand. For every competence model, the professionals discussed the relation between competence and learning. The author of this document collected the input and organized it after the first session. The second session was for review. The resulting requirement categories are shown in table 7.1. In the following, only the results of categorizing the models according to this scheme are provided. For a detailed introduction of the different competence models, see Erpenbeck et al. (2013).

Applying the requirements to the competence models collected by Erpenbeck et al. (2013) shows that all competence models consider aspects that belong to organizational and individual needs (see table 7.2). Some models go beyond a pure specification of competences, but they specify how the competences are derived, how they are identified, and which offerings are available to improve competences within the workforce. Strategy alignment and consideration of individual technical and soft skills exist for all competence models. While most models consider learning as a relevant step for competence acquisition, only the Deloitte model explicitly considers learning mechanisms for competence-based learning opportunities.

It shows that many competence models have static lists as their core, which are supposed to be global in some parts of the organization. A distinction is typically made on a job type and experience level. There are various aspects that go beyond static lists of competences, such as more complex interrelations between competences in a taxonomy. In addition, information is sometimes provided on processes related to the maintenance of competences.

Criticism of Global Competence Lists. The competence models, considered in this section, share a global perspective on competence. The models have additional organizational criteria such as grouping and other receiver classifications, such as work role and experience. Nevertheless, the models suggest that the same set of competences should apply to large parts of the workforce.

Garavan and Mcguire (2001) criticize *a general trend of decontextualization* of competence models following the assumption that work is precisely defined. The reviewed competence models have shown this very well. The models specify stable competence models, in many cases, with a very broad scope, be it the workforce of the information age (European Union definition) or, like with the organizational framework, very large organizations.

This broad scope and stability assumption is supported by Spencer and Spencer (1993) with their 21 competences, which cover nearly all competences they identified in more than 200 reviewed studies. From a very different perspective, this might just show that the considered competence models are subject to the same limitation. In view of the above-mentioned competences, there is a tendency towards competences with specific relevance for managers who lead people. Furthermore, many competences are subject to a very high level of abstraction, which is difficult to map to actual behavior at the level of individual work performance.

A contextualization of competence models that explicitly consider the workforce is a very different option to derive competence models. Garavan and Mcguire (2001) says that it might be good to avoid typologies for competence completely and that competences should be studied within a context that addresses the employee as a whole person. Garavan proposes a phenomenological approach. Though it is not used very often, it is promising as a means to investigate the experience with competence being internally framed, not externally.

Two examples of a phenomenological approach are Tyre and Heppel (1997) and Fielding (1998). These techniques alone would not necessarily consider strategy-based competence requirements in the organization, but they would offer another data source for deriving competence models that are closely related to work and could be adjusted dynamically to upcoming strategic and work requirements. To summarize, competence management currently focuses on static competence models, while more dynamic models that integrate workforce and organizational requirements seem to be a relevant alternative.

The concept of competences has been discussed from various perspectives in this section. Different approaches towards the understanding of competence have been discussed, based on the perspective of competence being more an individual characteristic or being more organizational characteristics.

Requirement	***Specification***
Requirement of integrating organizational aspects	
Strategy and value-derived competence	Deriving from organizations strategy and values
Job-specific offerings	Differentiating between specific audiences (e.g., managers with technical or person-focus)
Requirement of integrating individual aspects	
Offerings include interactive learning	Focusing on methods with a social-character (community based)
Offerings incl. learner-centered approaches	Focusing on methods with involving professionals themselves
Address soft- and cross competences	Proving offerings based on *soft* skills and knowledge, such as team building
Address technical competences	Providing offerings based on *hard* skills and knowledge, such as software engineering (easier to measure and quantify)
Handle intercultural sensitivity	Providing offerings based on intercultural differences
Non-functional requirements – based on both – organizational and individual	
Usability	Enabling to integrate within an organization
Learning design process w. employee involvement	Enabling to identify the *current status* of required of competences and,due to that learning design demands
Consider competence interdependencies	Enabling to identify the relations between them
Rich competence specification	Enabling to identify the competences by describing them through behavior anchors

Table 7.1: Competence Model Requirements – derived from Erpenbeck et al. (2013)

Category for pot. model elements	**Audi AG**	**Robert Bosch GmbH**	**Siemens AG**	**Daimler AG**	**Deloitte GmbH**	**Deutsche Bahn AG**	**Deutsche Telekom AG**	**Porsche AG**	**E.ON SE**
Requirement of integrating organizational aspects									
Strategy and value-derived competence	yes	yes	yes	yes	yes	yes	yes	yes	yes
Job-specific offerings	N/A	yes	yes	yes	N/A	yes	N/A	N/A	yes
Requirement of integrating individual aspects									
Address soft- and cross competences	yes	yes	yes	yes	yes	yes	yes	yes	yes
Handle intercultural sensitivity	N/A	N/A	yes	N/A	N/A	N/A	yes	N/A	N/A
Address technical skills	yes	yes	yes	yes	yes	yes	yes	yes	yes
Offerings include learner-centered-approaches	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Use of methods for interactive learning	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Non-functional requirements									
Learning design process w. employee involvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Consider competence interdependencies	N/A	N/A	N/A	N/A	N/A	yes	N/A	N/A	N/A
Rich competence specification	N/A	yes	yes	N/A	N/A	yes	yes	N/A	yes
Usability - ready f. implementation	yes	yes	yes	yes	yes	yes	yes	yes	yes
Use of various learning techniques	N/A	N/A	N/A	N/A	yes	N/A	N/A	N/A	N/A

Table 7.2: Related Competence Models – derived from Erpenbeck et al. (2013)

For individual characteristics, the abstract concept, including aspects like traits, knowledge, and skills, has been highlighted. From the organizational perspective, the idea of capabilities emerging as collaborative routines has been discussed. With regard to operational and dynamic capabilities, the question of organizational ability to transform their routines based on external requirements was discussed. All aspects indicate a need for learning, while the tacit nature of the competence makes this difficult at the individual and organizational levels. This has drawn the discussion to the issue of competence management. Here the need to understand competence for an organization and to enable training has become apparent. The existence of static and predefined competence models was contrasted with the idea of more contextualized competence frameworks based on observations in the field. In the following, the topic of competence training is considered with a specific focus on organizational processes to realize organizational learning.

7.3 Measuring and Managing Competences

The previous section has informed about competence models. The models give information about target competences workers should have, and in some cases, they support the development across competence scales. The limitation of global competence lists has been mentioned in this context. In order to apply competence models to individual employees, it is necessary to measure competence status. Based on the competence status and a competence target, the required measures can be derived. This section introduces different techniques that can be applied to measure the competence state.

The goal of the organization is to maintain those competences which are required to allow the individuals to realize their work and support them in contributing to core competences. Since competence requirements can change over the course of an individual's working life, learning is also relevant to the development of operational and dynamic capabilities (Eisenhardt and Martin, 2000; Zollo and Winter, 2002). This points to the complexity of competences as a valuable asset for organizations that are described by their characteristics as organization-specific, socially complex, and path-dependent (Wright et al., 2001; Collins and Clark, 2003). Despite these contextual aspects of competence, this does not automatically generate an organizational understanding of the present competences. An organizational function, such as human resources, must gain an understanding of the existing and required competences. This is addressed by a process called competence management.

Competence management is concerned with the development of competences in the organization, which is related to the RBV discussed earlier. A foundation for competence management are competence frameworks (Garavan and Mcguire, 2001). This has two purposes: First, to facilitate the identification of the individual learning needs of professionals; Second, to ensure that learning provision meets the business needs (Reid and Barrington, 1994).

Following the direction of creating learning opportunities to meet the competence needs in the workforce, competence measurement is an important goal.

There are various works that assess specific competences, such as a measure of interpersonal communication competence (Rubin et al., 1993) or cultural competence (Kumas-Tan et al., 2007). For certain groups, competence measures have been created. The TMIG index assesses competence for older people from a geriatric perspective (Koyano et al., 1991) or there is a competence scale for child development (Harter, 1982). Given the variety of organizations, the creation of overall competence assessment systems for organizations seems to be unrealistic. This has been highlighted by Henderson et al. in the context of competence assessment in research and development activities in the pharmaceutic area. They hint to a requirement of large quantities of data, which typically is on a very aggregated level (Henderson and Cockburn, 1994). This aggregation perspective would deny a better understanding of the actual competence situation on a workforce level as HR would require it. Only with data on a more workforce-oriented level of granularity, would it be possible for HR to relate competence assessment with actual learning requirements on the resource level. To realize this, different techniques have been mentioned, such as direct observation, simulation and objective testing (Kane, 1992). These more individually-oriented techniques require a certain amount of effort in their implementation and are difficult to evaluate.

In view of the challenge mentioned above, it is also necessary to consider that organizations strive for assessment in terms of measurement. Measurements are essential for HR to evaluate specific areas and their functions within an organization to find out how an organization and its professionals perform and evolve. Thus, performance measurement serves as an ultimate dependent variable in organizations (Richard et al., 2009). A particular requirement for the terminology is that it should specify the degree to which resources fulfill measurable requirements. Measurement can be understood here as "the assignment of numbers to properties or characteristics of objects based on a set of rules" (Becker et al., 2001, p. 113). Numerical measures seem to be often more appealing due to their quantities description – which is often central to make specific decisions. There are different types of measures, such as nominal (e.g., net promoter score), ordinal, interval, or ratio. Measurement systems can serve a variety of different purposes, such as finance, customers, operation/processes or learning. One mechanism for measuring competence that has been realized in many organizations is multi-source feedback or 360-degree feedback (Hensel et al., 2010). Multi-source feedback generates nominal scores, thus follows the idea of measurement just mentioned. A specific unit focuses on multi-source feedback. The information is collected from a variety of persons who have some sort of professional relationship with the person being assessed. This includes colleagues, i.e., the people who are managed by the assessed person. In all cases, the numerical assessment of predefined characteristics is provided, which can be used to generate net promoter scores. Due to the complexity and time required for the multi-source feedback process, it is usually only used for certain types of jobs, such as managers.

Therefore, individual competence is typically measured by the manager of the individual (Rothwell and Graber, 2010). It should be noted that an individual's assessment based on the perception of only one other individual does not necessarily capture all

aspects well. Furthermore, the manager's perception of individual competences also depends on the manager's understanding of the individual.

Regardless of the way a measure is implemented, its integration into the organizational processes of monitoring and steering is important. For this purpose, mechanisms such as dashboards and scorecards are important. They are used to track and monitor various measures. Two main indicator types for measures can be distinguished – *lagging* and *leading* – originally introduced by Kaplan (1993). Lagging indicators reflect on what has happened in the past, such as metrics of Net Promoter Score (NPS). Leading indicators, which are needed to guide future decisions and to drive value creation in the company. Leading indicators enable a long-term-view to derive specific future-oriented factors (e.g., performance-based). Dashboards focus on tracking and monitoring measurements and try to be a visual tool to make understanding and information on performance accessible immediately (Yigitbasioglu and Velcu, 2012). They are generated from a variety of indicators, typically focusing lagging measures. The business scorecard with emphasis on the application of both lagging and leading indicators targets steering from a medium and long-term perspective (e.g., current and future-oriented performance factors). For more information about business scorecards, see Kaplan and Norton (1992, 1993); Kaplan (1993); Kaplan and Norton (1996); Becker et al. (2001). For competence measurement, this points to the need to decide between a review of existing competences and the realization of a competence transformation process towards future competences (Garavan and Mcguire, 2001).

The review shows the complexity of measuring competences. Due to the complexity, the manager based assessment and the use of aggregated performance data to reason about organizational performance have been perceived by the author of this thesis in different companies. The challenge to guarantee the comparability of measures in the manager based assessment, as well as the challenge to reason about individuals for performance-based aggregates, make the measurement process challenging.

7.4 Summary

This chapter focused on how learning support in companies works. Organizational support for workplace learning is based on an understanding of competence needs. The concept of competence is very well suited to the domain of knowledge work. The generation of behavior based on competence requires the autonomy to choose a work process. In order to realize organizational performance, the workforce should have certain competences, which are defined in a competence model. On the basis of this model, competence goals are specified, and the competence status of the workforce is assessed. Learning support is provided with the main goal of addressing the identified competence gap.

The competence model and the identification of competence gaps were critically discussed. Two aspects can be emphasized in particular: First, *many competence models are static* and are mainly influenced by organizational strategy. The actual work context and individual needs are neglected in the modeling process. A competence model might miss important support that is only perceived by the workforce. Second, *measuring com-*

petence is difficult, and existing techniques are likely to have an observer bias. Therefore, the perceived state of competence in the organization is not necessarily correct.

These questions are not just theoretical options. The discussion of recent studies on organizational learning shows that these two aspects are nowadays perceived as points of pain (cf. section 1.2).

8 Learning Offering Development in Organizations

The previous chapter 7 has described the concept of competence and related processes to derive learning needs based on competence measurement. This chapter describes learning offering design and development techniques. First, an overview of a typology to distinguish different learning offering types is given (see section 8.1). It shows that advanced techniques for the creation of formal learnings exist. Here especially instruction-based learning is noteworthy. Design support for other learning types is less formalized, making it more complicated for organizations to institutionalize. Therefore, the chapter follows up on the formalized learning development and introduces instructional design (see section 8.2). Agile and classic process management techniques guide the development of instruction-based training. To give an idea of the process of learning offering design the ADDIE process is presented (see section 8.3). Overall, the chapter shows that organizations make use of mature techniques for developing learning offerings. Beyond this, it is important to consider that limitations in the competence identification process will limit the success of instruction-based learning in every case. Non-formal and informal techniques are less topic-specific and, therefore, would give the learners more ability to use them for their own learning needs.

8.1 Learning Typology

Learning offerings are products that are intended to trigger a learning process when they are utilized by a learner. To distinguish different learning offerings, a typology can be used. Three different types of learning can be distinguished (La Belle, 1982), which are introduced in the following.

Formal learning, they are dedicated training sessions taking place with a trainer in a classroom or as a virtual session. It is typically provided by learning departments or externally provided by official education institutions (outside the own company) or privately (not directly related to work). Instructions are part of the learning experience.

Informal learning, they are learning activities that happen in the context of broader activities and are not organized based on any dedicated training. The professional experiences tension in the process of achieving the work objective, whereby the tension consists of some lack. As a consequence, the professional identifies the required learning activities to address the challenge.

Non-formal learning, referring to learning activities that happen as activities with an explicit learning goal and some structure to manifest the non-formal learning situation. Still, non-formal learning does not have a specific curriculum but uses an open setup as

an opportunity for new types of learning to happen. This positions non-formal learning somewhere in-between formal and informal, is not as highly structured as formal learning but having defined goals (e.g., mentoring or coaching programs within organizations).

It is important to stress that there are studies that question the separation of the different types of learning. The research review by Manuti et al. (2015) shows that the borders are not that strict. Especially interesting here is the work by Colley et al. (2002), which highlighted that very few learning situations are based on one type of learning only. This perspective shows the complexity, as competences applied in informal learning applications might be the result of earlier formal training (e.g., someone learned the basics of programming in a course, gaining competence which is then used to solve a novel problem in an informal learning style).

Despite the critics regarding the learning offering typology, it is not only used in companies. Organizations like the OECD (Organization for economic co-operation and development) host the *Recognition of non-formal and informal learning* which targets "the recognition of non-formal and informal learning [...] as an important means for making the lifelong learning for all agenda" (ISO-29990, 2010). Another example is ISO 29990:2010, *learning services for non-formal education and training* (ISO-29990, 2010), which was established in 2010 and later withdrawn. The new standard under development focuses informal learning much more. The title shows that the learning type distinction is still considered as relevant, *Learning services outside formal education* (ISO/AWS-29994, 2014). In some respect, the learning typology is a de-facto-standard for organizations. Therefore, to understand the typical processes for learning offering design, the learning typology will be used in the following.

A central point in the learning typology is the goal-relatedness of learning activities. Formal and non-formal learning address goals that are identified and supported on an organizational level. Informal learning is different. Informal learning is goal-directed; some authors consider incidental learning to be part of informal learning (Marsick and Watkins, 2001; Marsick et al., 2009), without neglecting the intentionality of informal learning. For incidental learning, they stress the intentional exploration of a passing insight to be crucial. But the goals are identified in the work process on an individual level. Informal learning happens when the professional performs his work routine with his personal background (Levitt and March, 1988), a perspective later supported by Marsick and Volpe (1999) and described as an inductive process. The professional worker identifies a tension and will learn to the extent which is necessary to accomplish the work task. The choice of channels to learn is up to the individual. From a support perspective, this makes it very challenging, because not much is known about "how it can best be supported, encouraged and developed" (Marsick and Volpe, 1999, p. 3). Reviews and studies (Marsick and Watkins, 2001; Marsick et al., 2015) show the relevance of the organization and its culture as well as the relevance of the structure of the workplace itself, the access to information sources, and the strong relevance of interpersonal communication.

The practice basically states that 70% of all workplace learning activities should happen as informal learning. Non-formal learning follows with 20% and formal training with 10%. This follows the insight that informal learning is of high relevance for any

work-related learning. The proposal of 70% was also used by Leslie et al. (1998). A comparable number was identified for the learning activities of managers at Honeywell being 62% (Zemke, 1985). The 70-20-10 model itself was created based on a self-assessment of individual learning experience across 200 professionals (Lombardo and Eichinger, 1996). The model 70-20-10 was criticized because of the data used and the lack of further support (Kajewski and Madsen, 2012) and the focus target group of successful managers (Jefferson and Pollock, 2014). The contextualization discussion of Garavan and Mcguire (2001) is very interesting in the context of the typology. The consideration of a learning mix seems to depend to a large extent on the specific organizational context, such as the profession and the type of activity. In knowledge-intensive companies and autonomous work, a high degree of informal learning seems plausible, although the specific needs might be different in the different domains, especially considering that the studies mentioned for the learning model mainly target management jobs.

As a consequence of the different types of goal-orientedness for learning offerings, the creation of learning offerings for formal and non-formal learning differs significantly from learning offerings for informal learning. Following the studies on informal learning (Marsick and Volpe, 1999; Marsick and Watkins, 2001), support should focus on learning enablement of individuals.

Enablement stands for generating a workplace and an organizational culture that improves the individual application of informal learning. The research for this thesis did not show any results for dedicated processes for the generation and installation of informal learning offerings. For formal and non-formal learning opportunities there exist guidance building on the early specification of a learning goal. Through a pre-defined goal, formal and non-formal learning leads to learning opportunities that represent a structural decomposition of a complex learning goal into smaller sections. Through a pre-defined goal, formal and non-formal learning leads to learning opportunities that represent a structural decomposition (breakdown) of a complex learning goal into smaller segments.

To realize this process, different approaches exist, including *instructional design* (Reigeluth, 1983; Gagne et al., 1992, 2005), *holistic design* (Boud, 1993; Vanasupa et al., 2009), *complex learning* (Van Merriënboer and Sweller, 2005; Merrienboer et al., 2010), with the instructional design being the most popular approach (Gagne et al., 2005). In all cases, an actual learning goal is targeted and then based on a dedicated analysis of a variety of factors, respective training programs are created.

8.2 Development Techniques for Learning Offerings

This section covers the core aspects of instructional design, to give more background around the typical way organizations create learning offerings. A combination of different instruction-based courses in curricula is a frequently used arrangement.

Instructional design has been described as “a body of knowledge that prescribes instructional actions to optimize desired instructional outcomes, such as achievement and affect” (Reigeluth, 1983, p. 5). Instruction can be understood as “deliberately arranged

set of external events designed to support internal learning processes" (Gagne et al., 2005, p. 11). Instruction aims to help professionals in learning at work. The instructions realize as events which themselves are embedded in actions intended to support learning, such as classroom training or learning groups (Gagne et al., 2005). Also, computer-based learning is considered. From the view of instructional design, learning strategies can be understood as "behaviors and thoughts in which a learner engages and which are intended to influence the learner's encoding process" (Weinstein and Mayer, 1986, p. 315). Thus, learning strategies aim "to affect the way in which the learner selects, acquires, organizes, or integrates new knowledge" (Weinstein and Mayer, 1986, p. 315). There are different learning strategies, including rehearsal strategies focusing practice of the material to be learned (e.g., repetition of facts).

The instructional design considers learning as intentional and the learning activities as being guided by learning target goals and desired learning outcomes. The process of learning is interactive and explicitly includes feedback from the learning professionals. Instructional design does not favor one way of instruction but strives for curriculum structured combination of various instruction techniques developed in a rigid process including determination of desired outcomes, development of learning activities (e.g., formal, non-formal, informal-oriented), design of different learning formats of practices (e.g., communities, focus groups), assessment (e.g., self- and or trainer based) and feedback (e.g., interviews or surveys). All are guided by the understanding that *there is no best way to teach everything* (Gagne et al., 2005).

Thereby the learning process is acknowledged to be complex and affected by many variables. These variables include the opportunity to learn (having time for learning activities), quality of instructions, ability to understand instructions. Thus, the classification of teaching methods indicates the variety of elements to be included, such as teaching tasks, teaching approaches, purposes and objectives of the methods and the role of technology (Reigeluth and Carr-Chellman, 2009). This requires, in particular, an understanding of the individual needs of professionals in order to choose the most appropriate teaching method to be used for professionals in relation to their learning needs. The focus of an instructional designer (e.g., trainer within the HR learning department) is "to create environments where the learner repeatedly is cued to give a simple response which is immediately followed by feedback" (Reigeluth and Frick, 1999, p. 143). Instructional designer aims to obtain specified goals under certain conditions Reigeluth (1983). The Bloom taxonomy used earlier to investigate learning-goal orientation in workplace learning is often used in the development phase of instructional design-based learning offerings (cf. section 4.2). The conditions can be internal (within the learner) or external (outside the learner), as described in the following.

Internal conditions can be described as "states within the learner that are involved in learning" (Reigeluth, 1983, p. 98). "The instructional designer must understand and respond to [motivational factors] in order to produce instruction that is interesting, meaningful and appropriately challenging" (Reigeluth, 1983, p. 395). These motivational states can be specified by motivational-design models, such as ARCS which stands for Attention-Relevance-Confidence-Satisfaction (Keller, 1987*a*).

External conditions, are events that happen to the learner in the learning process and interact with the process in a positive manner. They activate and support internal and external learning processes (Gagne et al., 1992). The appropriate provision of external events is the framework for planning instruction (Gagne et al., 1992).

Boyatzis (1982) models *Effective Specific Job Performance* (see figure 7.1) and *Dynamic Interaction of Work Performance Components and Competence Levels* (see figure 7.2) in the previous chapter 7 have shown the relevance of integrating internal and external conditions to derive relevant competences of professionals. Nevertheless, models of competence development in today's organizations based on instructional design approaches by HR emphasize that external conditions dominate over internal conditions (Erpenbeck et al., 2013). This points to the need to involve professionals by taking more account of internal conditions, especially their motivational orientation.

Instructional approaches consist of strategies and instruction approaches. Examples of work-related learning activities are a) the peer tutoring approach, which aims to capture ideas and concepts from individuals through monitoring and feedback, b) the case-based study approach, which focuses on professional interaction and practice-based situations.

In summary, instructional design is an advanced technique for designing learning offerings. A necessary prerequisite is knowledge of the learning goal. If no learning goal is known, support for self-directed individual or informal collaborative learning seems to be more appropriate.

8.3 Development Processes for Learning Offerings

In organizations, two typical processes for guiding the creation of learning opportunities dominate. The two processes are ADDIE and SAM, ADDIE is *an organizational framework* (Gagne et al., 2005) as a flow of successive steps and SAM as a more agile technique for realizing learning opportunities. In both cases, learning objectives and learning outcomes-oriented development of learning content are supported. SAM focuses on the repeated execution of certain steps, while ADDIE assumes that each step of the model is immediately executed correctly. In the following, the focus is on the ADDIE process.

ADDIE is depicted in figure 8.1. The process consists of the phases of analyzing (A), designing (D), developing (D), implementing (I), and evaluating (E). They are briefly described in the following.

1. Analysis. The aim is to identify the learning needs and goals – with particular emphasis on needs analysis. It is important to differentiate between wants and needs (Kaufman et al., 2002). A want is a desirable goal. Need stands for a gap between some desired state of affairs and what currently exists. Gagne et al. (2005) stresses the relevance to conducting needs analysis regarding the opportunity to identify not only desirable goals (wants), but also the gaps between the desired situation and the current state of affairs. Seels and Glasgow stated, "if there is great variability among the members of the target audience, some students will need more and different instruction than others to reach the same goal" (Seels and Glasgow, 1998, p. 11). This indicates

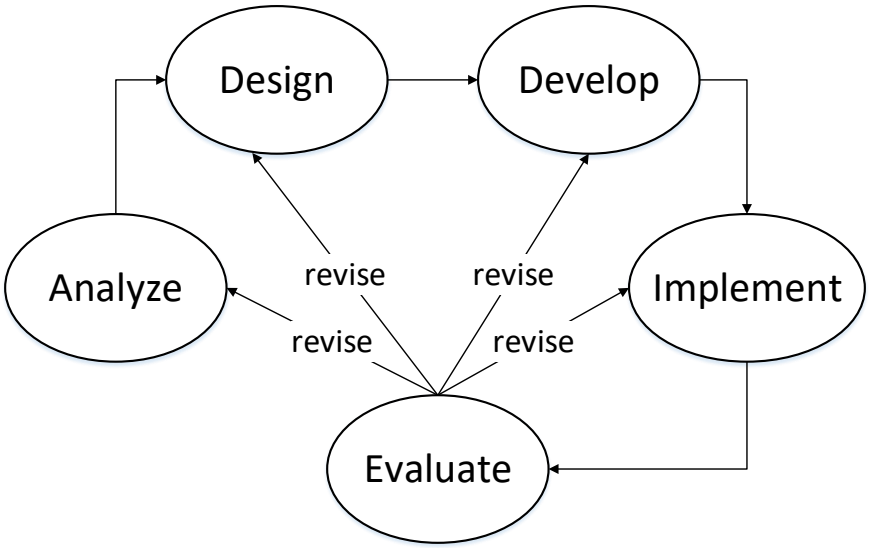

Figure 8.1: The ADDIE Model of Instructional Design (Gagne et al., 2005)

the variety of needs that can be very different across different learners. The analysis phase considers the basic learning need for which the instruction is the solution as well as conditions and constraints. Furthermore, situational factor-related needs are identified. These include professionals' knowledge, skills, and attitudes in terms of what a professional is able to do. Also, standards and expectations are relevant, related to the management-organizational aspects (e.g., departments require a specific skill). Other basic information includes motivational characteristics using techniques like the ARCS model (Keller, 1987*a*,*b*).

2. Design. The second phase is the design phase. Based on the learning needs identified in the analysis phase, a plan to guide the development of the instruction is created. Following Gagne et al. (2005) design results in creation of a specification or plans. These are used by the developers to produce the instructional support material. The process of design includes rapid prototyping to get early learner feedback regarding the functionality, feasibility, appearance of the instruction. This raises the main question of what the learners should be able to do after completing the course. Organizations often use the *top-down* approach of translating course goals into course level performance objectives (Gagne et al., 2005).

In the design phase, the instructional system design is applied. It is "an arrangement of resources and procedures used to facilitate learning" (Gagne et al., 2005, p. 18). Instructional system design includes various learning forms, highly structured, such as classroom training or less structured such as coaching/mentoring. Application within many combinations of delivery systems is possible, such as face-to-face-classroom training (training in person), web-based virtual classrooms (digital training), or self-directed learning.

The design phase includes the translation of goals into major objectives of learning offerings. Learning objectives include intellectual skills, cognitive strategies, attitudes, and/or motor skills (Gagne et al., 2005). The learning objective is used to identify single units with respective sub-goals, which are sketched. Basically, the overall learning process is generated based on offerings with respective units. The design process also includes assessment planning. Assessment is expected to be valid and reliable measures of what learners have learned as a result of instruction on specific objectives – this is called an objective-referenced assessment. Assessment makes use of techniques, such as data collection and analysis, consisting of two types *criterion-referenced* and *normative*. Both are objective-referenced. The difference between them focuses on how the performance standard is set (Gagne et al., 2005). The criterion-referenced measurement is a predetermined standard to assess personal performance – the level to which the learner mastered the learning objectives. The normative standard tests inter-learner performance – how different the levels are across the learners. Gagne et al. (2005) states, that criterion-referenced measures are used most frequently to assure that a majority of learners reach the course goals. This indicates the above-described tension between standardization and individualization of HR services.

3. Development. It includes decision making for a specific learning type or their combination, preparing learning activities, trying out, and revising/refining activities. Instructional designers must, on the base of the results from the previous two phases of analysis and design, construct a product (e.g., classroom and/or virtual training) for the delivery of the information during this phase. A process from planning to production is covered, including the preparation of materials to be used in the learning environment.

4. Implementation. Product delivery and ongoing maintenance are targeted. This may include management of a system that contains individual records of each learning offering with learner requirements, learner guidance as well as documentation and planning for changes. The implementation also includes training and supporting instructors. The delivery environment is another aspect, including schedules for various course-related activities, such as collection and utilization of evaluation results. Furthermore, evaluation in the implementation phase is used to achieve and ensure course effectiveness.

5. Evaluation. Compared to the formative assessment in the implementation phase emphasizing course improvement, here the focus is on the assessment of the learning effect. Here the individual evaluation of professionals to help to make these learning offerings suitable is especially important. Different models exist to realize evaluation. One is the Kirkpatrick model.

The four-level model of Kirkpatrick (1959) serves as one of the most popular approaches for evaluating training in organizations and aims to help instructional trainers to measure the effectiveness of providing training in an objective way. This measurement of training outcomes includes the following four levels:

1. *Reaction* – assessment of the training participants' reaction to the training, including general opinion, quality and relevance assessment.

2. *Learning* – focus on learner achievement evaluation by using various tests developed and validated during design (ADDIE phase two, s. above) and development (ADDIE phase three s. above). These tests in today's organizations are often standardized e.g., happy sheets.

3. *Behavior* – evaluation of the participants' ability to apply knowledge, skills and attitudes in daily life, including reaction (level 1) and learning (level 2). This third level, *the transfer of instruction*, refers to how well learners apply what they have learned. A crucial challenge is the identification of appropriate measures to estimate which factors influence the learner performance (Gagne et al., 2005).

4. *Results* – a measurement of training impact with respect to organizational goals. Learner reaction can be measured through a *self-report survey* conducted at the end of a learning offering (e.g., training). This can include questions referring to the instruction clarity, quality, instructor effectiveness, and logical connectedness of all instruction elements. A typical example is a financial measure (Bates and Bates, 2004).

This Kirkpatrick model is perceived as controversial (Bates and Bates, 2004). Despite the popularity of this model as the primary organizing design for training evaluations, this has important limitations – especially regarding the incompleteness and vagueness through lack of causal linkages.

To summarize, development and delivery processes captured in ADDIE and SAM are mature and organize the whole learning offering design process.

8.4 Summary

This chapter concludes the organizational perspective on workplace learning and the theoretical part of the thesis.

The discussion on measuring competence and the development of learning opportunities shows different tendencies. While organizations have an inherent interest in supporting the competence development of their employees, the techniques used have a pre-selection for a top-down definition of needs and related offerings. The commonly used competence metrics and measurement techniques are not able to capture specific workforce needs. The perspective is rather towards the generation of broad and standardized offerings to be consumed by a large audience.

The well-documented and goal-oriented way of developing formal offerings fit well into an organizational context. In contrast, techniques for non-formal and informal learning are less well specified and harder to develop in organizational structures. Therefore they may receive less attention in an organizational setup. In particular, support for fine-grained challenges in the work process that are to be addressed through learning at work is not supported. This does not mean that the techniques mentioned for workplace learning, such as self-directed learning or community of practice, are not taken into account by the organization. It is more the institutionalization of this type of learning that is not part of the commonly used techniques and processes described in this thesis.

Overall, two aspects need to be addressed in parallel. Firstly, the improvement of organizational performance by aligning organizational competence with the competence needs arising from the strategic objectives. Second and very closely related to the first aspect is to support individual competence acquisition by professionals by providing learner-centered, targeted formats of learning opportunities and creating attractive jobs to support the engagement of professionals in flexible learning modes (e.g., non-formal, informal, using learning communities) and learning environments (e.g., individual adaptation of new techniques or use of specific virtual or physical learning spaces). A tendency to separate organizational and individual levels should be avoided, as individual competence is what makes organizational success possible.

9 Research Questions and Theoretical Expectations

In the following, the main insights from the theoretical investigation are discussed from the perspective of the guiding question of this work. It will show that theory provides a framework that supports a general understanding of the processes involved in workplace learning. There is one limitation. How the framework is actually *lived* in a knowledge-intensive organization today is not immediately obvious. Investigation of workplace learning in organizations will guide the empirical research of this thesis. The focus will be the identification of the characteristics of lived workplace learning, including the relevance of experience for learning goals. Furthermore, differences in workplace learning across types of knowledge work and across countries will be investigated. These fields of investigation are worked out in detail in this chapter.

9.1 Research Design based on Theoretical Research

The guiding question of this work is: *How do professionals in organizations learn in the work process?* The theoretical part of this thesis has focused on knowledge work executed by experienced professionals who can autonomously decide how they structure their work process to realize work goals. For this group, the theory shows that learning in organizations is, to a large extent, embedded in the work process. In the following, the limitation of the insights gained by literature is specified and used to derive research questions that structure the empirical part of the thesis.

Unclear Integration of Learning into Work. Two types of embeddings were described. On the one hand, in the sense of reinforcement learning by repeating well-known work activities, on the other hand, based on self-directed learning activities or group interactions to address learning needs at hand. Action regulation theory and secondary experience support the assumption that in many cases, individual awareness of learning needs exists. In those cases, it is the knowledge worker who decides how to address a learning need. This decision has a considerable influence on learning success. To which extent these forms of learning emerge in the work process remains unclear.

Unknown Factors that Influence the Learning Processes at Work. Another aspect is the factors that influence the learning process as such. They are environmental aspects, such as places or community aspects that make learning easier or more difficult. Examples are office designs that facilitate self-directed learning by providing easy access to information and avoiding distractions. Another aspect is the idea of community when working with people who enjoy exchanging information and helping to close knowledge gaps. This can be regarded as a learning culture. Culture represents values and norms,

as well as a preference for certain activity schemes. Groups with a common learning culture make similar decisions regarding learning in the work process. Learning cultures are discussed in theory, for the organization, with particular reference to the concept of communities of practice. The actual influence of certain characteristics on learning at work is not discussed in the literature.

Investigation with Work Process Focus. To understand how learning is integrated into the actual work process and which factors affect it, empirical research will be conducted. It is necessary to consider the individuals and the work they do on a daily basis in their work environment. The consideration should relate to the actual work process of the individuals, to the things they do to fulfill their work tasks. In particular, the tensions experienced by the individual and the resulting learning processes that the individual encounters in a self-directed and self-regulated manner, either alone or in groups, should be taken into account, as they represent decisive moments in which existing knowledge is used to build new knowledge and to generate experience. Especially the existence of a learning culture and its differences within a company can enrich the understanding.

Organizational Goal. Beyond expanding a general understanding of learning in the workplace, there is also a practical reason for this. Organizations want to support learning. While there are advanced techniques for designing learning opportunities, the techniques for deriving competence needs and competence status are limited. Competence needs are often derived directly from the organizational strategy without taking individual needs into account. The examination of the competence status has weaknesses that can make it difficult to establish a reliable understanding of the status (for both aspects compare chapter 8). With an increased understanding of workplace learning, it is possible to integrate individual needs into learning needs and competence status investigation. This could improve the success of organizational learning offerings. With a better understanding of workplace learning, it is possible to integrate individual needs into the study of learning needs and competence status. This could improve the success of organizational learning offerings.

Explorative Empirical Research and Research Questions. As a consequence, the empirical research executed in this thesis targets the lived workplace learning of professionals in a knowledge-intensive company. Due to limited information, no dedicated assumptions are given. The research has an exploratory character. In order to address the limitations of existing knowledge about learning at work, field research will be conducted. The research in this work aims to answer research questions that systematically address the above-mentioned limitations – the integration of learning into the work process and the factors affecting learning. Research questions (RQs) are points of reference for characterizing the soundness of research design and the appropriateness of the methods to be used for collecting and interpreting data (Flick, 2009). Whether or not empirical activities provide answers depends on the formulation of such questions. This determines which methods are suitable and who (individuals, groups, institutions) or what (processes, activities) should be included in the study. In the following, the research questions and the associated expectations are described.

9.2 Workplace Learning Characterization

Research Question 1 (a and b): What are the characteristics of workplace learning?

The first topic of investigation is how workplace learning is lived and experienced by professionals. With learning being embedded in the work process and influenced by individual decisions of professionals, this is difficult to investigate. The investigation considers, on the one hand, the manifestation of learning in the work process, on the other hand, the individual perspective towards learning. Two approaches investigate this:

Research Question 1a: Workplace learning characterization – method of work process observation

For characterizing workplace learning, the work process of professionals is analyzed. The work process is the actual manifestation of workplace learning and should improve the understanding of the interplay between work and learning. The work process is an experience of the professional and interactions. This includes actual activities in the work process (cf. section 2.4). It will be part of the research to identify appropriate techniques to analyze the work process. Upfront, it is unclear to which extent learning materializes and whether next to activities themselves, also cognitive processes can be observed (e.g., meta-cognition, regulation, assimilation, and accommodation, cf. chapter 4). Answering these aspects is also an aspect of the research question 1a.

Theoretical expectation, according to research question 1a, is: Learning is embedded in the work process. The work process improves the understanding of this relation (TE-RQ1a).

In order to support research question 1a, which focuses on the perspective of the work process in deriving characteristics of learning at the workplace, it is relevant to include the professionals' own perspective. An obvious blind spot of research question 1a is the lack of understanding of the thoughts and considerations which generate the work process and the embedded learning. While it is not possible to derive this immediately, the individual understanding of workplace learning is investigated. This leads to the second approach to this research question:

Research Question 1b: Workplace learning characterization – method of self-report study

Research question 1b focuses on obtaining information on workplace learning activities in work from professionals themselves. Research question 1a and research question 1b have the same goal to derive workplace learning characteristics of professionals in their work but differ in the methods used to collect respective information. Considerations related to workplace learning are analyzed based on a self-report of professionals. Furthermore, it will show to which extent professionals are aware of their own learning.

Theoretical expectation, according to research question 1b, is: Professionals have an understanding of workplace learning beyond the learning considerations in the work process (TE-RQ1b).

9.3 Analysis of How Learning is Applied at Work

Research question 2: How is learning applied at work?

The work process of professionals can be understood to be generated purely from things learned at an earlier point in time. Every purely work-related thing was learned. This includes social interactions, interaction with computers, or behavior in an office building. It is a competence application. At the same time, the application of competence will be shaping the learning process again.

This interplay between applying what has been learned and new learning is likely based on theoretical analysis. The theoretical part of this thesis has discussed learning goals (see section 4.2) and knowledge building strategies (see section 4.5). The actual presence and relation are not obvious and should be analyzed. Especially, it is unclear which types of competences are used in work processes, and which types of learning are triggered in parallel. This research question focuses on the application of learning and resulting learning processes in the work process.

Following Bloom's taxonomy of learning outcomes, different complexity levels of learning outcomes can be separated. While simple repetition has a low position in the hierarchy, the ability to judge and integrate (evaluation and synthesis in taxonomy) has a high position. The characteristics of knowledge work (cf. section 2.2) suggest that the work process will frequently make use of learning outcomes positioned on higher levels in the taxonomy. This could again trigger learning for similar levels. This assumption will be investigated.

Theoretical expectation, according to research question 2, is: The work process continuously utilizes things learned earlier. Knowledge work is likely to make use of rather complex capabilities learned earlier, such as the ability to analyze, evaluate, or synthesize and train these capabilities (TE-RQ2).

9.4 Workplace Learning Differences

The way how workplace learning of professionals manifests will differ from person to person. The work on the research questions 1 and 2 will hint to aspects which are stable and to other aspects which are less stable across participants of the conducted study. It is the subject of the third research question to investigate the differences which exist between different types of learning. To investigate this, the perspective of a learning culture will be used. This perspective has been introduced in the theory section of this thesis (see chapter 5). The treatment of the research question will investigate whether different learning cultures exist in a company. For this purpose, two aspects are typically used to group learning offers in companies.

Depending on the *country* and *job profiles*, the way people work can vary. Therefore, this is used to investigate the possible differences in learning activities in the workplace. These insights would also support the work on investigating different learning cultures in an organization. This leads to the following research questions:

Research question 3a: Are there workplace learning differences due to the work location (country) of global professionals in their daily work?

Theoretical expectation, according to research question 3a, is: There are country-specific (culture-oriented) differences in the workplace learning activities of global professionals in their work (TE-RQ3a).

Research question 3b: Are there workplace learning differences due to the work profiles (managers/experts) of professionals in their daily work?

Theoretical expectation, according to research question 3b, is: There are work profiles (culture-oriented) specific workplace learning differences of professionals (manager or expert) in their daily work (TE-RQ3b).

9.5 Summary

The three research questions described in this chapter aim to address the overall research question of this work: *How do professionals in organizations learn in the work process?* The research questions guide an explorative study of workplace learning in organizations. The focal points are: 1) Characteristics of learning in the workplace, which are investigated on the basis of work process analysis (RQ1a) and the professionals' own opinion (RQ1b), 2) Application of learning in the work process (RQ2) and 3) Learning differences in work processes due to the *lived* learning cultures in an organization in relation to the country of residence (RQ3a) and the work profiles (RQ3b) of the professionals.

To address these research questions, appropriate approaches and methods are required, which are described in the following chapter.

10 Research Design: Approach and Methods

This chapter presents the research design used to create an empirical study to address the research questions specified in the previous chapter (see chapter 9). Empirical research typically involves the study of *human problem solving* (Ericsson and Simon, 1993). The direction of the research questions is to gain knowledge about the individual workplace learning activities of professionals. The research questions will be addressed using explorative research from the perspective of the social sciences. Social sciences investigate human behavior by studying relationships and interactions between people (Stebbins, 2001).

In this thesis, the research scope is workplace learning activities of professionals during their work in a company. The actual manifestation of these processes in modern workplace environments with the constraints considered in this work – knowledge-intensive work in the years 2016 till 2018 – is rare. An appropriate research methodology and methods are required to address the research questions of this thesis. This is described in the following.

10.1 Inductive Methodology

To address the research questions, a suitable methodology guiding the overall research process is required. The goal is to address the research questions based on empirical research on workplace learning, which considers the constraints of this work. Empirical research typically includes the investigation of human problem solutions (Ericsson and Simon, 1993) studying relationships and interactions between people (Stebbins, 2001). From this perspective, this work aims to investigate the learning activities of professionals at the workplace during their work in the organization to derive knowledge in terms of structured insights or theory. Human resource services are supported by this knowledge to develop appropriate learning opportunities for professionals in companies. This requires a research process that addresses the research questions and takes into account the complexity of the topic and the lack of insight into the actual learning processes in the workplace as they occur in everyday working life.

In the most basic perspective, two types of research can be distinguished, inductive, and deductive. It is necessary to choose a methodology that will be used for the research presented in this thesis. The focus of the approaches: 1) *The deductive approach* tests a priori specified theory. An existing model is tested against a topic in general in the specific way (top-down); 2) *The inductive approach* generates a new theory from data that goes from specific to general (bottom-up). Both research approaches – the deductive

and the inductive – differ in the differentiation of the investigated research object (see figure 10.1). At this point, it must be decided whether the deductive or inductive methodology is used in this work to address the research questions. Depending on the research methodology there are two main process models of research (Flick, 2009) (see figure 10.2) – linear and circular – which are briefly described below.

The linear model type of the research process and theory begins with an existing (a priori) approach to validate through hypothesis testing. This model of the linear process includes successive stages of: 1) Formulation of hypotheses focusing on which aspects of the theory need to be tested, 2) Selection of methods for conducting hypothesis testing based on the research questions, 3) Selection of the target group (sampling) for the research cases to be investigated, 4) Collection of data to obtain insights from the selected research cases using selected data collection methods, 5) Evaluation of the collected data using previously selected methods and, based on this, 5) Validation of the theory through hypothesis testing.

The circular model type of the research process and theory begins with preliminary theoretical assumptions such as working hypotheses (Dewey, 1938*b*), which should not be applied to the object under investigation but should be discovered and formulated as a result of the investigation. This leads to the goal of generating a new theory based on the data. In contrast to the linear model, the circular process is not sequential. This means that there are no isolated stages in this process until the theory is formed, but these stages are flexible in the combination and application of methods. Based on one or more methods for data collection, purposeful sampling is used to group the targeted selection of cases (Cohen et al., 2007; Given, 2008; Flick, 2009). The actual data evaluation of the collected data is referred to as type building. This evaluation and interpretation consists of four further steps (Kluge, 2000): 1) Development of relevant comparative dimensions (dimensioning, quantification), 2) Grouping of cases and analysis of empirical regulations (contrasting), 3) Analysis of contextual meanings and type formation (coding, reduction), 4) Characterization of the type building – capturing the typical. Type building serves as an opportunity to take theoretical concepts and hypotheses as a starting point and to present data-based theory and hypothesis formation as the goal of research.

Traditional deductive methods, which derive research questions and hypotheses from theoretical models and test them against empirical evidence, seem inadequate for the research situation tackled in this work. There is no a priori theory, only several hypotheses, and expectations shaped by the literature. Therefore, the deductive methodology does not meet the requirements of the workplace learning-related research questions in this investigation. This suggests the usage of *the circular approach* for the research process (see figure 10.2). The circular methodology, with its inductive approach, fits well with the exploratory character of the research questions in this thesis. It enables the exploration of the subject and sensitizes to the initially unknown contextual factors of the investigated phenomenon (Flick, 2009). Therefore it will be used in the research activity. This will affect the selection of appropriate methods for data collection and analysis. Understanding the variety of applicable methods and making an appropriate choice for this research activity is addressed below.

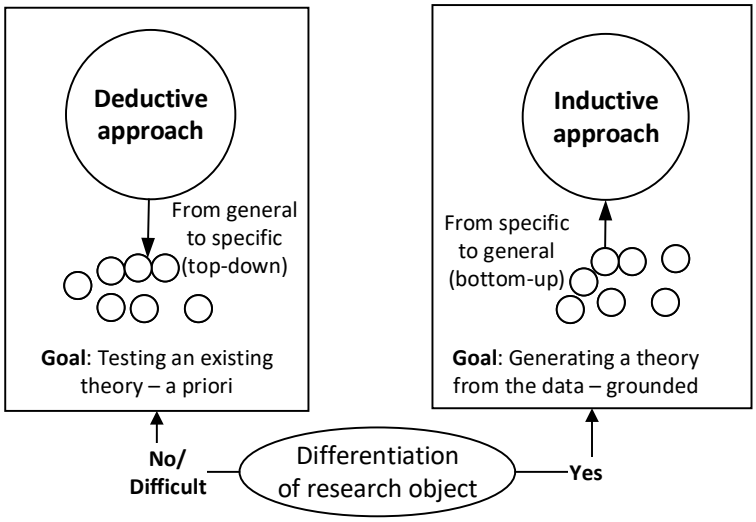

Figure 10.1: Deductive and Inductive Research Approaches, according to Cohen et al. (2007)

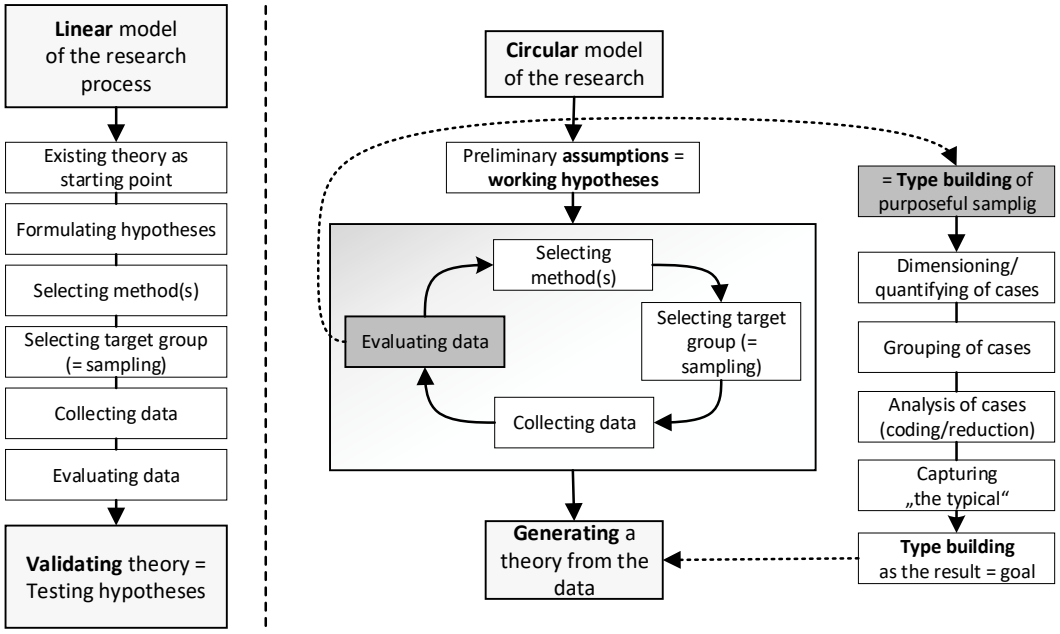

Figure 10.2: Linear and Circular Models of Research Process and Theory, according to Flick (2009)

10.2 Ethnography-based Research

The selection of a methodology guides the method selection process of the research activity. The planned research activity will focus on a mixed-method approach, integrating participant observation as an ethnographic method, interviews, and explorative data analysis. The following section gives an overview of these methods and their relevance to the research activity.

The inductive research approach has a strong focus on qualitative methods, while also quantitative methods like exploratory data analysis can be of relevance. Quantitative methods focus on the analysis of numerical data, typically measurements using mathematical techniques, often from the domain of statistics (Babbie, 2010). Qualitative research focuses on the identification and explanation of the qualities of entities without focusing on numerical measurements (Denzin and Lincoln, 2006). Through experience-based familiarization with the subject, usually language-oriented experience collection[1] and various language-focused treatments of the experience collections insights into the subject matter is created. The process of qualitative research serves as a sequence of decisions by the researcher to achieve the overall research goal (Flick, 1991). The beginning of this process is "assumptions, a worldview, the possible use of a theoretical lens, and the study of research problems inquiring into the meaning individuals or groups ascribe to a social or human problem" (Creswell, 2007, p. 37). Based on this, data is collected and analyzed to generate a theory. Qualitative research shows its strengths in that it makes it possible to gain in-depth knowledge of the field of research, such as underlying reasons or motivations. Still, it also has limitations in data validation based on unstructured data (Jick, 1979; Flick, 2009, 2014). To facilitate data validation within the qualitative research, which serves as one of the essential limitations method combinations can be used (Jick, 1979; Kaplan and Duchon, 1988; Denzin and Lincoln, 2006; Morgan, 2007; Driscoll et al., 2007; Flick, 2009; Hussein, 2009; Flick, 2014).

The researcher is *an active part* of qualitative research. This is, on the one hand, a relevant strength of qualitative research to gain in-depth knowledge through the researcher, on the other hand, weakness or neuralgic point due to the subjective view of the researcher as an individual (Morrow, 2005). Particularly relevant is the weakness of data validation based on unstructured data (Jick, 1979; Flick, 2009, 2014). A differentiated method focus applied by the researcher (Cohen et al., 2007). The reflexivity of the researcher serves as one of the essential principles of qualitative research (Flick, 2009, 2014).

For conducting qualitative research, a variety of methods can be applied. This includes grounded theory, ethnography, phenomenology, inductive thematic analysis, case study, and discourse analysis (for an introduction of the techniques see Maxwell (2008)). This work deals with *the explorative research* concerning the emphasis on human behavior (workforce) – investigation of relations and interactions between people (Stebbins, 2001). The emphasis on investigating workplace learning embedded in the work process as an everyday activity suggests ethnography, which focuses on the study of shared meanings

[1] With audio and video typically transferred to language transcripts.

and practices. Ethnography is "a scientific approach to the interpretation of culture" (Schaffer, 2017, p. 53) and aims at identifying implicit rules of a culture. Ethnography emphasizes the importance of investigating the nature of social phenomena instead of concentrating on testing hypotheses about them (Atkinson and Hammersley, 1994).

Schaffer stresses that "the difference between ethnography and what we all do every day in interpreting culture is that ethnographers do it formally and systematically" (Schaffer, 2017, p. 32). According to Spradley, "ethnography always implies a theory of culture" (Spradley, 1980, p. 5). As a result, an ethnographic approach aims at studying other cultures and, thus, other cultural learning activities. There are the following important aspects related to that: "What people do, what people know, and the things people make and use" (Spradley, 1980, p. 5). Those aspects in the context of learning activities are automatically in continuous relation with cultural behavior (e.g., reading), cultural knowledge (e.g., norms and rules), and also cultural artefacts (e.g., shaping and making the things from natural resources). This leads to the basic principle of ethnography that culture is a significant aspect of understanding human behavior: The word ethnography itself comes from the Greek for writing down (graphia) culture (ethnos). Therefore, ethnography serves as "an anthropological research method that relies on first-hand observations made by a researcher immersed over an extended period of time in culture, with which he/she is unfamiliar" (Schultze, 2000, p. 7). Atkinson and Hammersley (1994) distinguished ethnography by the following four main features. First, the exploration of the nature of specific social phenomena. Second, initial work with unstructured data. The data is only later subject to coding. Third, focus on a few number of cases. Fourth, an analysis process which requires "explicit interpretation of the meanings and functions of human actions" (Atkinson and Hammersley, 1994, p. 248) with mainly verbal descriptions and few quantification. The values of ethnographic methods have "a greater ability to capture the nature of social phenomena" (Hammersley, 2013, p. 2) compared to quantitative methods. Approaches for ethnographic studies are in-depth interviews, focus groups, participant observation (Flick, 1991, 2009, 2014).

10.3 Method Triangulation

The combination of research methods is common in qualitative research. This is called *systematic perspective triangulation* (Flick, 1991, 2009, 2014) as "the combination of methodologies in the study of the same phenomenon" (Denzin, 1970, p. 291) (quoted after Jick (1979)). The systematic perspective triangulation is suitable for taking into account as many different aspects of the research object as possible. It is "less a strategy for validating results and procedures than an alternative to validation which increases scope, depth, and consistency in methodological proceedings" (Flick, 2009, p. 445). The aim of method triangulation is to take into account a variety of perspectives of the research object by combining methods for collecting, analyzing, and interpreting the data. Triangulation "should produce knowledge on different levels, which means they go beyond the knowledge made possible by one approach" (Flick, 2009, p. 41). The approach is also called a mixed-method design.

There are different types of triangulation (Denzin and Lincoln, 2006). In this thesis, triangulation is used for data collection and analysis. They are described in the following.

10.3.1 Triangulation of Data Collection Methods

The focus of this work is on empirical research, in which professionals serve as research instruments to investigate their own learning activities at the workplace while working in organizations. The aim is to gain insights from different perspectives. A combination of methods is used to achieve this: Firstly, the method of participant observation aims to investigate learning in the workplace from the perspective of the work process. Secondly, the purpose of empirical interviews is to examine learning at the workplace from the individual perspective of the professionals themselves. Both methods are described below.

Participant observation is a data collection technique that requires the researcher to participate in events relevant to the research inquiry (Emerson et al., 2001). Participant observation is an ethnographic qualitative data collection method that enables the qualitative descriptions of the research subject (Jorgensen, 1989). The role of the researcher is to take the perspectives of participants and their variety into account by collecting the data about the subject of the research. In other words, the research field becomes an instrument of data collection as an active part of the research, called *a familiar stranger* (german: *vertrauter Fremder*) (Flick, 1991, 2009, 2014).

The observations made during the participant observation process are documented using *field notes*. The note-taking should happen immediately in the observation situation to avoid information loss due to issues in memorizing situations (Lofland et al., 1984). Field notes can include two types of information. On the one hand, descriptive information related to the occurring situation. On the other hand, reflective information which builds on the situation interpretation by the observer. Due to the nature of observation, field notes are governed by the process of selection. The researcher decides which things to note down and how. Spradley (1979) suggested various forms of field notes for documentation, such as condensed reports in single words, sentences, quotations from conversations, or an extended presentation of impressions from interviews and field contacts. The situation for interviews is related to field notes, while the focus is much more on the actual utterances of the individuals. Frequently video or audio recordings are used for recording, doing the transcription as a second step.

Field notes require a transcription system. As such, they are a document that typically focuses on the textual description, while it also can include drawings and specific symbols. In other words, field notes use a symbol scheme, which can be standard orthography based on the norms of written language. It can also be a specific rule set. The decision for an approach to transcription is called *a transcription system*, which consists of various selection decisions to be made, such as selecting the characteristics of the participants' behaviour to be transcribed (e.g. verbal expressions), selecting notations as symbols to make the transcription readable, selecting the transcription format, such as paper and pen or computer/tablet. Kowall and O'Connell (2004) emphasized that the different

transcription systems available differ in their degree of accuracy. The decision for a system depends on the research situation and the research goal.

In spoken language analysis, the emphasis is on achieving maximum accuracy in the classification and presentation of statements. Here the appropriateness of the procedure is essential. Following Flick, "these standards of exactness contribute to the natural science ideals of precision in measurement and are imported into interpretive social science through the back door" (Flick, 2009, p. 299). Still, the coding standards always depend on the research subject and the quality required to work with the data appropriately (Flick, 2009). This indicates that it makes sense to transcribe only as much as possible in relation to the research questions (Strauss, 1987). To achieve this, there are general criteria that are helpful as a starting point for evaluating a transcription system for spoken discourse. Svartvik (1991) emphasizes the need for manageability, readability, learning ability, and interpretability and concludes that simple reading, learning, and searching should result in a transcription system.

In this work, participant observation will be used to observe the professionals during their work process. Field notes will be taken as a basis for further analysis.

Ethnographic interviews are the second method applied during the participant observation with field notes. Ethnographic interviews are defined as "series of friendly conversations into which the researcher slowly introduces new elements to assist informants to respond as informants" (Spradley, 1980, p. 58). While the researcher observes the professionals during their work, there are spontaneous situational possibilities to obtain additional information. Accordingly, ethnographic interviews serve as a supporting method within the participant observation to collect specific experiences of the respondents (professionals) that cannot be explicitly communicated/articulated to the researcher during the observation activity and that could not be seen or heard by the researcher (e.g. non-verbalized thoughts).

In this work, ethnographic interviews extend the process of participant observation. Ethnographic interviews complement the field notes to provide additional information.

The individual perspective on learning at work with the help of *a self-report study.* The third method adds a further perspective to data collection. Professionals provide insights into their learning activities in the workplace and thus, "become an instrument" (Cohen et al., 2007, p. 36) to collect data about themselves.

The self-report questionnaire is an ethnographic method, commonly defined as "a collection of data gathered using voluntary response methods, such as questionnaires or telephone interviews" (Griffiths et al., 2014, p. 145). The self-report study serves as a type of survey. Typically, it is a questionnaire which is filled out the study participant without intervention of the researcher (Jupp, 2015). While the self-report study frequently makes use of closed questions using Likert-scales (Demetriou et al., 2015), there is no reason not to also include mixed or open questions. Closed questions offer limited response possibilities to study participants due to high-structure. In contrast, open questions allow study participants to provide answers in their own words as unstructured qualitative data. The data collected through a self-report questionnaire is subjective information from the person who is actually investigated. This individual perspective will be subject to the reporting decisions of the participant and to the participants' cog-

nitive processes. Decisions may involve avoiding certain issues or emphasizing certain issues as a willing-decision to convey a particular perspective. On the other hand, certain issues may be unconscious and, therefore, not be part of the individual's reporting. Despite these limitations, the self-reporting questionnaire brings a relevant additional perspective. In combination with other types of data collection, the limitations are not as strong.

In this work, a self-report study (questionnaire) is combined with the observation of the participants and carried out to supplement the overall data set with data related to the individual perspective.

In the research process, three methods are combined and contribute to a data set. The data set consists of the data of a researcher who investigates the working process by observing the participants. During the observation of the participants, field notes are generated, which are supplemented by ethnographic interviews. Another source of data are self-report studies that focus on the individual perspective of professionals on learning at work.

10.3.2 Triangulation of Analysis Methods

The analysis of the collected data set will apply method triangulation. Three analysis methods are combined. First, the field notes which are enhanced by ethnographic interviews are analyzed using a qualitative analysis process. Second, categories generated in the process of field note analysis are treated using a method of exploratory data analysis. Third, the self-report study is analyzed using content analysis.

The first analysis method applied is the coding of the field notes and ethnographic interview data. A typical coding process for qualitative coding is depicted in figure 10.3. Data analysis using coding is a common analytics technique in qualitative research. Coding organizes the collected data to generalize and structure the collected data. Flick considers coding to be "the anchoring point for making decisions about which data or cases to integrate next in the analysis and how or with which methods they should be collected" (Flick, 2009, p. 296). Coding is a sequential process across different stages, with the steps of open coding, axial coding, selective coding, comparative analysis, and finally, theory-building (Strauss and Corbin, 1990). The things extracted in each coding step are different, including concepts (open coding), categories (axial coding), causal relationships (selective coding), stories (comparative analysis) or theories (theory building). This shows a distillation process that guides the theory-building process mentioned initially. The presented coding process is only one across many. The coding process is a set of "different ways of handling textual material between which the researchers move back and forth if necessary and which they combine" (Flick, 2009, p. 83). As Flick stated, "starting from the data, the process of coding leads to the development of theories through a process of abstraction" (Flick, 2009, p. 148). It is important to highlight that the coding process focuses on a transformation on a natural language and relation level. The mentioned data analysis processes focus on a structured process guiding the researcher to abstract from cases, categorize and build relations. In the last step, the researcher constructs a theory. The whole analysis approach is situated in the domain

of qualitative analysis. A consequence of this is that quantitative characteristics in the data are only considered to the extent that the researcher is aware of them.

In this work, open and relational coding is used to investigate the research subject (see figure 10.3). They provide a classification of the work process and relate the application of classes. In this process, the researcher uses memos to reflect on the research subject and to gain insight into the work.

The second analytics method is the application of exploratory data analysis to the classes derived in open coding (see figure 10.3). Exploratory data analysis is a quantitative method used to supplement the insights gained in the coding process.

Using quantitative methods in a qualitative research process needs some consideration. Treating data collected in a qualitative study with quantitative methods is a special case of triangulation. Typical qualitative research would avoid any quantification. Still, there are such methods. Content analysis and qualitative content analysis typically include a frequency count applied to categories derived from texts (Mayring, 2004). This was also a source of criticism since the use of the counts was accused of decontextualization and thus of being misleading (Kohlbacher, 2006). The associated discussion goes beyond mere decontextualization but was rather led as epistemological discussion (Maxwell, 2010). Maxwell points out that many researchers consider numbers to represent the idea of a single objective reality, which is in contrast to the constructivist perspective underlying qualitative research in general. Relevant contributions to this discussion are Maxwell (2010); Hannah and Lautsch (2011); Morgan (1993); Sandelowski (2001); Sandelowski et al. (2009). Here the idea is followed that counting can be a useful contribution to mixed-method research and can complement the qualitative analysis process (Maxwell, 2010). Maxwell points out that counts can 1) support internal generalizability in supporting claims made from the research, 2) can show the diversity of actions, 3) can support pattern identification, and 4) can support evidence presentation. Still, it is required to consider pitfalls like verbal counting, overcounting, misleading counting, and acontextual counting (Sandelowski, 2001).

Exploratory data analysis is a statistical approach for analyzing data sets. The open perspective allows the realization of inductive research (Andrew et al., 2017). Typical techniques are descriptive statistics like box plots, histograms, but can also include factor analysis or regressions.

In this work, exploratory data analysis will support the investigation of the complex data collected during participant observation. The characteristics of the work, including frequent interruptions between tasks performed individually or in one of many forms of collaboration. Taking into account not only counts of occurrences and durations will help to understand these processes better. Nevertheless, the mentioned counting pitfalls in the process must be avoided.

The third analytics method is a qualitative content analysis applied to a self-report study. Qualitative content analysis is a bundle of methods for doing text analysis, originally developed for analyzing interview-transcripts (Mayring, 2004). The technique builds on original content analysis, which (as mentioned above) has a strong quantitative direction in applying word counts on derived categories in the analysis process. While quantitative aspects are not completely removed in qualitative content analysis,

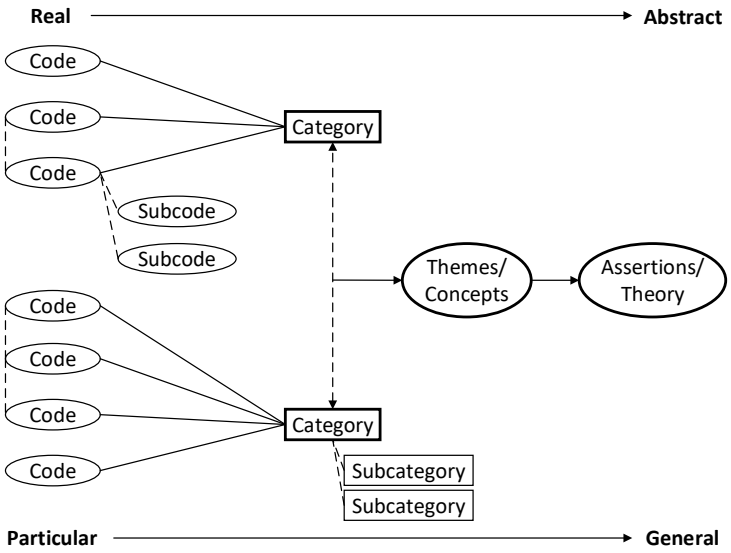

Figure 10.3: A Streamlined Codes-to-theory Model for Qualitative Inquiry According to Saldaña (2016)

additional considerations support qualitative demands, like preservation of context. The related analytics process comprises nine stages, starting from 1) Material determination, 2) Consideration of text origin, 3) Material characterization, 4) Analysis direction determination, 5) Differentiation of questions to be answered, 6) Analysis technique selection between summary, explication, structuring, 7) Definition of analysis unit, 8) Material analysis, 9) Interpretation (Kohlbacher, 2006). A specific type is *type-building content analysis* (Kuckartz, 2016). The term type stands here for a set of characteristics (attributes). A typology stands for a multidimensional classification that is defined by combining all possible categories of two or more categories. Within the framework of empirical research, type building stands for the space of characteristics (features). In qualitative social research, type building is characterized by *a case-oriented approach*, i.e., persons are compared and contrasted and then grouped into types. Accordingly, the focus is on the case and diversity (variety), which shows the perspective of difference as characteristic of qualitative methods. A so-called profile matrix is intended to illustrate the different perspectives of gained qualitative data (see figure 10.4). The cases are shown in the rows and the characteristics or topics in the columns. In an interview study, the cases are the interviewed persons. The columns of the matrix contain the characteristics, i.e., statements of the research participants on certain topics. With the column-related analysis of the profile matrix of qualitative data, the view into individual columns corresponds to a category-based analysis, i.e., the comments on certain topics are evaluated. Case orientation means that the view is not directed at the columns, but at the rows, i.e., it is rotated by 90 degrees. If only one row of the profile matrix is viewed, then only one case (one person) is visible, which corresponds to a case descrip-

tion. If two lines are viewed at the same time, this leads to case comparison and case contrast. Grouping of more than two rows, based on their characteristics, leads to type formation.

In this work type-building, content analysis as a type of qualitative content analysis will guide the extraction of the workplace learning understanding of professionals from a self-report study.

10.3.3 Summary

In this section, the application of the method triangulation in research on learning in the work process of professionals was presented. Triangulation is used in data collection and analysis. The methods used for data collection are participant observation, ethnographic interviews and a self-report study. The perspective of individual learning of professionals at the workplace is integrated with the external perspective of a researcher who observes and interacts with the professionals during their working day. Data analysis uses the techniques of coding, explorative data analysis and qualitative content analysis. The combination of qualitative inductive techniques with a quantitative inductive technique is a choice adapted to the complexity of the research object. It is assumed that the quantitative analysis of codes supports the coding process and thus promotes the treatment of the research questions.

Most of the data is generated in the participant observation process. In other words, participant observation during the working process of the professionals is the focus of the investigation. The triangulation will enrich the data set. During the analysis, the insights gained from the exploratory data analysis and the qualitative content analysis will enrich the understanding that the researcher gains from the process of coding and interpreting the observation data.

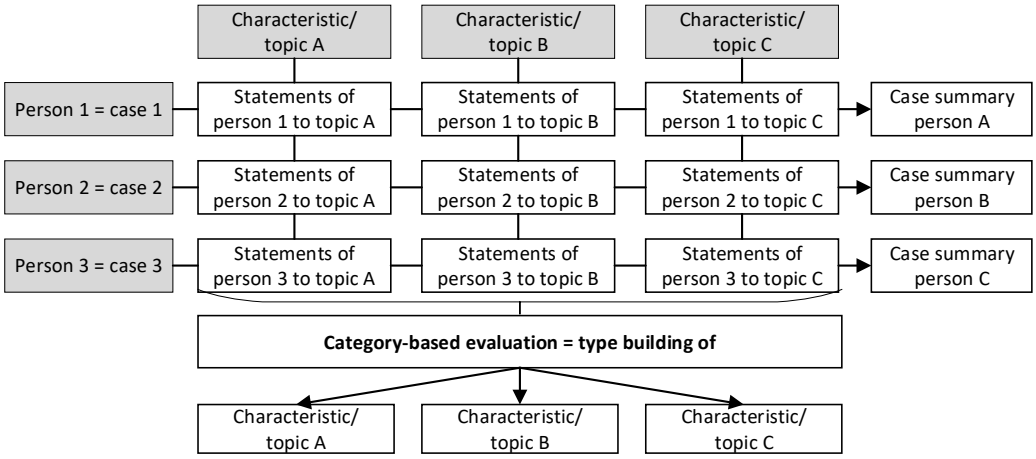

Figure 10.4: Model of a Profile Matrix – Here as a Characteristic/Topic Matrix of a Qualitative Study, according to Kuckartz (2016)

10.4 Study Design

A qualitative study was conducted to investigate the research questions of this work. The following study applied the methods described in the previous section, using triangulation through a combination of participant observation, ethnographic interviews, and a self-report study to investigate workplace learning from an observer and individual perspective. The data set included 50 participants and generated more than 800 hours of observation data and ethnographic interviews, which were recorded in field notes and 50 self-report questionnaires.

The broad steps of study design and execution are:

1. Target Group Identification and Study Design Sketch (April 2015)
2. Pretest Participant Acquisition (April-May 2015)
3. Pretest Execution (May 2015)
4. Pretest Evaluation and Adjustment of Study Design (June – September 2015)
5. Study Participant Acquisition (May 2015 – September 2016)
6. Study Execution Germany (September 2015 – May 2016)
7. Study Execution Other Countries (May 2016 – September 2016)
8. Workshops with Participants Discussing insights (November and December 2016)

In the following, different steps of this study design and execution process will be described in detail. These aspects are: Description of the target group (see section

10.4.1); Pretest of participant observation (see section 10.4.2); Case execution (see section 10.4.3); Note taking and episode coding (see section 10.4.4); Data treatment (see section 10.4.5); Data set (see section 10.4.6), Data analysis process (see section 10.4.7).

10.4.1 Target Group

The target group of the investigation of this work is professionals as knowledge workers who work in a knowledge-intensive company. Two constraints address the industry of knowledge work and the way how the considered companies organize their business and participate in the market economy. The high-tech industry is considered to account for short innovation cycles explicitly. The companies are intended to have a global organizational structure with units scattered across the globe.

The study was conducted in a large software company with its headquarters located in Germany. The company meets the requirement to work on high-tech products. Furthermore, the company operates worldwide and has regional offices in more than 180 countries. As a result, the workforce is composed of different nationalities working together to achieve the company's business objectives, including customer interactions across the globe. In the design phase of the study, it was assumed that the structure is a good example of a knowledge-intensive company. The informal discussion within the workforce indicated the high relevance of digital media and digital collaboration tools. The work process is governed by a high degree of individual autonomy that corresponds to intense and explicit business goals; the individual activities must contribute to this. Projects often provide a framework for cooperation and specific objectives. Project implementation includes classic project management techniques but focuses mainly on agile methods. Especially in the software development processes, SCRUM is a widespread technique that guides the development process based on sprints. The focus of SCRUM is to deliver a minimum viable product at the end of each sprint, led by specific job roles of professionals, such as a scrum master, a product owner, and the team.

From an organizational point of view, the company is composed of different areas with dedicated goals. The workforce belongs to different areas and is organized hierarchically, with job types specified based on frame descriptions. Such a frame description specifies a job type, the responsibilities, and domains of expertise, as well as a people development path. From an abstract perspective, a distinction is made between subject matter experts and managers. The responsibility of a subject matter expert is to apply his skills in a specific domain in the development, provisioning, or maintenance of a value-adding activity. The manager's responsibility is to organize a team of subject matter experts or other managers. This is often a combination of people management responsibilities, on the one hand, where the manager acts as the disciplinarian of these people, and various reporting and planning activities on the other. Especially the reporting and planning often still involve high degrees of subject matter expertise, with managers frequently being ex-subject matter experts.

By focusing on one company, the inter-company comparison of workplace learning is denied. This is a disadvantage as it is not possible to argue for the broad generalization of the findings beyond one company. The reasons for sticking to one company are

twofold. First, pragmatic as access to a management and expert workforce is very difficult to establish. Without being a member of the company, establishing contacts and having a legal agreement on conducting an observation is difficult to achieve. On the other hand, there are also systematic reasons which defend the one company approach. Focusing on one global high-tech company brings a workforce that shares a corporate culture, and the understanding and perspective towards different subjects are likely comparable. At the same time, the workforce is multicultural and diverse in terms of the topics that individuals work on. A shared corporate culture combined with diversity at a cultural and thematic level will support a study focusing on actual learning activities in the workplace. Different companies can lead to a very heterogeneous workforce, which in itself is very different, which could make it challenging to examine only learning in the workplace. In essence, the analysis could mainly examine differences in corporate culture. Examples of studies that took a similar direction in the company are competence management at Ericsson (Hustad and Munkvold, 2005), national cultures at IBM (Hofstede, 1980). Hofstede also pursued a similar line of argumentation concerning a one-company setting (see section 5.3).

The identification of study participants followed a process of purposeful sampling. According to (Patton, 1990, p. 169), "the purpose of purposeful sampling is to select information-rich cases whose study will illuminate the questions under study". Patton distinguished between various strategies for purposefully selecting information-rich cases which focus on different logic as a particular evaluation purpose, such as extreme cases, typical cases, the maximum variation of cases, intensity sampling, and others. In the context of this work, the type of intensity sampling is of relevance. An intensity sample consists of information-rich cases that manifest the phenomenon of interest intensively. To have such cases, two decisions were made. On the one hand, it was decided to include subject matter experts (called experts in the remainder of this document) and managers. To have such information-rich cases, it was decided to consider only people with a high degree of experience. This assures that workplace learning is investigated for people who already have a very good insight into their activities and have a history of executing work in their domain. This is the typical case for managers, as they are only nominated or hired if they showed the required expertise in the past. The expert position has entry-level positions that are intended for novices who finished their education and joined the company or a position in the domain for the first time. These positions were excluded. Access to the workforce was acquired using snowballing under consideration of the purposeful sampling criteria. Contacts in the company were asked who then recommended colleagues who fit into the scheme. To avoid a bias due to the snowballing, the entry contacts were chosen to belong to work on different topics.

There were two acquisition processes involved in the overall activity. Firstly, ten participants were identified for a pre-test to design the actual process. This phase had relaxed requirements for the participants, also considering direct colleagues, and was conducted very openly (see next section) to allow the researcher to familiarize himself with the environment. The second phase focused on the actual study. This took place between June and August 2015. For the acquisition of potential study participants, a short information overview (by e-mail, phone calls, and face-to-face meetings) was used.

This phase was realized in two ways: First, group information sessions with potential participants from different locations using audio-video Skype calls, face to face meetings and information sessions in teams including e-mail communication, e.g., conducting information sessions with potential study participants from Germany in their team meetings or discussion and information transfer with potential participants in groups using audio-video Skype calls from other locations. Second, individual interaction with potential study participants based in Germany. The overall acquisition took place in a combined form of face-to-face, audio-video Skype calls, and e-mails. The shared information was regarding the general objective of the study and the implementation overview of the participating observation. No detailed information on the specific focus of the researcher during the observation was shared. The idea was to share enough information to have the basic support of the participants without influencing the observation results in advance.

Overall, 100 persons were contacted to participate in the study. Fifty percent of the contacted potential participants declined their participation. This was often justified with no time or no interest. Many contacted persons considered the method of participant observation itself to be too obtrusive, did not want to be observed or assumed that observation would hinder them from doing their work. In total, 50 experts could be won for the study of participant observation: 35 men, 15 women with the work profiles of experts (N=28) and managers (N=22) at 6 locations, namely Germany (N=30), China (N=4), India (N=3), USA (N=6), Israel (N=4), Bulgaria (N=3). The work profiles of professionals in these six locations were precisely divided into the four groups due to their experience and work scope: managers (M), senior manager (SM), experts (E) and chief experts (CE). Due to the commitments of the participants, the majority of the participants were localized in Germany (N=30). Hence the focus of the study was based in Germany. The smaller number of participants from the other five countries (N=20) together form an opportunity for cultural comparison.

10.4.2 Pretest of Participant Observation

In the following, the pretest phase of the study is reported, which was carried out between April and May 2015. The insights from this test phase, which are referred to as *lessons learned*, were integrated into the design of the participant observation to be conducted.

In the context of ethnographic research using the participant observation method, the pretest phase with test persons is particularly relevant, especially from the learning perspective for the researcher, before the participant observation method is applied to the real target group. Pretest aims to sensitize as much as possible to avoid mistakes during the real study execution time. Pretests serve as an effective technique to improve validity in collecting qualitative data and analyzing-interpreting the findings (Bowden et al., 2002; Drennan, 2003). According to Hurst et al., "pretesting involves simulating the formal data collection process on a small scale to identify practical problems concerning data collection instruments, sessions, and methodology" (Hurst et al., 2015, p. 4). Accordingly, the pretest for this work was relevant from a learning point of view. In qualitative research as a circular/iterative process (and not as a linear process as in

quantitative research, see figure 10.2), the pretest allows the consideration of corrections in the phase between study design and actual realization (Morse et al., 2002).

The pretest in this work was carried out with 10 test persons as follows: First, test persons were acquired for a pretest using combined face-to-face, mail, call communication modes. Due to the dominance of the Germany-based target group (see section 10.4.1), the pretest was also planned with professionals located in Germany. Also, from a pragmatic point of view, the use of resources played an important role in the decision to conduct the pretest in Germany. Secondly, after recruitment by the researcher (N=10), the procedure of the participant observation was explained to the test persons individually.

The particular goal of the pretest phase was an appropriate participant observation design. On the one hand, it was intended to integrate different persons into the study to include a variety of perspectives on how workplace learning might appear. On the other hand, it was necessary to identify a suitable time frame for observing each person individually. Considering only a few hours on one day might result in catching a period which does not show any workplace learning behavior or only one type of workplace learning behavior. Short periods might also be overshadowed by the initial unfamiliarity of the subject with the participant observation situation itself, resulting in behavior that would not have occurred in a non-observation situation.

The graphics visualized in figures 10.5 and 10.6 were sketched during the pretest phase. Both figures visualize an understanding of how the ongoing work process of the professionals can be observed. The underlying idea is that professionals have a number of ongoing activities that are realized by a work process. This is shown in the overview figure 10.5. Most notably, the work process itself is scattered over time. It is not the individual who continuously works on a subject until it finished. These details are visible in figure 10.6. This idea follows action regulation theory (see section 3.1.1). The professional sequentializes the activities as actions and operations executed over time. As an effect, only observation over very long periods of time (weeks, months, or years) would be able to capture a complete activity. Any shorter observation will always capture only snapshots of smaller actions executed in the context of a broader activity. This can be attending a status meeting, preparing a document and collecting information at the customer site. From an activity point of view each smaller doing only makes sense in relation to the broader activity. Like writing a thesis with sitting in front of the computer and typing sentences only gets its relevance in relation to the overall activity of working on a thesis. For the study goal of observing workplace learning, this disconnection of the doings from the broad goals is considered uncritical. The goal is not to observe a specific type of workplace learning. It is explicitly nothing like the software developer fixing a bug or the manager mitigating a conflict. The goal is explicitly to consider a variety of workplace learning activities and generate an understanding of this. Therefore an assortment of different workplace learning situations related to a variety of tasks for every person being observed is even positive as the variety of the data is increased.

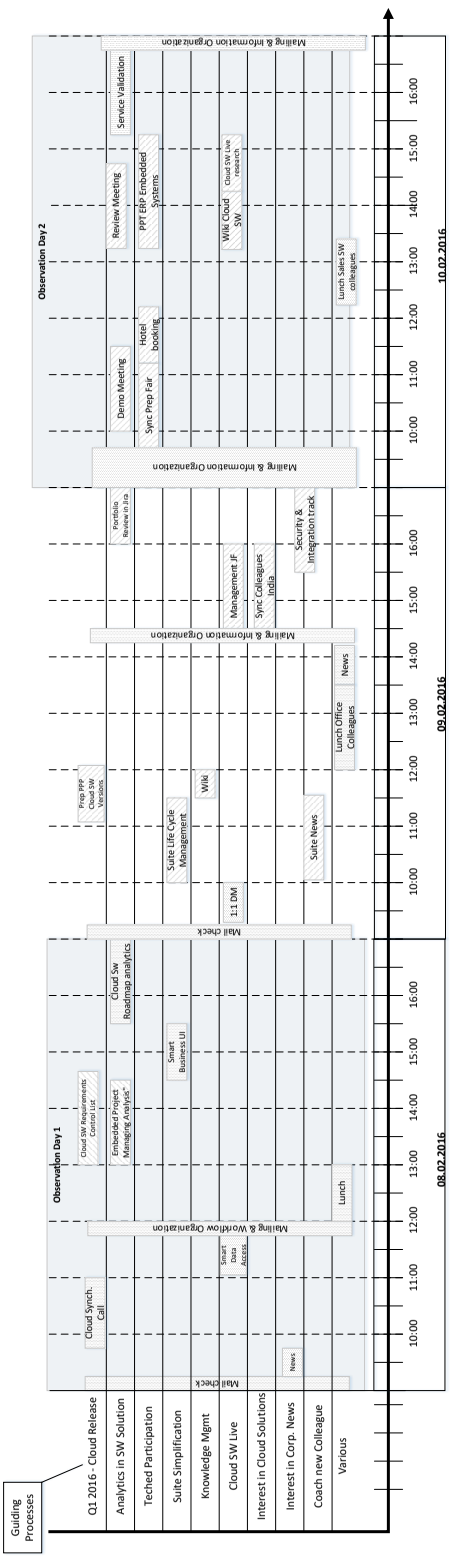

Figure 10.5: Relation between Work and Observation – Overview (Topics and Task Names are Random Examples from the Observation Domain)

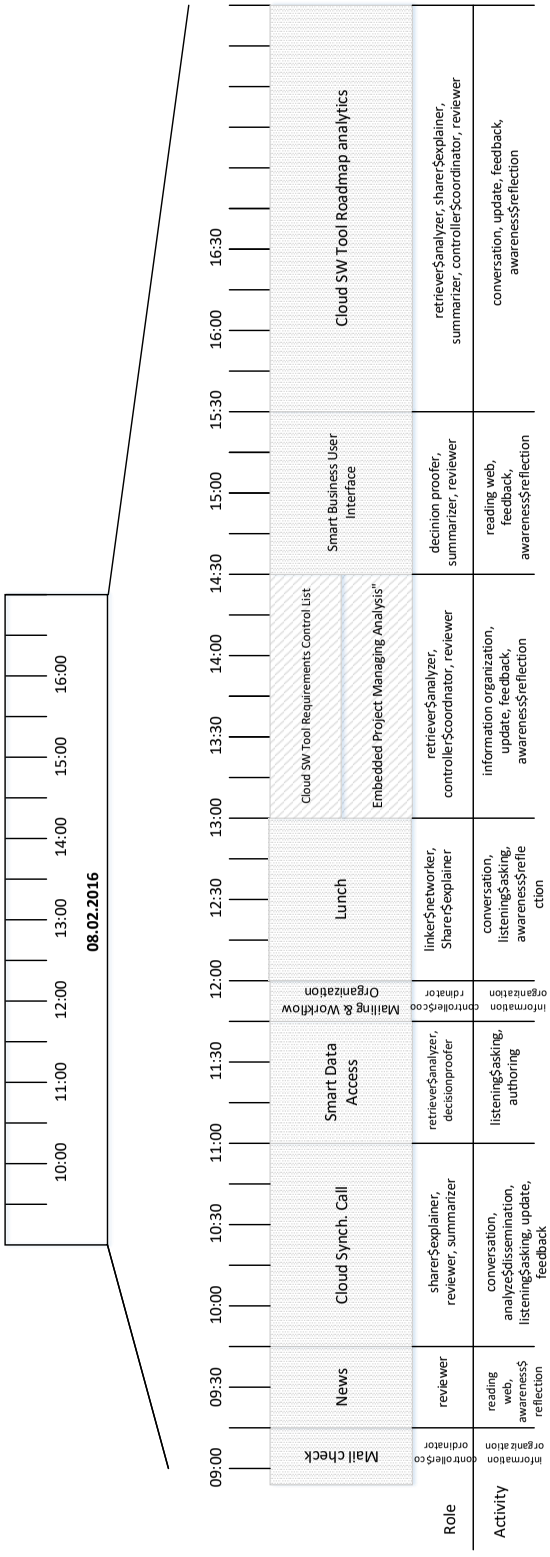

Figure 10.6: Relation between Work and Observation – Details

Under consideration of the monitoring of scattered doings of professionals, a decision on the observation period was required. The decision was to start with three full working days in a row (e.g., Mon-Wed). The assumption was that this was a starting point being long enough to come to relevant workplace learning situations in a settled observation setup and short enough to allow for integrating different professionals in the later study. A brief discussion between the researcher and the test person took place before each observation day, in which the test person gave the researcher a brief insight into the respective observation day, e.g., when and on what dates the researcher was not allowed to participate regarding confidential reasons or private meetings. After three observation days were conducted, the researcher had a short discussion with each test person to find out the individual impressions applying this method of participant observation.

The following insights were gained from the pretest: *Duration of the observation of participants.* During the pretest of observation activities with the above-mentioned test persons, it turned out that after the second observation day, the type of workplace learning situation became repetitive. The overall workday structure showed similarities, which were also seen on the workplace learning level. Despite the overall differences of the situations and discussions, there was stability in how the professional approached them, typical behavior towards work execution. This leads to the assumption of *regularity and repeatability* with regard to how the professionals act in their daily work (e.g., procedure/approach in problem-solving). In comparison, the first observation day was somewhat different (especially the first half of the first day) than the second and third day due to the so-called warm-up time with the method as such and the associated role of the researcher, observing this test person throughout the working day. On this basis, the researcher's decision was made to carry out this method with the real target group of 50 acquired professionals in a period of two instead of three working days per person.

Variety of insights gained by participant observation. Each participant provided different data during the pre-test period, e.g., a variety of topics on one day combined individual and social activities at work.

Relevance of the researcher's flexibility during participant observation. This represents the researcher's ability to maintain flexibility and openness during the observation days, especially in sudden situations where the observations have to be interrupted due to confidential or private meetings of the participants. Such episodes were called observation breaks.

10.4.3 Case Execution

The main steps in study execution were the following:

1. Contact with information material
2. Answering questions and getting observation agreement (phone call or meeting, 10-30 minutes)
3. Scheduling observation and review dates
4. Participant observation (2 days)

5. Self report study

To distinguish the participants, each participant was given an identifier (id). The structure of the id is as follows: idXY/(Work profile)/(Location). The work profiles can be type *E* for expert or *M* for manager. A location acronym specifies the country of observation, e.g., *GER* for Germany.

Each participant was observed on two consecutive days, such as Mon-Tue, Wed-Thu, Fri-Mo, from the beginning to the end of his working day (e.g., 9am-5pm or 7am-7pm). The average duration of two full working days was about 16-17 hours, giving a total duration of 800 hours for the 50 participants. The overall data collection process focused on 2 days. Each observation day was structured as follows. First, at the beginning of each observation day, a short discussion was held with the acquired study participants. The participants gave the researcher an overview of the day, the planned meetings, and the fixed or possible time windows in which observation breaks are required, i.e., the researcher is not allowed to participate. Usually it took 5-15 minutes. A short review session was held immediately after the second observation day. This was aimed at: a) finding out the professional's impressions of these methods and their impact on him individually, then b) completing a self-reporting questionnaire based on the professionals' current demographic data, including a relevant open question on their understanding of learning at work (method 2), and finally c) proposing and coordinating a separate review session. The total duration of these discussions varied between 15-45 minutes.

During the observation process, two distinct types of work were observed:

- **Individual Work.** The individual work of the participants who work alone in the office at their desk (e.g., writing mails, telephone calls, creating concepts). In these cases, the researcher usually sat behind the participant, about 1.5m away, to see what the participant was doing and to write this down (field notes, see section 10.2). Relevant note here that the goal of the researcher/observer was not to read the screen content while sitting behind the participant, but to see the tools and websites the participants use (e.g., outlook mail account, corporate news pages, Excel tool and other). It should be emphasized that each professional worked in different places and in a differently designed office, such as individual offices (e.g., Germany, USA), an office for four people (e.g., Germany) or an open space in which many professionals work simultaneously (e.g., China, India, and other locations).

- **Collaborative Work.** Participants who work in groups with other colleagues and use different communication channels, such as special topic-related face-to-face meetings, audio/video conferences or combined types of interaction channels consisting of face-to-face and virtual communication, e.g., team meetings via video conference, if one part of the professionals is located e.g., in Germany and the other part of the professionals is located elsewhere in the world and takes part in this conference virtually (e.g., Skype). A significant way of group communication between professionals is an informal personal conversation, which takes place in different places within a company, e.g., in the office, in coffee corners, in the can-

teen, or simply in the stairwell. The topics vary, e.g., due to a problem-solving situation or just a small conversation between colleagues.

During the participant observation, field notes were generated. For this purpose, the observer used Excel and a tablet as an instrument for data collection. The collected raw data during the participant observation was divided into two main categories: 1) *time in minutes* and 2) *what happens*, in sequential order, e.g., team meeting activities from 9-10am/60 minutes or coffee break with the office colleague 14.30-15am/30 minutes. Relevant note: Periods of situations where observation was not possible, e.g., due to confidential information in certain meetings or private lunch/coffee breaks, were characterized as observation breaks and referred to as *other*.

While the participant observation and embedded ethnographic interviews aim to explore the workplace learning activities of professionals through the work process, the self-report study focused on exploring the workplace learning from the professionals themselves, i.e., from their perspective. The self-report study contained demographic questions such as age, nationality, experience in the company, current work profile, or education level (see appendix, self-report study questionnaire A.1 and A.2). The last open question in this questionnaire was particularly crucial for the research goal, namely – *What does learning during your daily work mean to you?* This question aimed to find out how the professionals themselves see learning in their work in the company where they work. In other words, this study aimed to explore the personal understanding of the professionals themselves about their learning activities at work. After the second day of participant observation, each participant received a self-report questionnaire from the researcher to complete. Each observed participant could fill out this questionnaire directly in a prepared Excel document. The researcher did not give the participants a time limit to answer these questions. Therefore, each participant took as much time as they needed. On average, participants took 10-15 minutes to complete this questionnaire: one questionnaire per participant. The decision to put the questionnaire at the end of the observation phase, on the one hand, captured an increasing self-awareness of the participants for learning – which was an implicit effect of them being part of an observational study that focused on learning. On the other hand, completing the questionnaire at the end avoided an amplification of this awareness which could result from taking the questionnaire.

10.4.4 Note Taking and Episode Coding

The collected field notes were cleaned up and transcribed by the researcher after the session, and some aspects were highlighted. Tools used in this process were Excel, and R. Short overview documents were generated per person. In the following, the main elements of the field notes and the post-processing is described. Field notes are sequences of episodes identified based on core activities or topics. These are introduced in the following.

To investigate workplace learning from the work process perspective, a separation rationale and a coding scheme is required to structure the work process data. Only

if a structured understanding of the work process is established the work process can be analyzed with respect to the meaning of the work actions observed in the data set. Obviously, this follows the idea that each action of a professional is goal directed with respect to the working goal and also is a learning experience. A second major assumption is that the workday can be decomposed into episodes.

The separation rationale for episodes specifies the process of decomposing the continuous work process into smaller units. These units are called episodes in the following. As a sentence is composed of words, the idea is that the workday is composed of episodes. The episodes typically emerged during the field note creation. The observer automatically started new sections if something happened which seemed to indicate a change in some respect. These separations have been of various kinds, including longer-lasting external interruptions (colleague walking in), changes of location (walking to a meeting room), or changing applications on the computer. Later, the observer investigated the separations in the field notes in detail to identify the separation rationale. The observer identified a core activity or topic which is indicative of an episode. A core activity or topic can be participation in a meeting, writing a document, or organizing emails. If someone works on such a core activity, his behavior will be structured by this activity most of the time. Still, small interruptions might exist, like answering a short question, quickly flipping through emails, or looking up information during a meeting. Nevertheless, the core activity is not dropped, and the professional will return to the core activity once the interruption is over.

As already mentioned in the beginning, the identification of episodes based on core activities happens easily in an observation process. It is not very difficult for an observer to identify changes in core topics as they typically go together with a change in the environment. Application usage or location will change, and often the participant indicates it by some ritual such as getting a coffee or saying something out loud.

The observation process generates observation notes as a sequence of episodes. Each episode stands for a specific core topic and complementing activities. For every episode, the observer notes related information, like documents, persons, locations. This can also include information about multi-tasking, like the meeting, and included information lookups. All episodes last for a certain amount of time.

Coding Strategy. A consequence of the episode building process is that the data is made applicable for coding. Every episode has been coded later based on different coding schemes. These coding schemes support the structured analysis of the data with a focus on certain characteristics of the episodes. All coding schemes reported in this document are intended to highlight work and learning-related aspects of the workday. The coding schemes are reported in detail in the results chapter, to discuss the used classes together with the research goal. A coding scheme is introduced in section 11.1.2 which encodes the work process in terms of activities, roles and communication modes. Another coding scheme is introduced in section 11.3.2 which captures collaboration strategies and the cognitive level for each episode.

Sometimes the observation was disrupted for different reasons. This has been captured by two additional episode markers. Disruptions include *observation breaks*, specifying the time windows during the day when the researcher could not be with the participant,

e.g., due to the strictly confidential or private meeting, the researcher had to take a pause for a while (time varies, between 30 minutes and 3 hours). All disruption episodes are noted as *other* in the dataset.

Review Sessions. The separation of the work process into episodes is an important decision. Obviously, the workday is decomposed into chunks based on the observer's understanding of the work. Two reasons need to be considered. First, the already mentioned aspect that the observer only in rare cases had the feeling that the switches were difficult to identify. Second, the coding process was always validated in a review session with the participants. The decisions on episode change were typically supported; often, the professionals were surprised and then acknowledged the change. This was indicated by statements like "Did I really do that during the meeting. Oh yes, you are right, I remembered this deadline...".

Review sessions allowed to check whether the professional agreed to the observations made. In many cases, the professional appreciated the external insight into the day and supported the identified episodes and notes. Frequently professionals said something like "I was not aware of this, but yes, that is interesting", hinting to aspects covered in the data set which they were not consciously aware of. In many cases, the participant commented on the review to be enriching. Typically very few (between 1 and 3) adjustments were made during the review session. Only in one case a participant disagreed with the field notes and stated that many things were missing in the notes without being able explicitly to mention missing episodes. The review session took in general for 1 hour.

10.4.5 Data Treatment

Each study participant was observed for two full working days. The resulting total duration per participant varies greatly. The reason for this is that people have the freedom to decide on the actual organization of their working day, taking into account legal regulations. Therefore, some people work six or seven hours while others work ten hours.

Data normalization was used for the quantitative data to make the data per participant comparable. Specifying the share of time is based on the observation period. This process was guided by the findings of the prestudy that two days gave a good insight into the work distribution. Taking into account that the third observation day in the prestudy did not show very different ways of working. The realized understanding is that a working period (a day, a week, or another period of time) consists of a share of activities, roles, and types of communication. In the following discussion, the normalized data for each professional is considered together. The set of groups of participants is investigated concerning the characteristics of the data distribution (bar charts, box plots).

10.4.6 Data Set

The data set includes 50 participants and generated more than 800 hours of observation data and ethnographic interviews captured in field notes plus 50 self-report questionnaires. The participants belong to 6 countries, namely Germany (N=30), China (N=4),

India (N=3), USA (N=6), Israel (N=4), and Bulgaria (N=3). This includes the following categories of demographic data:

- *Age*, containing the following groups of 31-40 years (N=12), 41-50 years (N=24), 51 and older (N=14).
- *Gender*, consisting of women (N=15) and men (N=35).
- *Nationality*, consisting of German (N=30), Austrian (N=1), German-Vietnamese (N=1), Chinese (N=4), Indian (N=3), American (N=2), American-Chinese (N=1), Polish-Canadian (N=1), Israeli (N=3), Israeli-American (N=1), Bulgarian (N=3). Nationality of observation participants based on the observation location i.e. country where they were observed:
  - in Germany: German (N=28), Austrian (N=1), German-Vietnamese (N=1)
  - in China: Chinese (N=4)
  - in USA: German (N=2), American (N=2), American-Chinese (N=1), Polish-Canadian (N=1)
  - in Israel: Israeli (N=3), Israeli-American (N=1)
  - in Bulgaria: Bulgarian (N=3)
  - in India: Indian (N=3)
- *Highest level of education*, including the following groups of Bachelor (N=6), Master/Magister (N=20), Doctoral (N=14), Diploma (N=9) and Other (N=1).
- *Work profile*, consisting of managers (N=13), senior managers (N=9) including so-called development executives (N=2) as the high-level manager with personnel responsibility, experts (N=17), chief experts (N=11).
- *Experience in the company* (in years), including the time frames of 1-5 years (N=1), 6-10 years (N=10), 11-15 years (N=14), 16-20 years (N=16), 21-25 years (N=9).
- *Work time model*, consisting of 100 percent (N=42), 90 percent (N=2), 80 percent (N=3), 75 percent (N=2) and 60 percent (N=1).

In the following, the data analysis process is described.

10.4.7 Data Analysis Process

The results of the data analysis taking into account research questions will be reported in the next chapter. Only some general aspects of the data analysis process are presented here.

After the collection of raw data (time and events, see above), the phase of data cleaning followed to concentrate on the relevant data concerning the research objective and research questions. After collecting the raw data in real-time while observing the participants, the data was then structured, and a coding procedure was applied i.e., open

coding and relational coding. The next section shows how this process was integrated with mappings to existing taxonomies and their adaptation.

The coding process was initially conducted with the coding tool Atlas.ti and Maxqda. In both cases, the large variety in wording and languages complicated the use. Therefore open coding was done manually with the Excel tool. This was a continuous and circular process that was carried out during and after the exploration. It included trying out different coding schemes and perspectives. Personal memos were used to keep an overview and to improve the self-understanding of the actual coding goals. In all cases, the researcher tried to take into account the personal experiences gained during the observation phase. The mental reconsideration of concrete cases and their occurrence guided the process.

The result of the open coding was treated with R-scripts to structure and organize the data. A script for reading the Excel files (in CSV format) was used to obtain a data frame representation in R. The integration of data frames also informed the relational coding process by supporting the retrieval of data and the creation of subsets to investigate different perspectives. Later, R-scripts were developed to guide the exploratory data analysis. This included the creation of overviews of duration at the case and group level. The term *case* stands for individual professionals and the word *group* for the aggregation of several cases according to organizational criteria such as type of activity or location. The tools used, mainly for exploratory data analysis, were bar charts, histograms, box plots, and significance tests.

The quantitative and qualitative data were not considered separately but were seen as two sources of information to help the researcher understand the research subject and address the research questions. Consequently, the process was not linear, as the description suggests, but rather a circular process, in which the different phases were repeated to integrate new findings into the analysis process.

The individual perspective on learning at the workplace of professionals was investigated using the following questions in the self-report study: *What does learning at work mean to you?* This means that the data was collected from each participant individually, then grouped/categorized and then divided into different semantic categories, consisting of similar meanings but described by each professional with different words. As with the observation of the participants, a classification scheme was developed during the evaluation of the self-report study, which will be described later.

10.5 Summary

This chapter has investigated the research methodology and the corresponding methods for the identified research questions. A decision for qualitative, inductive research was made using method triangulation at the level of data collection and data analysis. The triangulation for data collection stands for the integration of two perspectives in the data set. First, an observer perspective on workplace learning in the work process using participant observation and ethnographic interviews. Second, an individual perspective of professionals on workplace learning using a self-report study. Triangulation at the

analysis level stands for the integration of coding with exploratory data analysis and qualitative content analysis. The combination of coding and exploratory data analysis should be done on the same data set, integrating quantitative and qualitative methods. The challenges and opportunities of this approach were discussed. In this study, triangulation with qualitative and quantitative data was considered relevant to structure the complex information collected and to enrich the analysis process.

Based on these decisions, a study design was prepared, and a study was conducted. The study applies the triangulation method to 50 professionals (managers and experts) of the large, globally active software vendor. The participants cover six countries. The study combines 800 hours of observation data and ethnographic interviews recorded in field notes with a self-report study. Mechanisms such as review sessions and workshops were used to collect feedback from participants on the data collection and analysis process. The analysis process itself integrated the qualitative and quantitative analysis circularly to answer the research questions. The results of the research question-oriented treatment of the data are presented in the next chapter 11.

11 Results

In the following, the results of the empirical study are reported. The results are organized based on the research questions. There are three main aspects considered. The first aspect is the actual realization of workplace learning for professionals in a company (research questions 1a, 1b). Two methods are used to investigate this aspect. Learning in the workplace is investigated based on the observation of the work process (see section 11.1). This process perspective is complemented by interviews with professionals about their understanding of their learning in the workplace (see section 11.2). The second aspect is an investigation of how learnings are applied in the work process (research question 2). By applying learning, new experience is generated, resulting again in a learning process. For the investigation, the professionals' work process is analyzed, focusing on applied abilities in the work process and strategies for collaboration (see section 11.3). The third aspect is an investigation of differences that exist in the way workplace learning is lived by different knowledge workers (research questions 3a and 3b). For this, a comparative analysis of the observed work process data is conducted. Organizations often structure their learning offerings based on location and job roles. Following this direction, workplace learning is compared by professionals in different locations with their different job profiles. The location is analyzed based on workplaces in different countries (see section 11.4) and job roles are analyzed using management and expert jobs (see section 11.5).

The analysis follows the process specified in the methods chapter (see chapter 10), combining qualitative and quantitative methods. Most results build on work process data (cf. section 10.4) with sequences of episodes (cf. section 10.4.4) that are subject to coding (cf. section 10.4.4). The coding schemes and process is specified in detail in the following section (see section 11.1.2 and 11.3.2). The work process was broken down into episodes, and the data was normalized to the episodes to show the observed duration as shares of the overall work process (cf. section 10.4.5). When applying normalization, each episode takes a particular share of time. Once the episodes have been coded, the shares of the different codes among the study participants can be compared. All reported insights into work process data are obtained by investigating data that have been plotted using bar charts and box plots on unnormalized and normalized data. In certain cases, matrices were created to show the simultaneous co-occurrence of coding combinations. A selection is used in the analysis. An investigation of significance would have been advantageous. Due to the sample size and distribution, it was not possible to investigate this.

The data analysis uses the study data set (cf. section 10.4.6) as follows. For research question 1a and 1b till research question 2, only the German data is used for analysis. For research questions 3a, the whole data set, including the observations made in other

countries, is included. For research question 3b data set based only on Germany is used. The reason for this selection is the country distribution of the data set. Most data has been collected in Germany (30 samples), while other countries contributed fewer samples (five countries have a total of 20 samples). The first three research questions strive for a general analysis of workplace learning. Here a focus on one country has been decided to increase the homogeneity of the considered data.

11.1 Workplace Learning Characterization – Work Process Observation (RQ1a)

This section analyzes the work process of professionals in terms of learning at work. In other words, the goal is to understand how work-based learning happens during the daily work of professionals. This addresses research question 1a.

The investigated theory suggests that *learning is embedded in the work process. It is not possible to separate learning from actual work execution* (see chapter 9). This theoretical expectation (TE-RQ1a) will be investigated further.

11.1.1 Approach

The taken approach is an analysis of the work process captured during participant observation. The aim is to investigate the work process, the things that the professionals do. This is a basis for understanding the manifestation of learning in the work process.

A coding scheme has been developed to analyze the work process in terms of learning at work. The episodes captured in the observation notes are very specific, as they record the behavior of people in certain situations. It is difficult to analyze these episodes because each situation is obviously different. Each situation happens at a different time and involves unique approaches. Nevertheless, these situations have similarities. For example, a work process involves a larger number of collaborative and individual activities that are carried out similarly. The coding scheme developed in the course of research generates a homogeneous perspective on the work process.

The goal of the coding scheme is to simplify the analysis of the work process and enable a structured investigation of embedded learning. The used coding scheme for the analysis of workplace learning covers three aspects: 1) Actions, 2) Roles, 3) Communication modes. The work process emerges as actions performed in the context of a role in a communicative situation. This coding scheme has been developed sequentially. It is described in detail in the following section.

The analysis of shares of time spent with specific actions, in certain roles or performing communication modes, is used to represent work processes. The accumulated episode durations provide a quantification of the relevance of certain aspects of work and learning.

11.1.2 Coding Scheme

The developed coding scheme considers the work process as a sequence of work episodes. The coding annotates each episode with 1) Actions that capture the observable behavior,

2) Roles for the social frame, 3) Communication mode for the communicative characteristic. The relationship between the three codes is as follows. During each episode, actions were performed. The actions were contextualized by a role representing a social frame in which the individual interacts. Each action can have communicative characteristics.

Each code was built on existing theoretical work and was refined in a sequential coding process. The subsequent procedure was carried out as follows: An initial coding scheme was developed based on the theory. The coding scheme was applied to the observation notes collected in the preparation phase of the study. The resulting codings were discussed with the participants. The feedback was used to refine the coding scheme. Then the refined coding scheme was applied to the same observation notes and discussed again with the respective participants. After two iterations in the preparation phase, the feedback indicated that the scheme had reached stability that allowed it to be used in the actual study. Similarly, the coding of the observation notes was discussed with each participant in the final study. The feedback showed a general agreement with the scheme, and only minor refinements were made to the coding of the study observation data.

The combination of actions, roles, and communication modes allows to capture the dynamics of the work process and enables the investigation of learning. In certain cases, an understanding of the role is required to understand the action. An example is an action of conversation. This makes it possible to distinguish the role in this action, which may be more in the direction of information exchange, information gathering, or collaborative creation of new information. The communication mode furthermore helps to understand the share of individual and collaborative mode. It helps to distinguish the different modes of collaboration, which can be face-to-face or mediated (e.g., via a video conference).

The dataset shows that work processes are often dynamic. Following the insights into workplace learning being strongly related to the experience, such dynamics are likely to transform the learning of the individual continuously (cf. chapter 3). Some actions seem to have a weak learning character, while others seem to have a stronger learning character – at least from the observer perspective. An example is a reporting action: for the person who is reporting (applied code: *conversation update* action with the *sharer-explainer* role). This is a repeating known fact. If a dialog starts due to questions from the audience, the individual needs to react to; the situation may change and also increases the learning experience (applied coding: *conversation-reflexion*) action in the *linker* role.

The coding typologies are presented in detail below.

Actions. The action typology used in the study contains 16 actions. It is listed in table 11.1. The table describes each action and provides links to the theory sources from which the action originates. The typology provides a coding vocabulary for individual interaction with the environment. Actions do not contain information about motivations or higher goals. The action typology developed for coding focuses on discriminatory power and completeness in terms of recording the working day and learning during the working day.

Action	Description	Reference
Analysis/Analyze	Analyze means to examine something carefully, and to completely understand it.	Efimova (2004)
Dissimination	Dissemination means spreading information or information objects, often work results.	Davenport and Prusak (1998)
Analyze-dissemination	Action of investigation/examination of something and dissemination of information about it.	Efimova (2004), Davenport and Prusak (1998)
Authoring	This means individual creation of textual and medial content using software system, e.g., word processing systems / presentation software.	Davis (2003)
Co-authoring	Co-authoring means the collaborative creation of textual and medial content using software applications, for example, word processing systems/ presentation software.	Hädrich (2008)
Authoring-co-authoring	Creation of a textual content, which occurs in a changing mode of individual and collaborative, e.g., writing a project paper.	Davis (2003), Hädrich (2008)
Conversation	This stands for the action of knowledge workers that manifest between three dimensions: 1) individual with other people, 2) their ideas, and 3) communities and networks.	Efimova (2004), Lave and Wenger (1991)
Conversation-feedback	Action in which one or more persons evaluate something and make a statement to another person(s) based on this evaluation (Efimova2004). Feedback can be when the interviewees routinely state whether something said or done has been processed and integrated (Eshghi 2015). Feedback from the conversation can help develop a new idea or support/reject an original idea (Ketch 2005).	Efimova (2004), Eshghi et al. (2015), Ketch (2005)
Conversation-reflexion	Reflection in conversation can be understood here as the think-aloud technique, e.g. loud thinking for a better understanding of something. The reflection can be individual and social.	Nielsen (2002)
Conversation-update	Action in which two or more people inform each other about a specific topic (e.g. project), i.e. a way of keeping each other informed about a specific topic by exchanging information and experiences	Efimova (2004), Eshghi et al. (2015)
Expert search	The use of an expert to discuss and solve a specific problem.	Reinhard et al. (2008)
Information organization	Information organization stands for the personal or organizational management of information collection.	Davis (2003)
Information search	This action stands for the search for certain topics in a certain form.	Reinhard et al. (2008)
Information search-reading print	The search for certain topics and the reading in a print form, e.g. book, magazine, paper.	Reinhard et al. (2008)
Information search-reading web	Searching for specific topics and reading on the Internet, e.g. Google or Wikipedia.	Reinhard et al. (2008)
Information search-reading web and print	Searching for specific topics and reading in a combined form of online (Internet) and offline (without using internet/printed).	Reinhard et al. (2008)
Listening-asking	Action that, through listening and questioning gives participants the opportunity to develop understanding that can then be used to support decisions about e.g., the choice of goals or actions.	Feldman (1999)
Monitoring-controlling	Generic meaning of monitoring stands for keeping oneself or the company up to date on selected topics, e.g. on the basis of various electronic information sources (Reinhard 2008). More specific, monitoring can be focused on controlling (Holsapple and Jones 2005).	Reinhard et al. (2008), Holsapple and Jones (2005), Efimova (2004)
Coffee break	The period during individuals drink coffee or tea/water in the company's coffee corner and take a short break talking to each other.	Author
Lunch break	The time period when individuals eat lunch in the canteen of the organization.	Author
No use	The period during which the observed person made certain private statements that could not be included in the field notes.	Author
Observation break	The period during which the researcher/observer was not with the observed person, e.g. due to strictly confidential conversations/meetings.	Author

Table 11.1: Description of Actions

The basis for the action typology is contained in section 2.4. The typology is based on Reinhard et al. (2008), which in turn integrate various activities derived from different authors, such as information organization, discussion, updating, analysis, dissemination, feedback, authoring, co-authoring, expert search. The coding process has shown limitations of the typology and suggested modifications. Thus, the coding typology has evolved during the coding process of the working day. Two modifications are noteworthy. Firstly, a more differentiated representation of learning has been included. Secondly, more representations of collaborations were included.

Two main action groups were formed and expanded as follows (in italics): 1) *Activities with interaction-communication characteristics*, such as conversation, update, feedback, reflection, analysis, dissemination, expert search; 2) *Activities as explicit learning indicators*, such as a) Expert search, when professionals explicitly search for information from other/colleagues by asking them, b) Information search-reading web, when professionals search for information through virtual channels such as Google, Wikipedia or others; c) Information search-reading print, when professionals search for information in printed form (e.g., books, magazine), d) Information search-reading web and print, when professionals search for information through combined virtual channels (e.g., Google, Wikipedia) and print (e.g., books, documents) simultaneously.

Deriving Actions. The coding of actions applies the action description to the notes for each episode. The noted behavior is mapped to an action, which is an abstract representation of the behavior. The coding process typically requires that the observer combines a number of separate fine-grained operations and maps them to action. An example is an interaction with Microsoft Outlook as an email client. A participant moves the mouse to use the cursor to interact with the emails displayed in the application. Based on the specific interactions, it can be identified that reading, authoring, or an information organization action happens. Examples for the respective decisions are given in the following.

Examples. In the following examples for the application of the action coding scheme are given. The example gives insights into the observer notes and the decisions underlying the coding process for actions. The focus is the morning till noon of a senior manager who is located in Germany (id15/M/GER). During the morning (date: 02/02/2016), the participant first mainly worked on emails and applied think-aloud related to work planning and situation judgments. He faced an issue that he directly addressed during his work and participated in a conference call. Concrete activities during the work of id15 are described below in chronological order.

The observer notes separated this morning in the following way. First, twenty minutes id15 spent on e-mails and think-aloud of the upcoming workday (9:00-9:20am). These two different scopes were coded as follows. First, the activity on e-mails has been coded as an *information organization*, as the participant mainly ordered the received information. Second, the activity of loud thinking in the presence of the observer without other colleagues present was coded as *conversation-reflexion*. Afterward, (9:20-9:36am) id15 worked individually on the e-mails, i.e., he read and wrote the e-mails and made entries in his schedule without saying anything and talking to others. By sending an e-mail, id15 then had technical problems with Outlook and lost the mail to be sent.

Then he thought aloud that he never had such technical problems like now and started writing the same e-mail again from the beginning (09:36-09:44am). This was coded as *information organization* and *authoring-co-authoring*. Then the observed person took a short coffee break with the observer and reflected loudly about an event he had the week before in Las Vegas, USA (09:44-09:50am). This activity was coded as *conversation-reflection*. After id15 was back at his desk, he continued to read and write e-mails (09:50-10:00am). This was coded as *authoring co-authoring*. The written mail while sending got stuck again and id15 reflected loudly that *it has never been so bad* with his view. This was coded as conversation reflection.

Afterward, the observed person id15 had a Skype meeting with colleagues located in other locations than Germany on the topic software patch with high priority (10:00-11:00am). Id15 as the initiator of this meeting had an active role i.e. he informed the other participants of the meeting about his current status (activity coded as conversation-update), took notes and included information in a PPT (activity coded as information organization and authoring-co-authoring), listened to other colleagues on the phone and actively asked them about their current level of knowledge in the common problem case (activity coded as listening-asking). Id15 tried to get as much information as possible from other call participants for his further status analysis and derivation of possible solutions to current problems related to the patch (activity coded as analyse-dissemination). This included such aspects as e.g. time period to make the necessary decision, playing with the possible scenarios in terms of who does what, when/if and until when. In summary, this 1-hour virtual Skype meeting included 5 activities that took place in an alternating dynamic manner during the conversation interactions and related information documentation.

Then, the observed person had a meeting in which the observer was not allowed to participate due to sensitive data to be handled in this meeting (11:00am-12:00pm). This time slot was coded as *observation break* (category *other*), because the observer didn't have a chance to see what was happening to derive observed activities.

A total of 45 episodes of id15 could be derived during two working days of observation. The episodes described above give a small insight into the coding procedure and their different duration, related granularity, and variety of actions.

Roles. The role typology used in the study contains 13 actions and is provided in table 11.2. The table specifies role names, describes the roles and mentions papers the roles originate from. The focus of roles is the information processing attitude during an episode. The role distinction contextualizes actions to support understanding of the actions.

Like for actions, the foundation for the role typology is discussed in section 2.4. The attitude in this work follows the perspective of Reinhard et al. (2008). The role is related to information processing, basically distinguishing the *giver* and *taker* perspective (Reinhard et al., 2008). An example of the *giver* perspective is the role *sharer-explainer* assigned once the observed participant shares information with others and explains the information. An example of the *taker* perspective is *retriever-linker* assigned once the observed participant collects information for self-improvement or personal development.

Role	Description	Reference
Controller	The aim is to monitor and ensure the company's performance so that the necessary knowledge processors and resources are available in sufficient quality and quantity.	Moore and Rugullies (2005), Holsapple and Singh (2001)
Controller-organizer	This stands for a combined role of performance monitoring and organizational planning of activities at the same time.	Moore and Rugullies (2005), Holsapple and Singh (2001)
Decisionproofer-decisionmaker	Embedding of knowledge into organizational results for release into the environment.	Holsapple and Singh (2001)
Linker	The aim is to connect and bring together information from different sources to generate new information, with an emphasis on individual (self-)improvement.	Davenport and Prusak (1998)
Linker-networker	This role aims to make connections and bring together information from different sources to generate new ones - with an emphasis on individual (self-)improvement.	Geisler (2007)
Networker	This stands for a role of making personal or project-related connections with people who are involved in the same kind of work, to exchange information and support each other.	Davenport and Prusak (1998)
Organizer	This represents a role in the organizational planning of activities, such as to-do lists and scheduling.	Moore and Rugullies (2005)
Reriever	In general, the role of the retriever stands for the knowledge worker who collects information on a particular topic.	Snyder-Halpern et al. (2001)
Retriever-analyzer	This represents a role for the knowledge worker in gathering information on a particular subject, including the objective of analysing something to better understand it.	Reinhard et al. (2008)
Retriever-controller	This stands for the knowledge worker who collects information on a particular topic, including an action/approach aimed at controlling something.	Moore and Rugullies (2005), Geisler (2007)
Retriever-linker	This role aims to connect people and bring together information from different sources to generate new information, with an emphasis on individual self-improvement.	Davenport and Prusak (1998), Nonaka and Toyama (2003)
Retriever-solver	This stands for the knowledge worker who collects information on a specific topic, including the goal of solving something.	Davenport and Prusak (1998), Nonaka and Toyama (2003)
Sharer-explainer	This aims to disseminate information to an individual or a group (community) with the emphasis on explaining it.	Davenport and Prusak (1998)

Table 11.2: Description of Roles

During the observation, various roles for information processing have been derived (see table 11.2). Considered roles are: sharer, linker, networker, retriever, controller, organizer, solver, helper. Similar as above described activities, the basic role typology of the literature was used and then merged and extended (in italics) in the following respect: 1) Communication character, e.g., sharer, linker, networker, *explainer*, *analyser*, *decisionproofer-decisionmaker*; 2) Indicator for learning, e.g., *retriever-linker*, *retriever-solver*, *sharer-explainer*.

Deriving Roles. The coding of roles investigates how the participant handles information. Based on the way information is collected, distributed or created, a role is identified. Role selection follows a mapping of the information behavior to the role description. Sometimes it is necessary to consider the information behavior of a number of related episodes to identify the correct role. In the following, examples for the coding are provided.

Examples. In the following examples for the application of the roles, a coding scheme is given for an observed participant. The example provides insight into the observer's notes and the decisions underlying the coding process for roles. The focus is on the morning until noon of an expert who is in China (id34/E/CN). During the morning (date: 26/05/2016), the observed person mainly acted as an information collector, sharer, and analyzer. These roles derived from id34 are described below.

After the start of the observation, id34 gave an insight into the working day and upcoming activities (09:05-09:14am). The role has been coded as *sharer-explainer*, indicating a giving perspective on information. At the same time, id34 controlled the schedule and the mail account, which was coded as *controller-organizer*. Then the observed person had a short private call in Chinese (09:14-09:16am), which was coded as observation break. Then the observed person briefly mentioned to the observer that it was her daughter calling her.

Afterward, a colleague called the observed person id34 to obtain information about the industry validation team (09:16-09:19am). The observed person listened carefully and provided the colleague with the necessary information and explanations. As an indication of the giver's perspective, this has been coded as *sharer-explainer* and *retriever-analyser*.

Immediately afterward, id34 had a short coordination meeting with a colleague on the topic of customer issues and scheduling (09:19-09:23am). The observed person id34 first tried to understand the current status, i.e., she asked the colleagues to provide her with the currently available information. This was coded as *retriever-analyser*. After receiving this information, id34 acted as an information provider for the colleague, i.e., id34 articulated her potential solution options for the current case. This was coded as *sharer-explainer*.

Next, one colleague came to the observed person id34 to get more details on the progress of the issue and the progress of the ticket, including possible new licensing solutions (09:23-09:47am). The observed person id34 first listened carefully to the colleague's question, in order to understand the status (coded as *retriever-analyser*), then id34 shared the required information and explained this to the colleague in detail (coded as *sharer-explainer*). In doing so, the id34 acted as a decision-maker or significant contributor in the decision-making process, which was coded as *decisionproofer-decisionmaker*.

Accordingly, id34 shared a future picture in planning and implementing the solution plan for the current case. id34 thus showed a tendency towards status controlling. This was coded as *controller-organizer*. In summary, four combined roles were derived in this session, showing the dynamic position of the observed person.

Afterward, (09:47-09:50am), the observed person id34 made a short introduction for the office colleagues to the research activities on learning in companies. In other words, id34 briefly explained to colleagues the reason for the observation. This was coded as *sharer-explainer*.

From 09:50 till 09:55am, the observed person id34 had a short discussion with a colleague about issues and team support. In essence, id34 tried to understand the current status, i.e., she asked the colleague several questions. This was coded as *retriever-analyser*.

The following half-hour (09:55-10:30am), the observed person was individually working on the mails (reading and writing) and the schedule entries. This was coded as *retriever-controller*, *controller-organizer* and *retriever-analyser*.

These eight episodes described above were very short and still implemented a large variety of different means of collecting and sharing information in a mostly collaborative manner.

A total of 49 episodes of id34 (2 days) were observed which contained dominant role varieties.

Communication Modes. Communication during the work processes can be structured differently. The communication mode typology comprises four different types, which allow a rough differentiation of the most important communication types. The typology covers the way the professional interacts with his environment. The aim is to complement the perspective of activities and roles. The basic idea is to distinguish between individual and collaborative work. In addition, a distinction is also made between co-local communication and distance communication. This information provides further information for understanding the situation in which the actions are carried out.

In the preparation phase of the study, it was necessary to consider the way people communicate. Especially a basic distinction between individual and collaborative work seemed relevant. While different approaches for classifying collaborative work exist (cf. section 2.4.2), they introduce additional complexity. Therefore a fundamental taxonomy was developed in the prestudy phase. The goal of the communication mode typology is to distinguish between various ways of conducting social interaction (e.g., talks) and individual work (e.g., own reflections). The following types of communication modes within a company can be distinguished: *virtually* (e.g. audio or video Skype meetings), *face to face* (onside talks), *face to face-virtually* (combination of virtual and personal communication, e.g. on-site meetings with video-audio-conferencing so that colleagues from other locations also participate) and in the *office-individually* (working alone in the office). This classification of communication modes helps to investigate the dominant modes of interaction of professionals as members of collaborative groups (e.g., project-related meetings).

Deriving Communication Modes. Communication modes are coded based on the present collaborative situation. The mapping of an episode to remote or immediate collaboration and individual work, respectively, is straight forward.

Examples. In the following, an example for the application of the communication modes coding scheme for one observation participant is given. The example gives insights into the observer notes and the decisions underlying the coding process for communication modes. The focus is the morning till noon of a manager who is located in the United States (id42/M/US). During the morning (date: 21/07/2016), the observed person id42 acted in a combined mode of individual and socially-oriented activities. These are described in detail below.

After the observation started early in the morning, the observed person id42 had a virtual meeting via Skype about quality measures and methodology with a colleague who is in a different location. During this Skype call (07:30-08:03am), id42 listened, took notes, analyzed the status, and derived action steps. The communication mode has been coded as *social-medium*.

Immediately after the Skype meeting (08:03-08:09am), the observed person id42 reflected aloud on this meeting in the presence of the observer. This has been coded as *individual-observer*.

Afterward, the observed person id42 had one other virtual meeting via Skype, focusing a status task force on product understanding (08:09-09:03am). Id42 passively participated in this meeting i.e., he did not say anything, just passively listened. In parallel, id42 read the mails and coordinated his own schedule. Since id42 was in a group conversation (Skype call with more than one participant), but at the same time working on individual things (mails and schedule) that were not directly related to the current topic of the Skype call, this was coded as *social-individual*.

After the Skype call, the observed person reflected in the presence of the observer loudly on how to deal with information overload and emotions under pressure in daily business (09:03-09:29am). No other colleagues were present during this reflection, so this was coded as *individual-observer*.

Afterward (09:29-09:48am), the observed person read and wrote emails individually and modified the schedule. During this time, id42 had no conversations with other colleagues and did not make loud reflections in the presence of the observer. This was coded as *individual-medium*.

Then, id42 collected information and made hand-notes for a status preparation of the next release decision meeting (09:48-10:43am). This was coded as *individual-medium*. At the same time, id42 read the new mails and reflected loudly in the presence of the observer on what he was working on. This was coded as *individual-observer*.

Afterward (10:43-11:01am), id42 made his notes in a notebook for a status preparation of the next release decision meeting. In parallel id42 read e-mails. No reflections or conversations were observed. This communication mode was coded as *individual-medium*.

Next, the observed person id42 had another virtual meeting via Skype (11:01-11:35am). Id42 passively participated in this virtual meeting and worked on e-mails and schedules in parallel. The communication mode here was coded as *social-individual*.

Then, the id42 had a lunch break with other colleagues (11:35am-12:30pm). During this, he talked about the current status of the workflow and cultural differences at work. This was coded as *social-person*.

Only 9 episodes were briefly described here. Altogether, 50 episodes could be distinguished in the observation of id42, which included different modes of communication in a changing manner.

11.1.3 Results

The first research question (1a) is *which characteristics of professionals workplace learning can be derived from their work process?* In the following, the analysis of actions, roles, and communication modes is presented. The analysis shows the complexity of individual workdays and the large number of different things people are doing. By investigating the distributions of codes across individuals, assumptions are made regarding the strength of different learning processes embedded in the work process.

The researcher experienced the observation as an intensive period during which the participants executed a very large number of actions and took over a large number of roles, covering all communication types. Despite personal characteristics and some outliers, the typical workday was intensive, filled with very many interactions, planned and unplanned. The participants showed confidence in their work execution, performing ongoing planning, which sometimes was expressed by speaking out loud what they anticipate and plan to do. Most participants gave the researcher the impression of high confidence in their personal work, which was also guided and constrained by a strong interpretation of the immediate situations they were involved in. The researcher only in rare cases observed dedicated learning activities but observed ongoing work processes which sometimes encapsulated episodes of explicit learning. Furthermore, the work, as such, represented ongoing learning based on the new experiences created. This perspective is supported by the numbers reported in the following.

Furthermore, collaboration was very prominent throughout the workday of almost every observed participant. The dominance of socially oriented actions such as conversation update, listening-asking and the interaction-based role of sharer-explainer show this. This also shows from the ranking of communication modes, with face to face being most frequent. Learning and teaching seem to happen mainly as an effect of the experience of actions. A mixture of various individual and socially oriented workplace learning characteristics has been observed. The main learning situation observed was learning in interaction.

1) Coding of Actions. After applying the action codes, the time-share per action and participant was aggregated and then normalized. These distributions have been analyzed. In the following, the report will focus on quantitative analysis. The respective share per action is summarized lowest to highest share (see box plot figure 11.1, the related table B.1 and bar chart figure C.1 are in the appendix).

The 2nd and 3rd quartil contain 50% of all cases are smaller than 20% for all actions. In other words, there is no top action that consumes most of the time. The work process is a composite of a large variety of different actions. A similar effect will be seen for

roles later. The summary of actions on information handling and collaboration shows that they dominate the working day. With an average (avg) of 16,49%, information organization has the highest share of the overall work process.

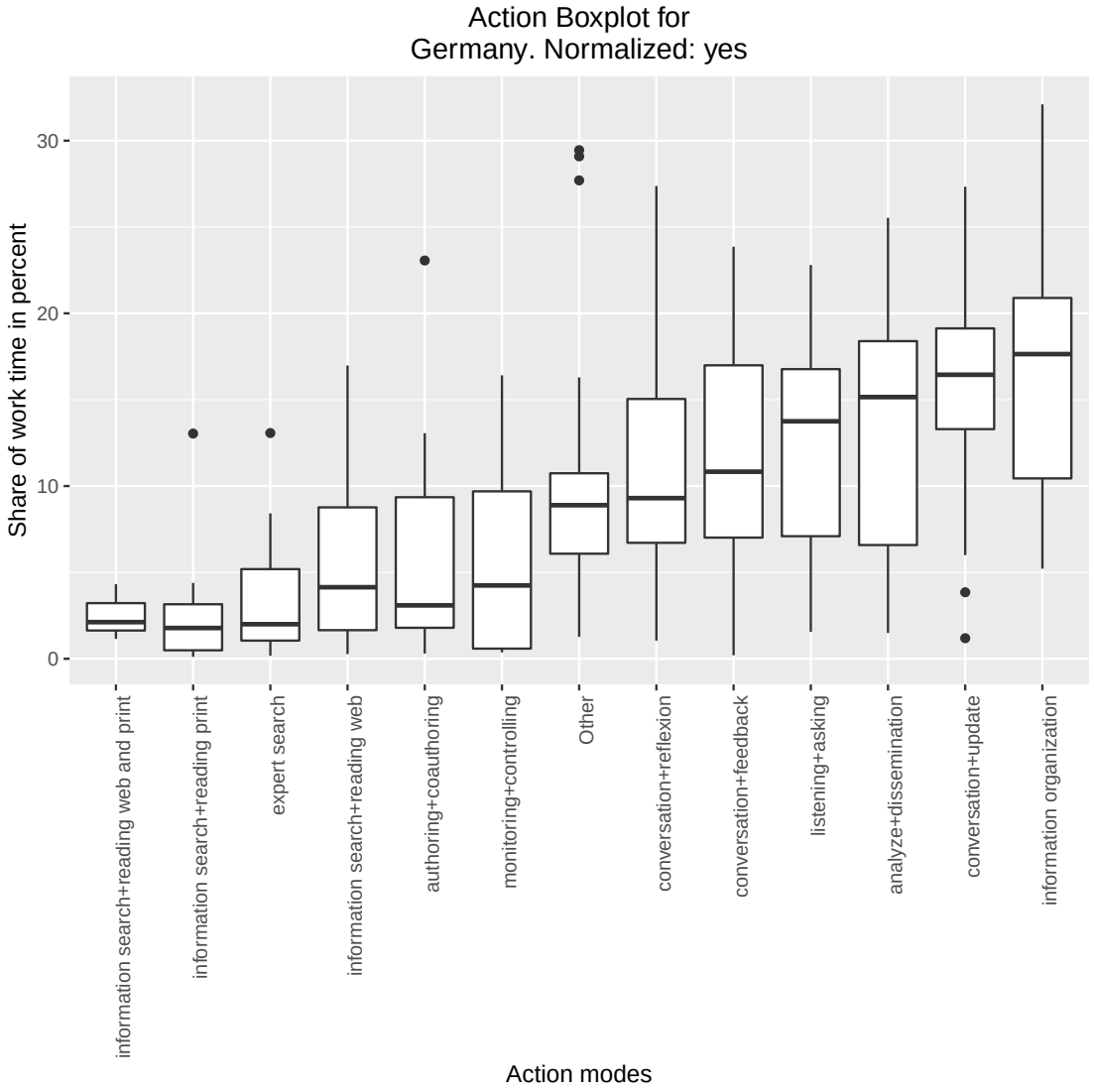

Figure 11.1: Actions during Work of Professionals in Germany – Box plots

Overall the number of outliers in the dataset for the activities is rather small. In most cases the size of the 2nd and third quartil does not exceed 10% in total (see figure 11.1). This shows a relative homogeneity for the share of time spent with actions across all participants in the investigated sample.

The distribution of actions (see figure 11.1) shows that much time is spent with *social actions*. While most of the time is spent organizing information, five of the six most

frequently used actions have a social character, such as *conversation-update* (15,68%), which occurs during a conversation when people exchange information with each other (e.g. project-related meetings), *listening-asking* (12,04%), when the observed participant actively listens and asks someone (e.g. during a meeting), or *conversation-reflection* (11,52%) when participants reflect by sharing their individual thoughts and experiences. Next to socially-oriented activities, a large share of time is also spent on individual activities, such as information organization, which can stand for the coordination of appointments or writing e-mails. This indicates a mixture of social and individual activities with a focus on interaction.

During the observation, the researcher established the understanding that during the execution of the dominant collaborative and individual activities, learning is an important aspect. In some cases, the professional had more of a teacher role to another professional, in other cases, he consumed and learned. In many cases, the collaborative process generated new information. Learning as a dedicated action does not happen very often. Dedicated learning activities like *information search-reading web* were rare, with only 4.57% avg share in the work process. Similarly, *expert search*, which serves as an explicit learning indicator, has only 2.08% share. These two examples, which point to explicit learning characteristics during work, show a much more concentrated and shorter share and less wide dispersion compared to the socially oriented and more individual work focused activities.

This shows that learning often is a by-product of a work-goal oriented execution of actions. The boundaries between work and learning are fluid, i.e., learning actions occur as part of the work execution. This underlines the tacit dimension of workplace learning, making learning in work, and work in learning interdependent.

The mentioned results can be seen in the following example of one observed professional (id15/M/GER). The distribution of activities shows a mix of individual and social activities with a particular focus on *interaction*. These activities of the participant id15/M/GER include the following activities (from the highest to the lowest share): information organization (19,30%), conversation-update (19,1%), listening-asking (13,4%), other (10,59), conversation-feedback (10,3%), conversation-reflection (10,2%), analysis-dissemination (9,5%), information search-reading web (5,6%), authoring-co-authoring (2,9%), expert search (2,4%). As the quantitative analysis above shows, the example is representative of most samples.

In summary, the analysis shows the complexity of workdays and a variety of actions. All participants make use of a large variety of actions throughout the workday. The time spent with each activity was very similar, with collaboration and information handling being very relevant. This shows that despite the overall complexity, the actual actions are comparable. As no sequence analysis was conducted, it is not possible to say whether the actual execution sequences are also comparable.

2) Coding of Roles. A total of 10 roles of professionals were derived in Germany. This data has been summarized with regards to the share from the lowest to highest (see box plot figure 11.2 and the appendix for overview table B.2 and bar chart figure C.2).

The four roles with the highest share are sharer-explainer (21,96%), retriever-controller (18,88%), retriever-analyzer (16,15%), controller-organizer (13,05%). This is interesting,

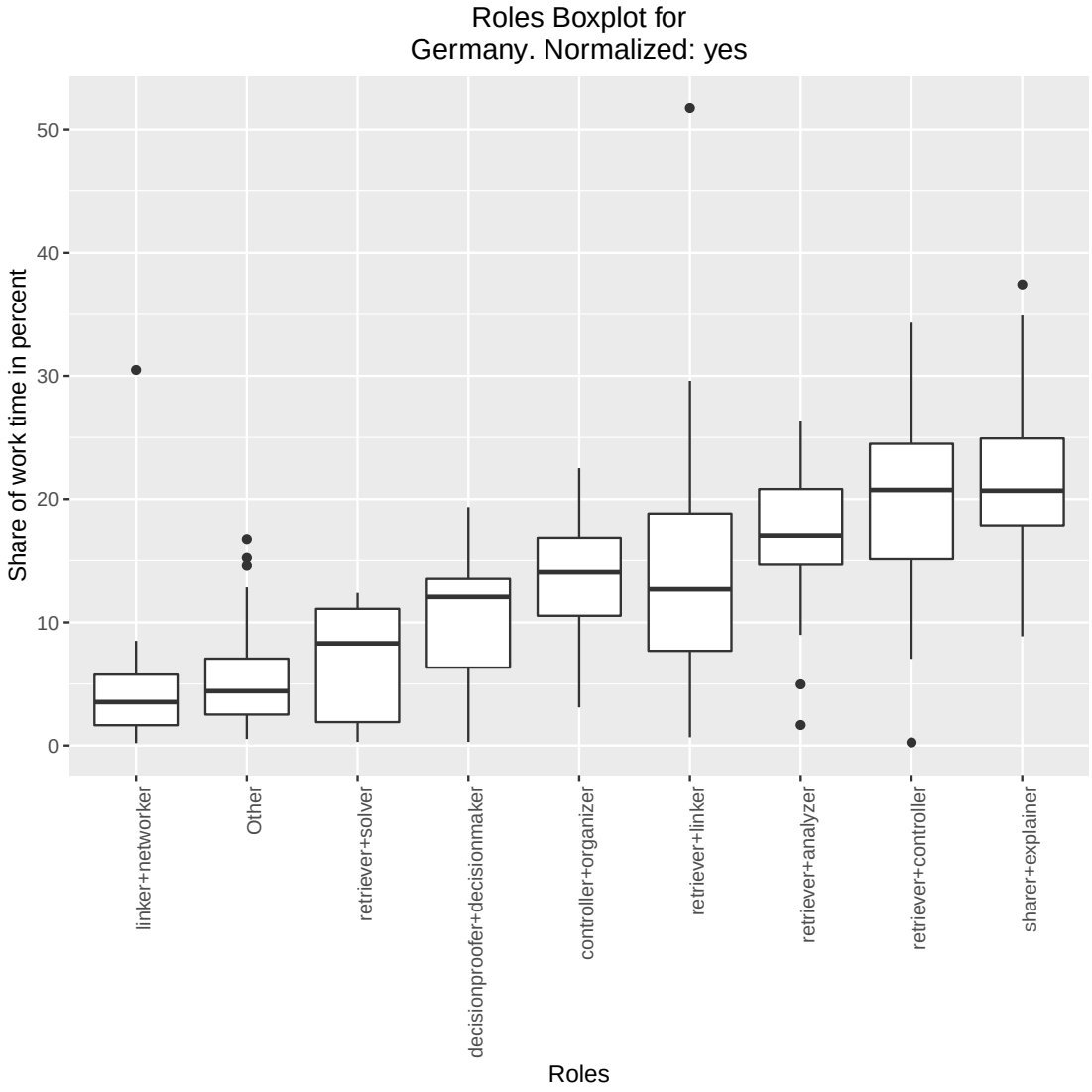

Figure 11.2: Roles during Work of Professionals in Germany – Box plots

as *sharer-explainer* and *controller-organizer* are situations in which professionals share information. Thus they give information and, in some respect, teach others. *Retriever-controller* and *retriever-analyzer* stand for learner roles based on the consumption of data. This shows a very similar distribution of situations when giving information and when taking information.

The co-occurrence analysis of roles and actions shows a strong relationship between collaborative actions and roles which have giver and taker, or teacher and learner focus. For example, professionals typically act as *sharer-explainer* during actions of: a) conversation-update (4,14%), b) conversation-reflexion (3,61%) and c) listening-asking (3,23%). The role of *retriever-controller* by professionals could be identified during the following actions of: a) information-organization (4,15%), with emphasis on individual work (e.g, writing mails, working on a document) and b) conversation-update (3,12%), which focuses on collecting and monitoring information, such as specific project status-based updates.

Some roles are representative for personal learning. These are *retriever-solver* and *linker-networker*. These roles with a focus on the conscious decision for personal learning only take a very small share of the day, e.g., retriever-solver (1,95%) or linker-networker (3,67%). These two roles as explicit learning indicators (see left side in box plot of figure 11.2) are much more concentrated and taking a smaller share than roles with interactive focus, e.g., sharer-explainer. Apart from this dominating interaction-oriented role of the *sharer-explainer*, other roles e.g., controller-organizer (middle of the roles box plot, figure 11.2), retriever-linker, retriever-analyzers, or retriever-controller (see right side of the roles box plot, figure 11.2) can be perceived both individually and socially oriented. All these roles together show a dynamic between each other: These roles can act as individual and social-oriented, which leads to the implicit learning dimensions.

In the following, an example for one participant is given which shows how the insights desribed above are represented on individual level. For participant 15 (id15/M/GER) the following time distributions per roles were identified: sharer-explainer (19,8%), controller-organizer (17,3%), retriever-analyzer (17,1%), retriever-controller (15,6%), retriever-linker (13,5%), decisionproofer-decisionmaker (12,1%), other (2,5%), linker-networker (1,6%), retriever-solver (0,3%). All these percentages make up 100% of one observation per person.

The role analysis indicates that work execution, learning, and teaching are frequently merged. People do not decide explicitly to learn or to teach; they plan and execute their work and experience situations of learning and teaching (see in particular the discussion of Billet in chapter 4). This shows the relevance of informal learning. i.e., manifests through a tacit focus, is demand-oriented and highly situational) in work and thus reinforces the theoretical expectation of research question 1a (TE-RQ1a) described above.

3) Coding of Communication Modes. The classification scheme of communication modes aims to support coping with research question 1a by deriving the social modes during the episodes of the work process. In this sense, it also shows in which way information is exchanged and how learning and teaching potentially take place. The cod-

ing scheme helps to identify how social activity takes place in direct or technologically mediated form.

The episodes showed six different communication modes, which are presented from the lowest to highest share in box plot figure 11.3 (the appendix the duration table B.3 and bar chart figure C.3).

Two main highlights can be derived from the classification scheme of the communication modes:

- **Face to face:** This communication mode was mostly observed during the actions conversation-update (8,07%) and listening-asking (6,79%). This leads to the dominant communication level of *social-person*, which typically accounts for 29,02% of an observation per person consisting of two working days. The *virtual* communication mode also proved to be relevant during the conversation update action (4,73%), leading to the social-media communication level (15,98%). This shows the relevance of digital communication channels (e.g. Skype audio/video) between professionals during their daily work.

- **Office-individual:** This communication mode took second place regarding the frequency (29,26%), mostly observed during the information organization action (7,82%), e.g., writing e-mails. This leads to the *individual-medium* communication level, which typically accounts for 21,84% of the total working day of a professional in Germany.

These results show that there is a mixture of social and individual-oriented communication modes at work, with particular emphasis on the interaction between professionals. Face to face has an average share of 40% per person, varying between 20 and 50% which indicates a high variety (the right side in figure 11.3). The second most frequent communication type of office-individual shows the relevance of the individual work in professionals' daily work, which typically takes place between under 20 and over 40%. Additionally, the use of virtual communication channels, such as video conferencing via Skype or other similar tools, shows the relevance in professionals' daily work. This manifests in the use of virtual communication mode, which varies between under 10 and more than 20% share.

These results show that there is a mixture of social and individual modes of communication at work, with particular emphasis on the interaction between professionals. The variance of the communication modes is in general quite high, with a range of more than 20% for the 2nd and 3rd quartil for office individually and face to face (see figure 11.3). This shows that individuals show very different tendencies with respect to the communication modes they use. It is important to consider that this also is highly related to the actual work type. Particularly when interaction with remote locations of external partners and customers is required, the communication, although in the office, has a high tendency to technology-mediated communication. *Face-to-face* communication varies between 20 and almost 50%, indicating a high diversity. The second most common mode of communication of *office-individual* shows the relevance of individual work in the daily work life of professionals, which typically takes place between less than

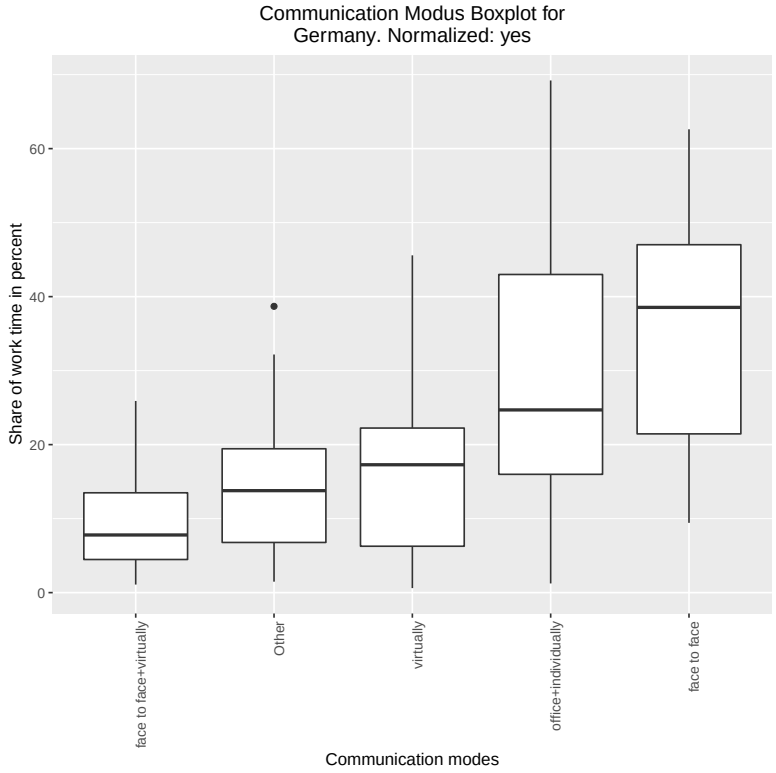

Figure 11.3: Communication Modes during Work of Professionals in Germany – Box plots

20 and over 40%. Besides, the use of virtual communication channels, such as video conferencing via Skype or other similar tools, shows the relevance in the daily work of professionals. This can be seen in the use of the *virtual* communication mode, which is between less than 10 and more than 20% share. This perspective, which underlies the high relevance of interaction-based communication modes, confirms the theoretical expectation of the first research question (TE-RQ1a).

Like for actions and roles, an example is provided here as well to show how the insights reported typically show on an individual level. Study participant id15 (id15/M/GER) helps to better understand this perspective, which consists of the following communication modes: face to face (46,3%), office-individual (23%), virtually (21%), other, e.g., observation break (6,9%), face to face-virtually (2,5%). All these percentages make up a total of two working days of 100%.

Overall, the derived classification schemes of activities, roles, and modes of communication show more socially rather than individually oriented activities within the work process, indicating the embedding of workplace learning activities in them and emphasizing the tacit implicit dimension through the dominance of non-explicit learning activities in work. For this reason, the individual view of the experts addressed by research question 1b must be taken into account. This is described in the following.

11.1.4 Interpretation

To investigate workplace learning of professionals in the work process, a coding scheme was created. The code analysis supported the analysis of learning in the work process.

The theoretical discussion hinted to three learning types: Learning as the application of knowledge, self-directed learning, and problem-solution based learning (see chapter 2). The analysis suggests that learning is deeply embedded in the work process. The identified role distribution supports the earlier mentioned perspective that individuals strive for work execution and generate situations with a learning character. Furthermore, the role analysis shows that many situations have a teaching character and that the participants constantly switch between both roles. Based on the personal experience of the observer, this switching happens very quickly, without the person always thinking about which role is taken over.

The communication analysis shows the relevance of collaboration for the whole work process, especially face-to-face communication. The used activities strongly suggest that learning is an important part of this collaboration, again embedded in work goal-oriented work execution. In contrast, self-directed learning actions with professionals deciding to learn something and explicitly working on realizing the work goal only happened rarely within the data set.

The action, role, communication mode typology does not immediately support the identification of work problems and their solution as a trigger for learning (cf. theoretical discussion in section 3). It is difficult to observe problems, despite rare cases of individuals explicitly highlighting a problem. The personal experience of the observer was that many problems are identified and fixed immediately by applying a solution strategy. People seem to understand problem characteristics and often just know where to look or whom to ask. Only in rare cases, problems in the observation process were highlighted explicitly. In those cases, however, it seemed likely that the participants planned for separate, self-directed learning activities or scheduled specific meetings to investigate the problem further.

The analysis does not make cognitive learning processes visible: meta-cognition, regulation or assimilation and accommodation. Sometimes the participant thinking aloud suggests such processes, but the selected coding scheme is unable to identify these processes by merely observing the way people work. Given the identified integration of work and learning, it is unlikely that a purely observation-based method would be able to separate work and learning. The author of this work is convinced that the separation would be artificial and that it is more important to continue the study of the relationship between work and learning in the work process.

Overall, the analysis supports the insights of workplace learning sketched in the theoretical part of this thesis. Furthermore, it gives insights into the relevance of different aspects and shows some consistency across the general handling of workplace learning across the study participants.

11.2 Workplace Learning Characterization – Self-report Study (RQ1b)

Research questions 1a and 1b have the same goal but apply different approaches. In the following, the characterization of workplace learning is addressed using a different tool set. The previous section used the analysis of coded work process data. This section analyzes workplace learning based on a self-report study. This addresses the research question 1b, aiming at investigating what understanding professionals have of their own workplace learning. The related theoretical expectation TE-RQ1b is that *professionals have an understanding of workplace learning beyond the learning considerations in the work process.*

11.2.1 Approach

To obtain the individual perspective of professionals on workplace learning, data was collected in a self-report study (see chapter 10). The study sample is attached in the appendix, figures A.1, A.2. The approach focuses on Mayring's qualitative content analysis (Mayring, 2004). The self-report consists of 8 demographic data-based questions (e.g., experience, current work profile and work model, education) and an open question: *What does learning in daily work mean to you?*

The individual findings on this open, learner-based question were obtained individually by each professional immediately after completion of the participant observation (= end of the second working day) and later evaluated by means of qualitative content analysis with a focus on type development, the so-called *type construction method* (see chapter 10). The type of construction process concentrates on two essential aspects:

- **Internal homogeneity:** This means that the individual descriptions of learning by professionals must have meaning-based similarities that make it possible to place different findings under one category. Two following statements can be included under the category *interaction with other people*: a) Discussions with colleagues and topic experts (id29/E/GER)[1] and b) Communication with colleagues via e-mail, telephone and direct meetings (id6/E/GER).
- **External heterogeneity:** Individual statements without internal homogeneity are to be distinguished from each other. In this way, different categories can be formed. For example, a statement regarding research and investigation of new technologies (id13/E/GER) can be assigned to the category *use of new technologies*, which differs in its meaning from the category of interaction with other persons described above.

Based on this approach, different perspectives of professionals on workplace learning were collected and evaluated. From this, a classification scheme consisting of the eight main categories was derived, which is described below as an example.

[1] For participant identifier acronyms, see section 10.4.3.

11.2.2 Results

The following illustrates a classification scheme consisting of eight categories based on the individual insights of professionals themselves about what learning means to them in their daily work.

Category 1: Interaction with other people (N=14). This category refers to social interaction between people and thus highlights the relevance of exchanging knowledge and experiences during the work between each other, which leads to collaborative knowledge building (see section 4.5). Interaction plays a highly significant role, not only from the perspective of the work process (RQ1a), but also from the own view of professionals themselves (RQ1b). Examples are: a) Interact with colleagues from other areas, share information, and bring things together into a more comprehensive picture (id27/E/GER); b) Nobody can know everything: Good networking is also the key to learning. Following the motto: Learning from others who know better (id28/E/GER); c) Listening, explaining, exchanging experiences (id17/M/GER); d) Discussions with my colleagues and experts are my main method to learn (id30/M/GER); e) Sometimes asking more knowledgeable experts (id13/E/GER).

Category 2: Exploring/understanding/facing new situations (N=11). This category emphasizes the relevance of curiosity for unknown situations, with regards to the fast-moving knowledge work of professionals in their daily work in organizations (see chapter 2). Examples are: a) Exploring and researching unknown stuff. Instead of "drilling deep holes" it implies "drilling wide holes", requiring very wide knowledge of new stuff (id13/E/GER); b) Quick exploring updates from different teams (id24/E/GER); c) Learning is a crucial part of my daily work, because in my job, I am constantly facing situations that I never faced before and nor did anybody else (id4/M/GER); d) New topics, new people (id16/M/GER), e) Ongoing input of new and unknown facts and artifacts and discussion of new things with colleagues and external business partners (id14/E/GER).

Category 3: Using new technologies (N=3). This aspect emphasizes the relevance of new technologies applied in knowledge-intensive organizations, such as software-based learning by using computers to learn programming techniques for data analysis and statistics (Kabacoff, 2015; Cody and Smith, 2005). Examples from the self-report assigned to this group are a) Learning is essential for me, as new technologies are regularly emerging in my working environment (id11/E/GER); b) Exploring and researching new technologies (id13/E/GER); c) Exploring new things, such as technologies (id24/E/GER). These examples do not describe exactly which technologies have been learned or planned, but indicate their direction.

Category 4: Solution finding/Problem solving (N=4). This category can be broadly defined and understood, such as identifying technical problems internally or externally (e.g., in software tools) or helping colleagues in an inter-personal conflict situation. Examples from the self-report, categorized under this group are: a) Understand the situation, compare it with my experiences and compare it with the problems I am confronted with, translate it into the current situation and close the gaps in order to develop new problem-solving strategies (id4/M/GER); b) Learning helps to find new

ways of solving problems in order to master my daily challenges (id8/M/GER); c) Solving customer problems (id2/E/GER); d) Optimize current processes (e.g. provisioning specific systems for customers): reduce complexity, reduce costs, improve provisioning time; improve current rules (id3/E/GER).

Category 5: Formal, non-formal learning (N=8). This category refers to the learning formats under the guidance of a trainer, *instructional designer* or learning facilitator, e.g., classroom, virtual training or mentoring, coaching programs (see section 8.3). Examples from the data obtained are: a) Internal classroom learning or web lessons; looking at the parallel process in the company in order to learn and use for one's own work (id3/E/GER); b) Medium-term training for new products is essential to maintain my expert status; internal learning opportunities are an important tool to support this (id28/E/GER); c) Doing training within our organization is maybe 5 percent or less (id16/M/GER); d) First online training, including Youtube, internal portal and Wikipedia (id6/E/GER); e) Online video lectures, such as meetup.com (id24/E/GER).

Category 6: Collecting information/Learning on my own/Individual learning (N=6). This category was derived on the basis of professionals individual learning activities during their work with an emphasis on information gathering through different channels. Examples obtained from professionals are a) Individual learning. Difficult technological concepts can usually not be understood by just working in a team (id13/E/GER); b) Feedback received and intended results. For me, learning means collecting this information, evaluating it with the knowledge of past insights and structuring it into a uniform system. This system can refer to business processes for which we develop software, to our software, to my personal behavior, to the customer's company or business processes (id7/E/GER); c) Reading, search information on the Internet (id29/E/GER).

Category 7: Improving skills/getting better/personal development (N=9). This category was derived on the basis of the findings that characterized the willingness and recognition of relevance from the point of view of the professionals to improve themselves (e.g., skills) and thus become better at work. This is related to competence development. Examples of professionals are a) I consider constant learning as essential to the work as a developer or architect in IT. As IT is driven by innovation and a high dynamic environment, where the inability to acquire new knowledge and skills would mean still stand and missing the requirements of the job (id9/E/GER); b) To keep up motivation; to stay curious; getting better in communication; soft skills (id16/M/GER); c) To improve skills and competencies e.g., lean management (id22/M/GER); d) Staying curious and getting better (id23/M/GER); e) Not to rest on existing knowledge, to challenge it and to review it from time to time (id27/E/GER).

Category 8: Informal Learning/Hands-on learning/learning by doing (N=10). This category was derived on the basis of the findings of professionals that learning at the workplace is essentially carried out through situational, need-oriented and mostly informal learning activities. This refers to self-regulated learning, manifesting in the work process as both individual and social activities (see section 4.4). In that context, the implicit-tacit dimension is of high relevance (e.g., individual reflection). Examples from professionals building this category are a) I have to learn myself on a daily basis

about new processes, new technologies. Most of the learning is by doing. This keeps the work very interesting and challenging at the same time, since you can almost never rely on routine processes (id10/E/GER); b) Continuous learning is the major part of my work; there is not much difference between working and learning, the acquisition of knowledge happens automatically in my daily work (id15/E/GER); c) Hands-on experience (id29/E/GER); d) Informal learning is much more important than participation in formal training (id26/E/GER); e) Reflecting retrospectively on the results of finished projects (id24/E/GER); f) To rethink approaches, processes, own perspectives, and behaviors every day to adapt it to newest information (id7/E/GER).

In addition, a ninth category called *other* was derived, which contained various insights and statements from professionals from countries other than Germany. These findings could not be classified into any of the categories described above because they were collected by global professionals, e.g., useful (id50/M/BUL) or confidential (id39/M/US). This will be discussed later in research question 3a (see section 11.4), which focuses on the differences between locations in terms of learning characteristics during work.

To ensure the reliability of the qualitative data described above, all these results were recorded in a document and validated by the professionals themselves.

The results described above, which were obtained by the self-report study and evaluated by qualitative content analysis based on type building, show a variety of ways how professionals understand, experience, and practice their learning activities at work.

11.2.3 Interpretation

The results on research question 1b described above show a variety of individual perspectives on workplace learning. The learning types considered in the theoretical section of this thesis were explicitly mentioned in the self-report study. Examples are self-directed learning and collaborative learning. The self-report study also provides insights into the opinions of knowledge workers about the learning opportunities that their environment offers them. Here some limitations in the existing offers become apparent and, at the same time, seem to be addressed by the individual design of solutions. Cooperation proves to be a highly significant way of learning in the work process.

One limitation of the self-report study is that the actual integration of learning into the daily work is not reported in detail. Possible reasons for this are that the participants consider this to be of little relevance or that they are not aware of how they integrate learning into their daily work.

Overall, the results of research question 1b support the findings of research question 1a. There is no disagreement between both. While 1a provides insights into the shaping of the workday and involved learning, 1b provides information on professionals' personal views on learning at work. Beyond the insights of 1a, here it also showed that people are concerned about the relation between learning and the organization. This includes consideration what type of formal offerings the company provides and whether this fits the individual needs. The collected statements are in-line with the McKinsey study discussed in the introduction of this thesis (cf. section 1.2 and Gryger et al. (2010)). Professionals are concerned that purely formal learning offerings do not meet their learn-

ing needs. Furthermore, professionals seem to be very aware of the necessity of learning and consider a large variety of techniques to address their learning needs.

11.3 Analysis of How Learning is Applied at Work (RQ2)

In this section, the application of learning in the work process is investigated. Every action of a professional at work is an application of something learned, a competence. This competence application itself at the same time stands for a learning process. Treatment of research question 2 – *How is Learning Applied at Work?* – investigates this interplay between competence application and competence development. The applied competences might differ concerning their complexity (for details on competence, see section 7) and stand for a learning process with a learning outcome of different kinds (cf. section 4).

The investigated theory suggests, that *the work process continuously utilizes things learned earlier. Knowledge work is likely to make use of rather complex capabilities learned earlier, such as the ability to analyze, evaluate, or synthesize and train these capabilities (TE-RQ2).* This will be analyzed in detail.

11.3.1 Approach

A similar approach to research question 1a is used to investigate learning applications in the work process (cf. section 11.1). Episodes of the work process are annotated with a coding scheme specifying the type of learning applied in the work process and the learning process. The analysis of learning focuses on collaborative work processes. The reason is that collaboration results in the externalization of the learning process, which supports the analysis. Individual learning remains implicit in the work process. The application of learning in the work process is analyzed for collaborative and individual work episodes.

11.3.2 Coding Scheme

Two coding schemes have been developed to approach research question 2. First, the cognitive level of learning applied in the work process is coded. This is intended to distinguish the complexity of applied learning or competences. Second, the learning processes are analyzed using social dimensions of the co-construction of knowledge in social learning. Both codes together capture the application of learning in work processes. The coding schemes are presented in detail in the following.

Social Modes of Co-construction of Knowledge in Social Learning. The classification of social modes of co-construction of knowledge is used as a coding scheme for learning in the work process. It has been introduced by Weinberger and Fischer (2006) and is presented in section 4.5 of this thesis.

The classification distinguishes different ways of how learning happens in a collaborative setup. Five dimensions are distinguished. In the following, the dimensions are

introduced and discussed. The classification originates from the domain of computer-supported collaborative work. For the domain of work process analysis, the category description is adjusted without changing the meaning. These categories are a) *Externalization*, which stands for distributing information without explicit or implicit reference to previous contributions. One example is a meeting participant distributing information to the other participants; b) *Elicitation*, which is an active request for information to be provided by someone else. An example is asking a colleague for information; c) *Quick consensus building*, which is the acceptance of a peer contribution without any change; d) *Integration-oriented consensus building*, which stands for alignment of different perspectives between different persons without obvious disagreement. An example is status reports that are integrated into an overall picture in a meeting; e) *Conflict-oriented consensus building* happens when the contributions of others are not accepted in a collaborative process, resulting in a discussion. An example is a status report that is not supported by a meeting participant, which leads to a discussion of the different perspectives.

Deriving Social Modes of Co-Construction. To derive social modes of co-construction of knowledge, it is necessary to investigate the situation of collaboration. The action and the role already coded in the context of the research question 1a provide this information. The action specifies behavior, and the role gives the information exchange situation. The following examples show the usage of existing codes to derive social modes of co-construction of knowledge.

Examples. In the following, examples for the application of the coding scheme of the social dimensions of co-construction of knowledge on one observation participant are given. These examples give insights into the observer notes and the decisions underlying the coding process for social dimensions of the co-construction of knowledge. The focus is the morning till noon of a chief expert who is located in Germany (id10/E/GER). During the morning (date: 12/07/2015), the observed person id10 acted in different work episodes and acted in different social modes of co-construction of knowledge. These are described below. Important note: The derivation of the social dimensions of the co-construction of knowledge is based on three previously described categories of actions and roles and communication modes.

After the start of the observation, the observed person id10 attended a telephone conference via Skype regarding a round table related to software hotfixes (09:30-10:00am). During this Skype conference, id10, together with other colleagues who attended this Skype conference, tried to integrate current knowledge into a feasible action plan. For this purpose, the observed person actively participated in this Skype meeting with the following activities: actively listening and asking questions (derived action: listening-asking, derived role: retriever-analyser), giving own status updates (derived action: conversation-feedback, derived role: sharer-explainer) and listening to updates of others (derived action: conversation-update, derived role: retriever-controller), analysing the current status and trying to derive an appropriate action plan (derived action: analyse-dissemination, derived role: decisionproofer-decisionmaker). In parallel, id10 made his own notes (derived action: information organization, derived role: retriever-controller).

Communication mode derived here was social-medium. Due to that, social-dimension of co-construction of knowledge coded here was *integration-oriented consensus building*.

Afterward, the observed person id10 gave tasks to a trainee in person and explained exactly which tasks to be executed and respective timelines (10:00-10:16am). Derived actions are conversation-feedback, and related roles of sharer-explainer and decisionproofer-decisionmaker. Communication mode derived here is social-person. Due to that, the social-mode coded here is *externalization*.

Then (10:16-10:30am) id10 worked individually on the mails and the schedule (derived action: information organization, derived role: controller-organizer) and at the same time, in the presence of the observer, reflected aloud on what id10 was doing (derived action: conversation reflection, derived role: sharer-explainer). Derived communication mode are here individual-observer. Due to that, no social-mode of co-construction of knowledge could be derived here, as no social activity was observed during this episode. Thus, this was coded as *not applicable*.

Accordingly, the observed person id10 had a short phone call, regular daily synch with one colleague (10:30-10:36am). Id10 and the other colleague gave each other information updates (derived action: conversation-update, derived role: sharer-explainer). Id10 tried to get more information about the current status from the colleague by asking questions to understand the current status better to move forward (derived action: listening-asking, derived roles: retriever-analyser and retriever-controller). Communication mode derived here is social-person. On that basis, social-mode of co-construction of knowledge coded here is *quick consensus building*. Accordingly, the observed person id10 had a short phone call, regular daily synchronizations (a short interaction on current topics) with one colleague (10:30-10:36am). Id10 and the other colleague gave each other information updates (derived action: conversation-update, derived role: sharer-explainer). Id10 tried to get more information about the current status from the colleague by asking questions to understand the current status better to move forward (derived action: listening-asking, derived roles: retriever-analyser and retriever-controller). Communication mode derived here is social-person. On that basis, social-mode of co-construction of knowledge coded here is *quick consensus building*.

The four episodes described above show a mixture of social and individual activities during the work of id10. A total of 39 episodes of id10 were distinguished, which were characterized by different social modes of co-construction of knowledge or its non-existence due to individually oriented activities.

Cognitive Levels. The application of earlier learning per work episode is classified in terms of the cognitive level of the applied competence. For this purpose, Bloom's learning objective taxonomy is used (Anderson et al., 2001; Gagne, 1985; Gagne et al., 1992, 2005). The Bloom taxonomy of learning objectives builds on the assumption that learning outcomes are applied on different cognitive levels. The taxonomy has been discussed in this thesis in the context of learning goals (see section 4.2). An interesting aspect of Bloom's work is that he specified verbs that can be used to describe the successful utilization of a learning goal. If the cognitive level of comprehension is reached, the ability to repeat memorized information is given. These verbs can be used to analyze the work episodes in the work process notes already used in research

question 1a. This allows showing successful learning applications on different cognitive levels. In this perspective, the work process is an application of learnings on different cognitive levels. In the following, the cognitive levels are described. Without changing the meaning, the description is aligned to the domain of work processes: 1) *Knowledge*, the successful recall of memorized facts in a work situation; 2) *Comprehension*, the summary of information collected in the work process and their contextualization; 3) *Application*, successful usage of a method, process or algorithm applied in the work process; 4) *Analysis*, the ability to investigate something in the context of the work situation; 5) *Evaluation*, the ability to make judgments about a work situation, according to criteria like quality, effectiveness, efficiency and consistency; 6) *Synthesis*, as solving complex problems through the integration of various things and their recombination in a novel form. This consists of: 1) Hypothesis about a problem; 2) Developing a plan to solve a problem; 3) Creating a solution.

Deriving Cognitive Levels. Basically, the successful application verbs of Bloom are mapped against the work episodes. Since there is no direct mapping between the verbs of Bloom and the actions of knowledge work, but a broader understanding of the situation is needed, the process requires more information. Deriving cognitive levels makes use of all earlier applied codings: 1) Actions; 2) Roles; 3) Communication modes, and in case of collaborative work episodes; 4) Social-dimension of co-construction of knowledge. The actions give the corresponding cognitive levels a general direction. Still, only by taking into account the framing role and the way the interaction is structured it is possible to derive a cognitive level. In the following, examples for the derivation of cognitive levels are given.

Examples. In the following examples for the application of the cognitive levels coding scheme on one observation participant is given. The example gives insights into the observer notes and the decisions underlying the coding process for cognitive levels. The focus is morning till noon of an expert who is located in Israel (id44/E/RA). During the morning (date: 24/08/2016), the observed person id44 acted in different episodes and applied knowledge on various cognitive levels, which are described below. Important note: The derivation of these cognitive levels is based on 4 previously described categories of 1) Actions, 2) Roles, 3) Communication modes and 4) Social-dimension of co-construction of knowledge.

After the official start of the observation, the observed person id44 had a virtual meeting via Skype with other colleagues on issues related to an integration activity on a software product (09:00-10:05am). This call discussed different product-related topics, including technical issues, user interface, resources, communication modes, deployment infrastructure and product delivery. The observed person id44 concentrated and actively participated in the call which was conducted using the Skype software. Id44 and the colleagues updated each other about the current state of knowledge (derived action: conversation-update, derived role: sharer-explainer). During this call, id44 listened to what the colleague was telling her and, in parallel, actively asked various questions to understand the status better and derive possible action items (derived actions: listening-asking and analyse-dissemination, derived roles: sharer-explainer, decisionproofer-decisionmaker). Thus, id44 acted as a relevant contributor in the decision-making pro-

cess to find a suitable solution for the current issue case. As she stated: "I am trying to find the right people for the right topics". Id44 also reflected loud to the colleagues: "I am thinking about what is possible to do and what makes sense to do" (derived action: conversation-reflexion). During the call, id44 made hand-notes to fix the discussed status (derived action: information organization, derived role: retriever-controller). Based on the coded actions (see above), roles (see above), modes of communication (social-medial) and the resulting social dimension of co-construction of knowledge (integration-oriented consensus building) coded in the previous phases, the cognitive level coded here was *synthesis*. Synthesis as the highest cognitive containing all other levels (e.g., analysis, comprehension, evaluation and other) was identified during this issue-oriented conversation.

Afterward, the observed person id44 called one colleague via Skype to get required information about the software architecture used in a project (10:05-10:10am). Id44 asked the colleague about the status to be able to understand it better. In that case, a) derived actions were listening-asking and expert search, b) derived related roles were retriever-analyser and retriever-controller. The communication mode was here social-medium, and the resulting social-dimension of co-construction of knowledge was in this case, elicitation. On that basis, the cognitive level coded here was *analysis*.

Then (10:10-10:30am), the observed person was individually working on mails (reading and writing) and scheduled entries. In this episode, a) derived actions were information organization and authoring-co-authoring and b) derived roles were controller-organizer and retriever-controller. Accordingly, the coded communication mode was individual-medium and the social-mode of co-construction of knowledge could not be derived here because the id44 did not have any interaction with others (during this episode). Building on this, the coded cognitive level here was *application*.

These three episodes briefly described above show that the application of the cognitive levels is different, which depends directly on the concrete situation and the related actions of the persons. A total of 73 episodes could be identified during the observation of id44, which include the corresponding cognitive levels.

11.3.3 Results

The research question 2 is: *How is learning applied at work?* This aims to investigate the relationship between the application of learned competence in the work process and the learning processes resulting from the work process. The theoretical expectation based on this (TE-RQ2) is that *the work process continuously utilizes things learned earlier. Knowledge work is likely to make use of rather complex capabilities learned earlier, like the ability to analyze, evaluate or synthesize and train these capabilities.*

The coding scheme for social dimensions of co-construction of knowledge and cognitive levels was applied to the work episode data already used for research question 1a. In the following, the share of times for the codes is analyzed using tables, bar charts, and box plots. It will show that collaborative knowledge building is the most frequent type of knowledge building. When it comes to learning applications, the assumption that

Social Modes of Co-construction of Knowledge in Social Learning	**Actions**	**Role**	**Communication Mode/Level**
Not applicable (35,45%)	information-organization (9,51%), conversation-reflexion (6,02%), information search-reading web (4,25%)	retriever.controller (8,31%), controller.organizer (6,90%), retriever.linker (6,28%)	individual-medium (21,80%), individual-observer (7,78%), social-individual (4,91%)
Integration-oriented consensus building (24,77%)	conversation-update (7,13%), analyze-dissemination (6,76%), listening-asking (6,69%)	sharer-explainer (7,84%), retriever-controller (6,71%), retriever-analyzer (6,58%)	social-person (15,98%), social-medium (10,71%), social-individual (0,39%)
Externalization (11,16%)	conversation.update (3,16%), conversation.feedback (2,11%), conversation.reflexion (1,98%)	sharer-explainer (3,96%), linker-networker (1,56%), retriever-analyzer (1,54%)	social-person (8,27%), social-medium (2,38%), social-individual (0,21%)
Elicitation (5,58%)	listening-asking (1,58%), expert search (1,17%), conversation-update (1,11%)	retriever-analyzer (1,22%), sharer-explainer (1,19%), retriever-controller (1,19%)	social-person (3,17%), social-medium (2,09%), social-individual (0,13%)
Quick Consensus Building (1,67%)	conversation-update (0,48%), conversation-feedback (0,28%), listening-asking (0,20%)	sharer-explainer (0,47%), retriever-controller (0,33%), controller-organizer (0,29%)	social-person (1,26%), social-medium (0,32%), social-individual (0,03%)
Conflict-oriented Consensus Building (0,85%)	conversation-update (0,32%), listening-asking (0,32%), analyze-dissemination (0,25%)	sharer-explainer (0,31%), retriever-controller (0,26%), retriever-analyzer (0,24%)	social-medium (0,50%), social-person (0,35%)

Table 11.3: Coding Scheme of Social Modes of Co-construction of Knowledge in Social Learning

rather complex capabilities are used does not hold. In contrast, pure application is very dominant. These aspects are detailed out in the following analysis.

1) Classification of Social dimensions of Co-construction of Knowledge in Social Learning. The most frequent modes are integration-oriented knowledge building (24%) and externalization (11%). Elicitation only took 5% of the time, quick consensus building and conflict-oriented consensus building less than 2% each. This is visible in box plot 11.4 (see also in the appendix duration table B.4 and bar chart figure C.4).

The classification scheme for social modes of the co-construction of knowledge in social learning was derived based on the classification schemes of actions, roles and levels of communication described above. These relations are visualized in table 11.3, which shows the actions, roles and communication modes resulting in the respective coding. The process of deriving integration-oriented consensus building for examples especially used a) action of conversation-update (7,13%), b) role of sharer-explainer (7,84%) and c) communication level social-person (15,98%).

Overall, the used modes have a high standard deviation, with 50% of all observations using between 18 and 41% of time for integration-oriented consensus building.

The reported time differences for the modes result not only from the different relevance but also from the typical duration. Elicitation should typically take less time than a complex discussion. Therefore these differences are not taken into account too much. The general relevance of integration-oriented consensus building still underlines the importance of this mode, especially in contrast to conflict-oriented consensus building, which occurred only very rarely.

Overall, it can be stated that learning that takes place in a collaborative situation typically takes place in the context of complex, solution-oriented interactions.

It is also noteworthy that 35,45% of all episodes were not considered in this analysis, as they contained individual work, mainly resulting from a) action of information organization (9,51%), b) role of retriever-controller (8,31%) and c) communication level of individual-medium (21,80%).

The reported results are exemplified in the following using one participant (id15/ M/GER). The mixture of individual and social-collaborative oriented actions shows a particular emphasis on interaction. This includes: a) Individual work without interaction with other people termed as *not applicable* (39,3%), b) Integration-oriented consensus building (25,6%), c) Elicitation (16,9%), d) Other (9,8%), e) Externalization (7,4%), f) Quick consensus building (1%). Building on this, it is important to stress that the social mode of integration-oriented consensus building serves as *integrator* of all other social modes, such as externalization, elicitation, quick consensus building. This example shows a typical distribution in a concrete case.

2) Cognitive Levels. The most frequent cognitive levels observed in the work process are application (29%) and synthesis (18%). The respective shares are listed in the box plot 11.5 (see the appendix for duration table B.5 and bar chart figure C.5). Comprehension and evaluation are relevant as well, with time shares around 15%, while analysis and knowledge are irrelevant (less than 4%).

The cognitive levels most frequently observed in the work process are considered in more detail as follows:

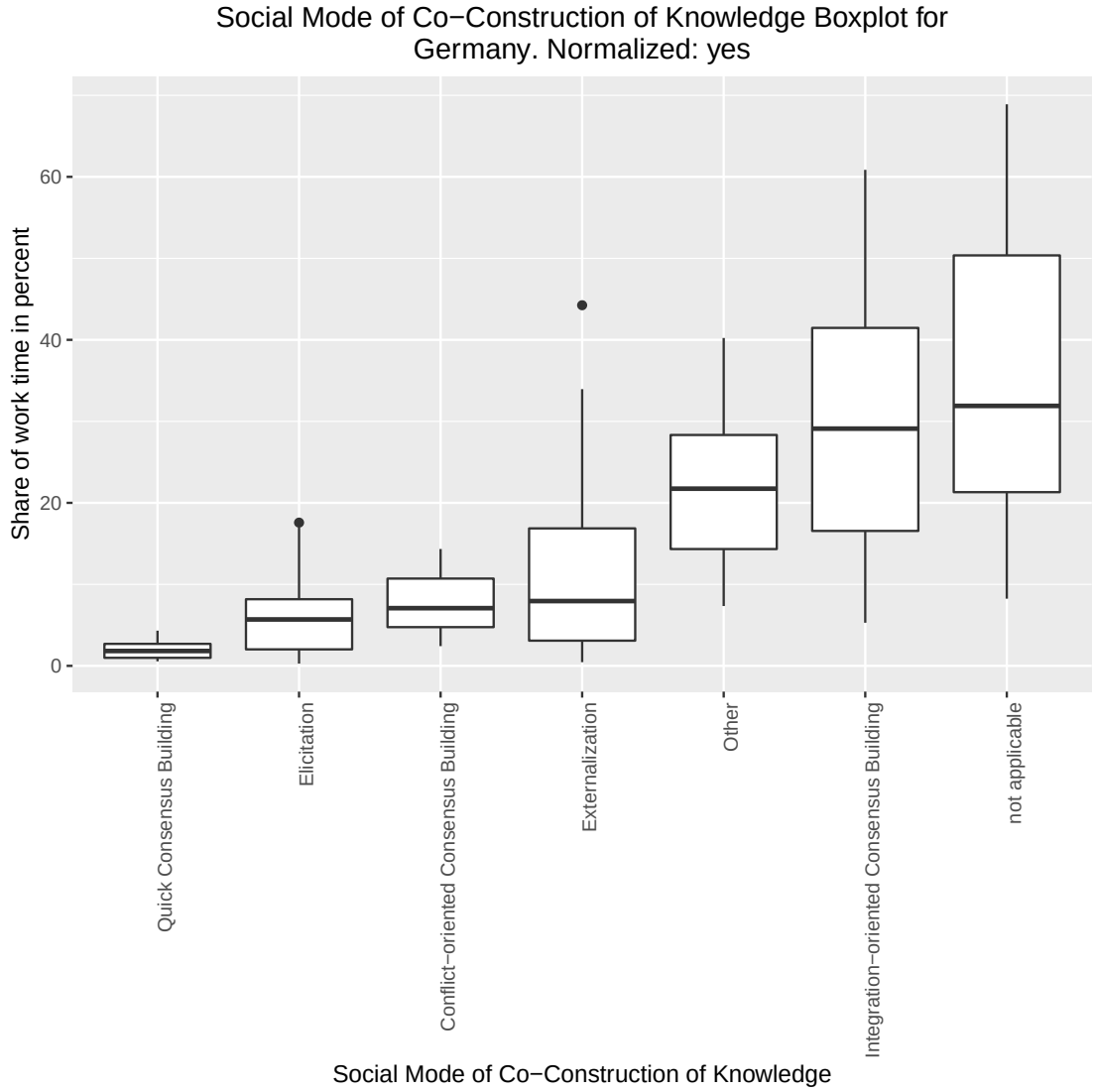

Figure 11.4: Social Dimensions of Co-construction of Knowledge in Social Learning – Box plots

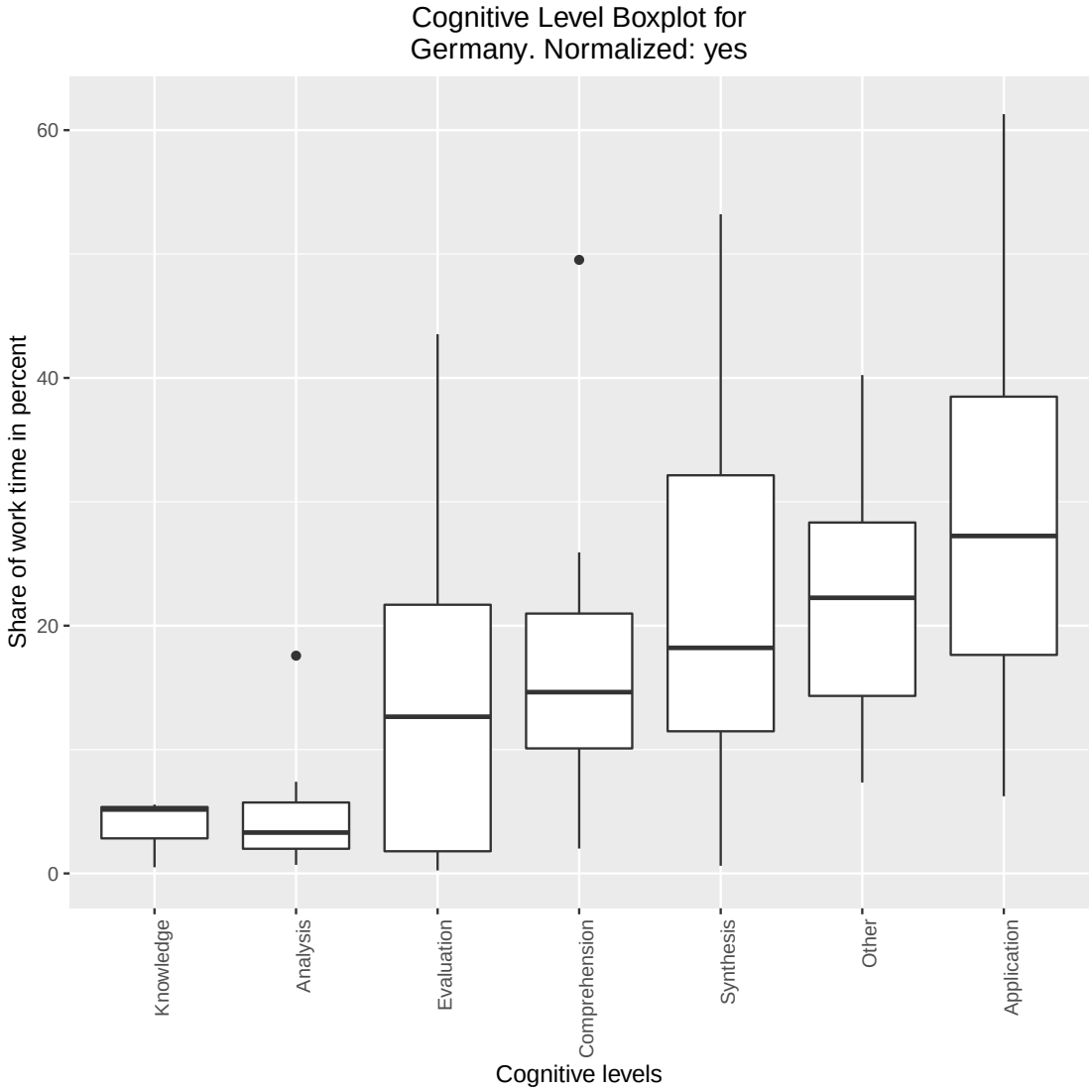

Figure 11.5: Cognitive Levels – Box plots

- **Application** (29,07%), often occurs for an individual work situation. An analysis of the cross table 11.4 shows that it typically results from: a) Action of information-organization (9,24%), b) Role of retriever-controller (7,93%), c) Communication level of individual-medium (21,76%), d) Social mode of *not applicable* (27.29%), indicating that due to the focused individual work no social mode could be derived.

- **Synthesis** (18,07%), which serves as the highest cognitive level and stands for a mixture of all other cognitive levels in it, such as evaluation, analysis or comprehension. This typically takes a share between 19 and 31%. This was derived based on the highest frequency of a) action of listening-asking (5,15%), b) role of sharer-explainer (5,59%), c) communication level of the social-person (10,87%) and additionally d) social mode of integration-oriented consensus building (17,41%).

The box plot shows that the all levels have very different shares (cf. figure 11.5).

The results can be made more understandable with the help of the following example of one of the observed professionals (id15/M/GER), which includes the following distribution: Application (38,9%), Comprehension (16,3%), Synthesis (14%), Evaluation (14%), other (9,8%), Analysis (7%).

Thus, a combination of very high and less high cognitive levels could be observed, manifesting in a mixture of individual and social-collaborative activities during work. This insight differs from the original assumption that high cognitive levels dominate the work process. Rather, many work episodes are controlled by the use of rather simple learning activities.

11.3.4 Interpretation

The analysis of learning in terms of social modes of co-construction of knowledge and learning application in terms of cognitive levels has provided important insights into the relationship between the two. Synthesis, as advanced cognitive level and integration-oriented consensus building, often happened in the same work episodes. In contrast, application as the less advanced cognitive level was mainly observed for non-social activities, typically happening in the context of the organization of information objects during individual work, taking a large share of time.

A core outcome of the analysis is the relationship between what people are doing (actions, taken roles), the involved cognitive levels and the social-modes of co-construction (cf. table 11.4 and table 11.3). Based on these relationships insights into the learning at work are enabled. The identified share of cognitive levels is as follows: Application (29%), synthesis (18%), comprehension (15%), evaluation (13%), analysis (3%) and knowledge with only 0.3% [2]. This shows that the learning which occurs during work has mixed cognitive complexity. On the one hand, the more basic type of application and comprehension together take roughly 45% of the workday. On the other hand, synthesis and evaluation take 21%. It is also interesting, that knowledge as the most basic form of learning happens extremely rarely.

[2]The remaining percentage are other activities which were not tracked.

Cognitive Level (derivates)	Action (focus)	Role (supporting action)	Communication Level (way to transfer action/role)	Social Dimension of Co-construction of knowledge in social learning (interaction types)
Application (29,07%)	information-organization (9,24%), information search-reading web (4,18%), authoring-co-authoring (3,53%)	retriever-controller (7,93%), controller-organizer (6,48%), retriever-analyzer (5,95%)	individual-medium (21,76%), social-individual (5,05%), social-person (0,88%)	not applicable (27,29%) elicitation (1,54%), externalization (0,23%)
Synthesis (18,07%)	listening-asking (5,15%), conversation-update (4,97%), analyze-dissemination (4,32%)	sharer-explainer (5,59%), retriever-controller (4,91%), retriever-analyzer (4,67%)	social-person (10,87%), social-medium (8,34%), social-individual (0,39%)	integration−oriented consensus building (17,41%), quick consensus building (0,28%), elicitation (0,27%)
Comprehension (15,45%)	conversation-reflexion (4,81%), conversation-update (2,83%), listening.asking (1,23%)	sharer-explainer (5,40%), retriever-controller (1,72%), retriever-linker (1,70%)	individual-observer (7,19%), social-person (6,62%), social-medium (0,8%)	not applicable (7,68%), externalization (6,50%), quick consensus building (0,77%)
Evaluation (13,04)	conversation-feedback (3,77%), analyze-dissemination (3,64%), conversation-update (3,46%)	sharer-explainer (4,31%), retriever-analyzer (3,04%), controller-organizer (1,40%)	social-person (8,59%), social-medium (4,83%), individual-observer (0,23%)	integration−oriented consensus building of (7,14%), externalization (4,18%) conflict−oriented consensus building (4,18%)
Analysis (3,35%)	listening-asking (1,12%), conversation-update (0,77%), expert-search (0,73%)	retriever-controller (0,79%), sharer-explainer (0,72%), retriever-analyzer (0,64%)	social-person (1,90%), social-medium (1,32%)	elicitation (3.19%), conflict−oriented consensus building (0,15%)

Table 11.4: Derived Coding Scheme of Cognitive Levels

Investigating application and comprehension further, it shows that both typically happen as individual activities. During the observation, these were more the repetitive tasks. This includes organizational activities like maintaining Excel sheets, interacting with enterprise software or organizing information. In this thesis, different types of learning in the workplace have been distinguished: the learning by repetition and learning based on acknowledged tensions (cf. chapter 3). Application and comprehension activities can be attributed to the learning by repetition. Application typically happens individually in retriever or controller roles. Comprehension in a mixed form, sometimes individually sometimes in a social setup. In contrast, synthesis and analysis almost exclusively happen in social interactions. Most notably, the social interaction is in both cases mainly integration—oriented consensus building. This complex form of learning in social interaction (cf. section 4.5) hints to complex interactions between the learners to come to a conclusion.

To conclude, it shows that learning with a high cognitive complexity typically presents itself as a collaborative activity and takes a significant share of the knowledge workers' workday. Tensions especially emerge in interaction with others and are addressed in these interactions.

11.4 Workplace Learning Differences – Comparing Locations (RQ3a)

The following two sections investigate factors influencing workplace learning. The analysis of workplace learning (research questions 1a and 1b) and of the relation between learning in the work process and application of learning in the work process (research question 2) analyzed cases and distributions across different codes applied to work episodes of professionals. The applied codes are: actions, roles, communication modes, social-modes of co-construction of knowledge and cognitive levels. The distribution and case analysis made it possible to derive various insights into the work process. While the investigated cases contained only a few explicit outliers, the distributions show differences between the cases. One example is that the share of time spent with certain actions differed in some cases, notably. There were participants, who spent 10% of the recorded workday with information organization, while others spent 20% of the time with it. These differences can also be attributed to the method of data collection, which only collects two-day snapshots. In this case, it is always possible to record only one working day, which is structured differently – the collection of a number of cases is intended to counteract this.

The idea for the following two sections is that individual, job-related, or environmental factors result in developing very different types of workplace learning. In this case, the collected data set analyzed in the previous sections can be a melting pot of very different types of workplace learning. This does not negate the conducted analysis. The analysis is capable of showing broad trends, but the subtle differences are leveled out. The following two sections focus on two characteristics of workplace learning which are typically used by human resources to organize learning content and manage staff: job type and work profile. The characteristics have been chosen in this thesis because they

have a strong influence on the work of an individual. Job type and location influence not only what type of knowledge work someone is doing, but also with whom interaction takes place, which tools are available, where to work. In other words, they have a very strong influence on the work of professionals. These characteristics are used in two comparative studies.

The analysis will show differences in the work process and workplace learning based on location and job type. This indicates the existence of factors that result in different types of workplace learning. Such a type of workplace learning is supported by a number of people and in active development in this group. Whenever a new member joins the group, there will be a new process of aligning the perspective of the individual with the group. This process can be interpreted from a cultural perspective. The different types of workplace learning which exist can be understood as different work and learning cultures which exist in a company. The necessary foundation for this perspective is provided in chapter 5, which specifies culture and discusses the concept of a learning culture.

This section focuses on the question of whether and how the learning activities of working people differ due to the different locations where they live and work.

The third research question (RQ3a) is: *Are there workplace learning differences in the daily work of professionals working in Germany and globally?*

The associated theoretical expectation (TE-RQ3a) is that *there are workplace learning differences in the daily work of professionals working in Germany and globally.*

To address these, two groups are compared: Professionals working in a globally operating company with work location in a) Germany (N=30) and b) global, i.e., countries other than Germany of the same company (N=20) consisting of China, India, USA, Israel and Bulgaria.

11.4.1 Approach

The comparative cultural study is an appropriate method to investigate differences based on selected factors. Based on coding and analysis done for research question 1, the comparative study is conducted. The differences in the applied codes of action, role, and communication modes are compared based on the selected factor of location. Location is interpreted as a country of residence. This follows the assumption that local work practices and local communities of practice are more dominant than the original place of birth and the original education system.

The investigation is enriched based on qualitative data collected in the field notes of the observer. This provides an additional perspective towards the reported and discussed numbers, sometimes just providing context, in some cases also questioning the pure quantification-based reasoning.

An analysis of the codes social-modes of co-construction of knowledge and cognitive levels was performed, but with inconclusive results. Therefore it is not reported in the following.

For the comparative analysis of workplace learning for different locations, the following two groups are considered: a) Germany (N=30) and b) Globally (N=20) i.e., locations other than Germany. This second group of globally distributed professionals consists

of 5 countries, namely Bulgaria (N=4), China (N=4), India (N=3), Israel (N=4), USA (N=6). The integration of all non-German locations is primarily aimed at investigating whether there is any difference at all. Furthermore, the investigation will be of interest as Germany is the location of the headquarters of the company under consideration, and the study will show that this influences the learning culture based on the relationship between the locations and implements control strategies that are not specified but exist on a subtle level.

The analysis is structured in the following way:

- **Comparing workplace learning characterization – Work process observation.** The data used here consists of the categories a) actions (Group1-a), b) roles (Group1-b) and c) communication modes (Group1-c). An analysis focusing on these groups refers to the goal of research question 1a, the identification of workplace learning characteristics of professionals. Building on this, the goal here is to determine whether there are differences in the workplace learning characteristics due to the locations where professionals work.

- **Comparing workplace learning characterization – Self-report study.** The data used here refers to the categories which were derived in the self-report study (see section 11.2). The goal here is to determine whether there are differences in the eight categories identified as the individual understanding of workplace learning with regards to the locations where professionals work.

The average and standard deviation were calculated from the categories of the coding schemes of Group 1 and Group 3 to be able to read and interpret the data appropriately. This calculation was not possible for group 2 due to the qualitative data type of self-report study. The participants themselves, therefore, gave the validity of the data, i.e., each statement was written and confirmed by each professional. Building on this, statements were filtered based on the location, to enable the comparison of professionals in Germany and globally – concerning the content-based derived category (see section 11.2).

11.4.2 Results

Research question 3a is: *Are there workplace learning differences in the daily work of professionals working in Germany and globally?* The results of a comparative study of data collected for professionals located in Germany and professionals in different global locations are presented in the following.

Comparing Workplace Learning Characterization – Work Process Observation. Actions: Germany (N=30) vs. Global (N=20. Two main findings are described below.

Social versus Individual. Concerning the various activities (see table 11.5), there are differences between the professionals working in Germany and working globally (see figure 11.6). During the observation phase, the researcher established the feeling that individual work was observed more frequently in Germany than in the other locations.

Meetings were different; the ad-hoc way of interaction was lived differently. It was not that collaboration vanished, but it emerged differently. Short conversations could have a more friendly and supportive or more demanding character.

From a quantitative perspective, the shares of individual actions show no real difference, e.g., actions such as information organization were observed slightly more often globally (18,82%) than in Germany (16,49%), but this difference is likely data related. Similar conversation-oriented actions, such as conversation-update, listening-asking, conversation-reflexion, and conversation-feedback could be observed slightly more often in Germany than in other global locations. Still, the difference between these two groups is marginal, varying between 2 and 1,5%. Based on memos and field notes, it cannot be said that professionals globally have deliberately less communication and prefer to work more individually. Inspecting the researcher's feeling with the data another aspect became obvious. The difference in work was more based on the direct work tasks that professionals have to perform and their position in the overall organizational hierarchy. The actual work focus of the professionals' tasks (e.g., concrete projects) and the *chain of control* in which they are embedded determines the way they work and also influences the associated learning at work. Furthermore, the researcher considers it likely that this lived way of working develops a culture that is then shared in certain locations. From this point of view, locations which have people who are in different relationships to the headquarters than others (lead positions) have different work tasks than others and will establish their own perspective on collaboration which might still be very similar in a classification scheme to the one applied here. It is, therefore, not an ethnocentric perspective, but could rather be based on control and hierarchical structures that influence the individual. The location of the company, such as the headquarters or satellite location, could also influence the understanding and outcomes in determining a different type of interaction. As a consequence, there are qualitative differences in the way people interact and, consequently, in the learning culture, they build. According to Billett (see section 4), work in learning and learning in work cannot be separated from each other. Location and goals can create communities that establish an understanding of interaction that is different from other parts of the organization. The investigation shows that the close integration of learning and working applies between the compared locations. Moreover, the reported figures even show close similarity in the action shares. Nevertheless, how learning is perceived and carried out varies and is highly dependent, autonomous, and self-regulated.

Trust versus Mistrust. Another interesting aspect is that the category *other* which basically included *observation break* was observed much more frequently in locations other than Germany. It is worth mentioning that the researcher is also based in Germany, this was experienced at the locations as an outsider who was "sent to investigate them" (participant quote). Concerning memos and field notes, this tendency leads to the assumption that the observed professionals have uncertainty or lack of confidence in the relationship between researcher-observer. On the other hand, the few observed breaks in observation indicate that professionals in Germany have more trust and are more open towards the researcher-observer. This leads to the very relevant aspect of trust. Local professionals need local trainers from learning units who can build up trust with local

Action	Avg Germany (%)	Avg Global (%)	Std Global
information organization	16,49	18,82	0,98
conversation + update	15,68	12,98	0,84
listening + asking	12,04	9,22	2,76
conversation + reflexion	11,52	10,45	2,34
analyze + dissemination	10,82	12,17	2,66
other (e.g. observation break, lunch)	9,95	16,04	3,73
conversation + feedback	9,46	6,87	3,14
information search + reading web	4,57	6,25	3,82
authoring + coauthoring	4,05	3,51	2,39
expert search	2,08	0,32	0,31
monitoring + controlling	1,71	3,36	2,72
information search + reading print	0,79	0,02	-
information search + reading web and print	0,27	0,03	0,03

Table 11.5: Comparison of Actions: Germany vs Global

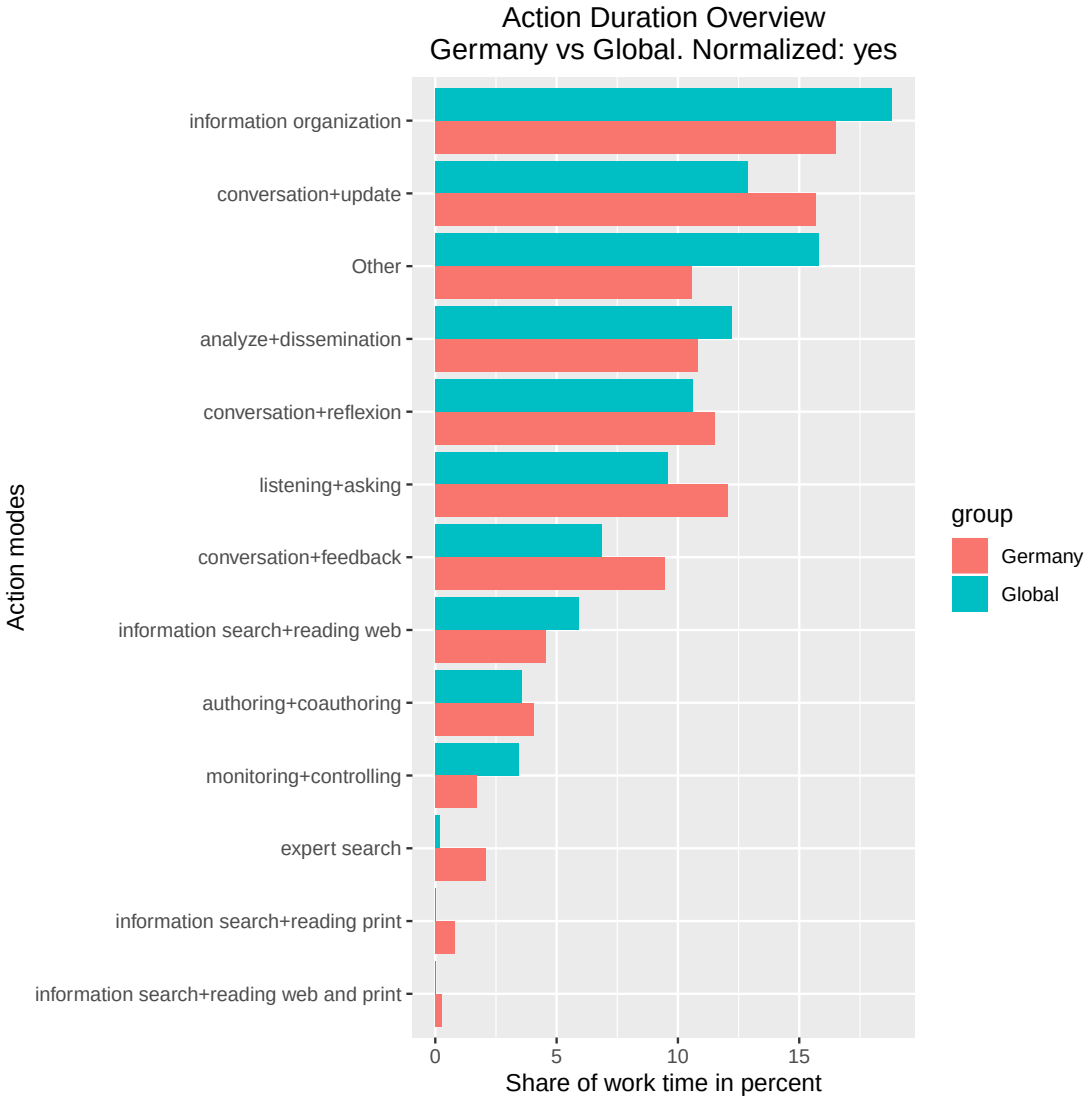

Figure 11.6: Actions: Germany vs Global

professionals, and thus to find out more about their local learning needs to integrate these needs into appropriate learning offerings.

Comparing Workplace Learning Characterization – Work Process Observation. Roles: Germany (N=30) vs. Global (N=20. There were different categories observed by the professionals in Germany and other global locations, which show some differences (see table 11.6 and figure 11.7). Based on this, two main findings could be derived, which are described in the following.

Linker versus Retriever: The following relevant differences could be derived in relation to the workplace learning roles of professionals in their work processes. The role of the *retriever-linker* could be observed much more frequently by professionals working in Germany (11,85%) than by professionals working globally (5,96%). A parallel to this is the role of the *retriever-controller*, which could be observed more frequently by the global professionals (24,17%) than by the professionals working in Germany (18,88%). This leads to a very relevant assumption which can be described as follows: *Retriever* as role stands for data acquisition in different forms, but both roles of *linker* and *controller* have two completely different meanings behind them. The linker as someone who collects information for personal development is associated with intrinsic motivation and curiosity, e.g., when professionals learn a new programming language only out of individual interest and not because it is directly needed for his work. In contrast, the role of the *controller* is related to the achievement of goals, which combines both individual and organizational goals (e.g., performance). Concerning memos and field notes, this assumption can be associated in particular with the thought of a professional observed in a global country who claimed that he only learns what he needs for his job. This points to the role of the controller. Thus, intrinsic and extrinsic motivational aspects seem to be different in the learning of professionals who work in different locations.

Comparing Workplace Learning Characterization – Work Process Observation. Communication Modes: Germany (N=30) vs. Global (N=20. There were different communication modes that were derived in the daily work processes of the professionals (see figure 11.8 and table table B.6 in the appendix). Building on this, the following key finding can be derived.

	Avg Germany (%)	**Avg Global (%)**	**Std Global**
sharer + explainer	21,96	19,29	1,88
retriever + controller	18,88	24,17	4,18
retriever + analyzer	16,15	16,99	3,43
controller + organizer	13,05	15,85	2,42
retriever + linker	11,85	5,96	2,12
decisionproofer + decisionmaker	7,08	5,54	2,35
other (e.g. observation break)	5,39	10,92	2,70
linker + networker	3,67	1,82	0,78
retriever + solver	1,95	1,53	0,66

Table 11.6: Comparison of Roles: Germany vs Global

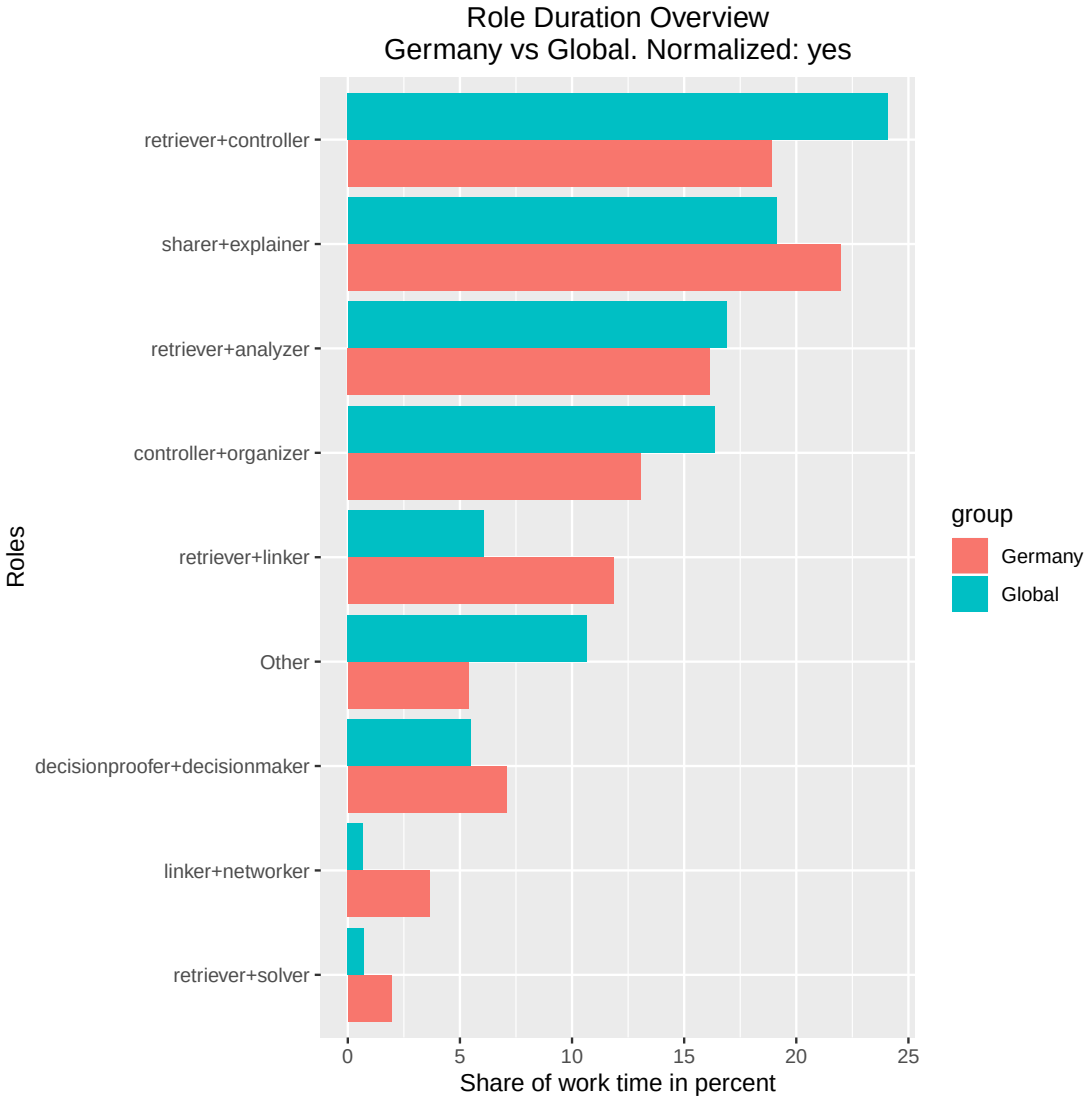

Figure 11.7: Roles: Germany vs Global

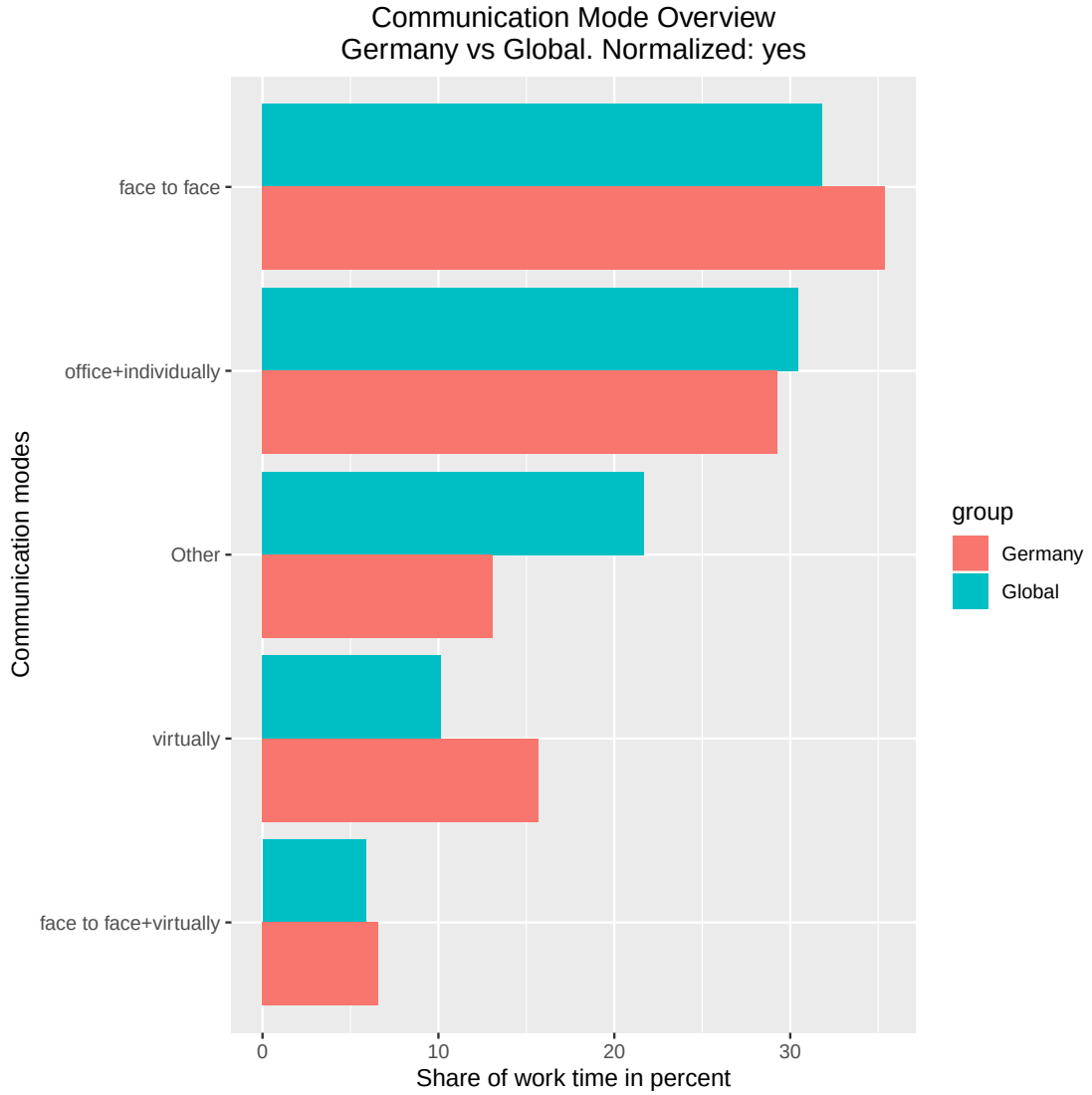

Figure 11.8: Communication Modes: Germany vs Global

Personal versus Digital. In daily work, professionals very often work together in work groups to achieve their work-related goals. The way of communication has different modes, such as two common types of them – personal so-called face to face (e.g., discussion) and digital called virtual (e.g., chat, Skype call), which were very often observed both in Germany and in other countries of the world. Both modes (face to face and digital) indicate the social-collaborative focus. In parallel, the communication mode of office individuals has remained in second place after the frequency – but with a marginal difference. This shows the relevance of both: 1) personal and digital mode of communication with an emphasis on professionals' collaboration with each other supported by various communication channels, tools; 2) individual work with an emphasis on concentrated working in the own offices. Both modes are relevant and are used in the daily work of the professional – in Germany and globally. Most noteworthy, the headquarters and the other global locations heavily interact which automatically results in a high relevance of technology-mediated interaction. This also might be considered a breaking factor when it comes to transferring cultural aspects. It is an idea of the researcher that control structures might be more easily transferred using mediated interaction, while something like a learning culture is much harder to share using mediated communication.

Comparing Workplace Learning Characterization – Self-report Study. Research question 1b (see section 11.2) targeted: *What understanding do professionals have of their own learning while working in the current company?* Based on the insights gained on this question, 8 categories were derived, which include statements of professionals from different countries, e.g., "learning means knowing something new you didn't know yesterday" (id35/E/IN). Based on these derived category groups, the following key findings can be derived.

Category 1: Interaction with other people (N=7: Experts=2, Managers=5). This data is based on: USA=3/M, China=1/M, India=1/E, Bulgaria=1/M, Israel=1/E. Examples for the category 1 are: The exchange of information, including discussion and brainstorming, helps you update yourself and others (id36/E/IN); On the job learning, learning by doing, with an emphasis on interaction (id45/E/ISR); To exchange the knowledge with each other, share best practices with each other, and build networks with each other (id32/M/CN); Interact with colleagues by listening and asking questions (id38/M/US); Learn through discussions with other colleagues about what they do/how their product works (id40/M/US); Talking to colleagues (id42/M/US); Active listening, asking questions, participating in group exchanges (id49/M/BUL). *In comparison to Germany (category 1)*, there were no major differences that would show relevant aspects that would distinguish the two groups.

Category 2: Exploring/understanding/facing new situations (N=7: Experts =4, Managers=3). This data is based on: USA =3, Israel=2, India=1, China=1, Bulgaria=0. Examples are: Learning means knowing something new you didn't know yesterday (id35/E/IN); Learning means to get to know something new (id41/E/US); Learning new things, not necessarily from books, but from new experiences (id44/E/ISR); Learning means working with people and experimenting in different topics and areas (id47/E/ISR); Be curious of what's going on and how we can collaborate and co-innovate, and the most important how we can change something (id32/M/CN); Challenge. Dis-

covery. Keep interested. Exciting (id42/M/US); That I know something new at the end of the day, that I did not know when the day started. This can be related to network/people, processes, functionality, technology (id43/M/US). *In comparison to Germany (category 2)*, there were no major differences that would show relevant aspects that would distinguish the two groups.

Category 3: Using new technologies. This category contains only the data of professionals in Germany. In other words: *In countries other than Germany this category could not be observed and derived.*

Category 4: Solution finding/problem solving. This category contains only the data of professionals in Germany. In other words: *In countries other than Germany this category could not be observed and derived.*

Category 5: Formal, non-formal learning (N=6: Experts=3, Managers=3). This data is based on USA (N=4) and Israel (N=2), China=0, India=0, Bulgaria=0. Examples are: To actively seek something via training class (id41/E/US); Practical training, classroom training. Feedback through training is an essential component, type of evidence of skills and competencies is required. Follow-up trainings are very useful (esp. online) – they are actively integrated into the process. Mentoring is also important and helpful (id45/E/ISR); Official Trainings, such as mandatory trainings (virtually and face to face) incl. Soft Skills (e.g., communication, management) (id47/E/ISR); Participating at the conferences e.g., Hadoop Spark Summit (id38/M/US); Formal learning in the classroom (id40/M/US); Classroom training, info sessions (id42/M/US). *In comparison to Germany (category 5)*, there were no major differences that would show relevant aspects that would distinguish the two groups.

Category 6: Collecting information/learning on my own/individual learning (N=5: Experts=3, Managers=2). This data is based on USA (N=3) and Israel (N=2), China=0, India =0, Bulgaria=0. Examples are: Reading, watching material (id41/E/US); Reading different documentation, project documents, e.g., presentations and various sessions (id38/M/US); Learning via reading research websites/wiki (id40/M/US); Learning on my own individually (id45/E/ISR); To have capabilities to learn by yourself (id46/E/ISR). *In comparison to Germany (category 6)*, the following relevant aspect could be derived which distinguishes both groups of Germany and Globally meaningfully. This category of information collection by professionals working in Germany is usually associated with feedback that indicates more social than individual tendencies. In contrast to that, professionals working in other global countries associate the collection of information with reading something or watching videos that indicate a more individual than social-oriented action.

Category 7: Improving skills/getting better/personal development (N=4, Expert=3, Manager=1). This data is based on Israel=3 and USA=1, China=0, Bulgaria=0, India=0. Examples are: Development of my skills in many directions (id44/E/ISR); Success and promotion of myself, it is the way to growth (id46/E/ISR); Improving soft skills, e.g., communication, management (id47/E/ISR); Personal development (id42/M/US). *In comparison to Germany (category 7)*, there were no major differences that would show relevant aspects that would distinguish the two groups.

Category 8: Informal learning/hands-on learning/learning by doing (N=4, Experts=2, Managers=2). This data is based on USA=2 and Israel=2, China=0, India=0, Bulgaria=0. Examples are: Learning by shadowing others (id45/E/ISR); Learning also means experimenting in different topics and areas (id47/E/ISR); Working on different projects (id38/M/US); Via observation on how people interact, present their ideas (id40/M/US). *In comparison to Germany (category 8)*, the following relevant aspect could be derived which distinguishes both groups of Germany and Globally meaningfully. Professionals working in Germany combine informal, experience-oriented learning with practical implementation, continuous learning, reflection and rethinking. This leads to a self- and person-oriented orientation. Professionals from other countries than Germany associate informal learning with the observation of their colleagues or experiment with new, different topics that are objectively results-oriented.

Category 9: Other (e.g., reflexion, challenges). N=2, Israel=1 and USA=1. Examples: Learning is what makes me happy and satisfied at work. If I'm in a place where I don't learn or feel challenged, then I'm not happy (id44/E/ISR); Confidence: When I don't know something or am new to something, I have some anxiety, worry, maybe feel more shy about it – what if I can't do this task? As I learn, I feel more confident (id39/M/US). *In comparison to Germany (category 9)*, This category could only be derived from the global experts, with an emphasis on high self-reflection (e.g., self-confidence) and a broad global perspective (e.g. be useful).

11.4.3 Interpretation

Based on the findings on the workplace learning differences of professionals working in Germany and other global locations, the following assumption should be reflected.

The way professionals learn, i.e., their workplace learning in their work, might be a cultural thing. Professional learning might be heavily influenced by the relation between the work location and the company as a whole. Especially control relationships and disconnection of the workforce from the people they work for, their mental leads may have an influence on establishing a culture. This is also strongly related to the work tasks, and even in knowledge, work falls back to the experience of autonomy by individuals. Thus, very different learning cultures might establish, which from the outside perspective look very similar. Applying the coding scheme and treating it with a quantitative method did not show relevant differences. It is more the way certain actions are lived, the means of communication, and the reinforcement of each other in dialogues, which might stand for culture and learning culture. This indicates the relevance of understanding the locations and their learning culture very well, once the development of learning opportunities is targeted. In certain cases, it might be worthwhile to have measures that change the general understanding of work to change the way how workplace learning takes place. In order to achieve this, an understanding of professionals' workplace learning needs is required that is country-specific and context-dependent. This situational-orientation through goal-drivenness in the work processes leads to the highly contextual self-regulated learning activities, which stand in conflict with standardized learning opportunities for a broad audience. The question which should be reflected and

reconsidered in large companies is how meaningful culture-oriented, uniform learning offers are.

The perspective *one size fits all does not work* is that this is already perceived[3], but concrete measures are not yet clear. In this context, reference is often made to the concept *Future of Work*[4], which emphasizes more freedom for employees (autonomy in one's own work) and thus less micro-management on behalf of management (control). Interesting is the time of increasing relevance of this concept, which is extremely hyped[5], but – the core of this idea is not new at all (Adler, 1992). This leads to the assumption that the awareness of the urgency of change in learning units of large companies is already present, but how this should be implemented and where to start is unclear. The discourse about it is relevant.

11.5 Workplace Learning Differences – Comparing Job Types (RQ3b)

This section continues the analysis of factors influencing the work process and embedded workplace learning from the previous section. Here the investigated factor is the job type executed by professionals.

Research question 3b covered in this section is the following: *What are the workplace learning differences between the professionals' two groups in terms of their individual work profiles?* The considered work profiles are experts and managers.

The associated theoretical expectation (TE-RQ3b) is that *there are differences in the learning culture of managers and experts.*

11.5.1 Approach

Similar to the work on research question 3a (see section 11.4), a comparative approach is conducted to identify differences between the workplace learning characteristics of professionals. Organizations include a large variety of often very specific types of jobs. For the analysis, a broader distinction of work was made, distinguishing managers (work focus is supervision) and experts (work focus is technical). The previous section on the research question focused on identifying differences based on the location of work. To investigate this, the same classification schemes are used as in the previous section, i.e., 1) *Comparative characterization of the workplace based on observation of the work process*, consisting of a) actions, b) roles, and c) communication modes. 2) *Comparative characterization of the workplace based on the self-report study*, consisting of qualitative

[3] https://www2.deloitte.com/content/dam/Deloitte/de/Documents/strategy/Future-of-Human-Resources-2030-Deloitte-Glimpse-Paper.PDF, https://capitalhblog.deloitte.com/2018/01/04/one-size-does-not-fit-all-for-business-hr/, https://enterprisersproject.com/article/2016/10/one-size-fits-all-approach-hr-will-no-longer-cut-it-it-talent-management

[4] http://hrexecutive.com/looking-ahead-to-the-future-of-work/

[5] https://www.forbes.com/sites/jeannemeister/2018/09/24/the-future-of-work-three-new-hr-roles-in-the-age-of-artificial-intelligence/#260d163f4cd9

findings. In contrast to research question 3a, here German manager and German experts are compared.

11.5.2 Results

The research question 3b is: *Are there workplace learning differences in professionals' daily work (learning culture) due to their work profiles of managers and experts?*. The associated theoretical expectation (TE-RQ3b) is that *there are workplace learning differences in professionals' daily work (learning culture) due to their work profiles of managers and experts.*

The presentation of the results is based on the manager-expert comparison in Germany.

Comparing Workplace Learning Characterization – Work Process Observation. Actions: Experts (N=16) versus Managers (N=12).

Due to the derived workplace learning activities of professionals with the work profiles of managers and experts (see figure 11.9 and appendix with table B.7), the following main difference between these both groups could be observed. Although conversation-based activities were observed slightly more by managers than by experts, conversation-reflection actions had a higher share for experts (13,97%) than for managers (8,26%). This indicates that the often held opinion that experts are focused on individual work and do not talk much is not true. Following the memos and field notes, the experts have several discussions. Nevertheless, they tend to look for a technical discussion with people with the same (or similar) expertise to reflect technical issues and challenges. This is combined with expert reflections in the form of speaking thoughts out loud (in the presence of the researcher during observation) to better understand the current state of one's own work and the next steps. The statement was that talking out loud was often used, even if no observer is present, which is a simulation of a social conversation without actually including someone else. The structure leads to the conclusion that informal learning activities dominate during the work process. The implicit focus on learning and the lesser relevance of explicit self-directed learning is reflected in the data of both managers and experts. In this respect, there is only a qualitative difference between managers and experts concerning the content of work and learning in social activities.

Comparing Workplace Learning Characterization – Work Process Observation. Roles: Experts (N=16) versus Managers (N=12). There are two main findings which are described below.

For workplace learning roles of professionals with the work profiles of managers and experts (seefigure 11.10 and appendix with table B.8), the following differences between both groups could be observed.

Decision-maker versus Supplier. The role of decisionproofer-decisionmaker could be observed twice as often for managers than for experts. This is directly related to the people's focus of a manager's work profile, compared to experts who usually have a higher technical focus in their work. Accordingly, managers often organize the tasks of the experts. The experts, in some sense, act as suppliers for the managers. The task of

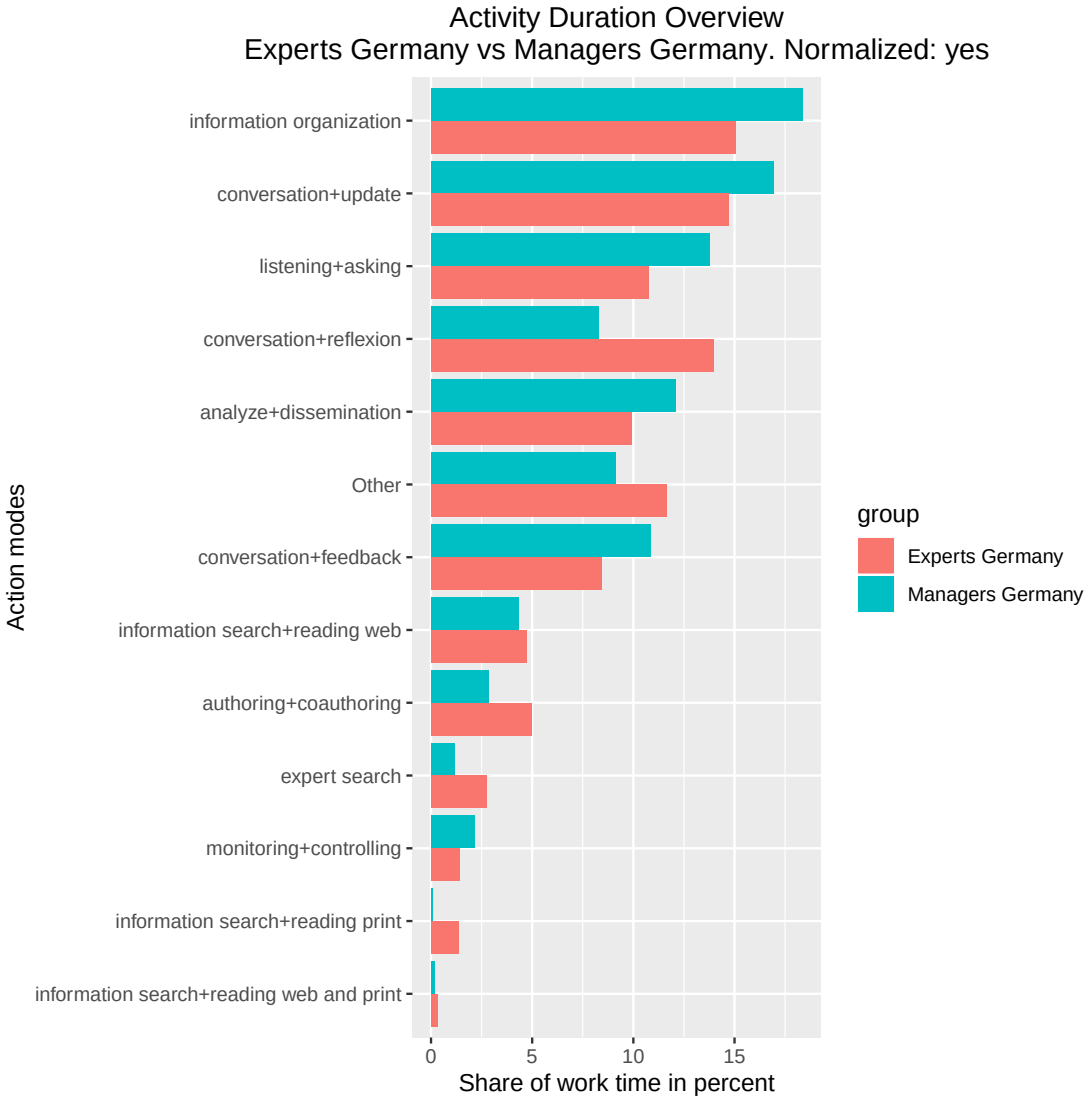

Figure 11.9: Actions: Managers vs Experts

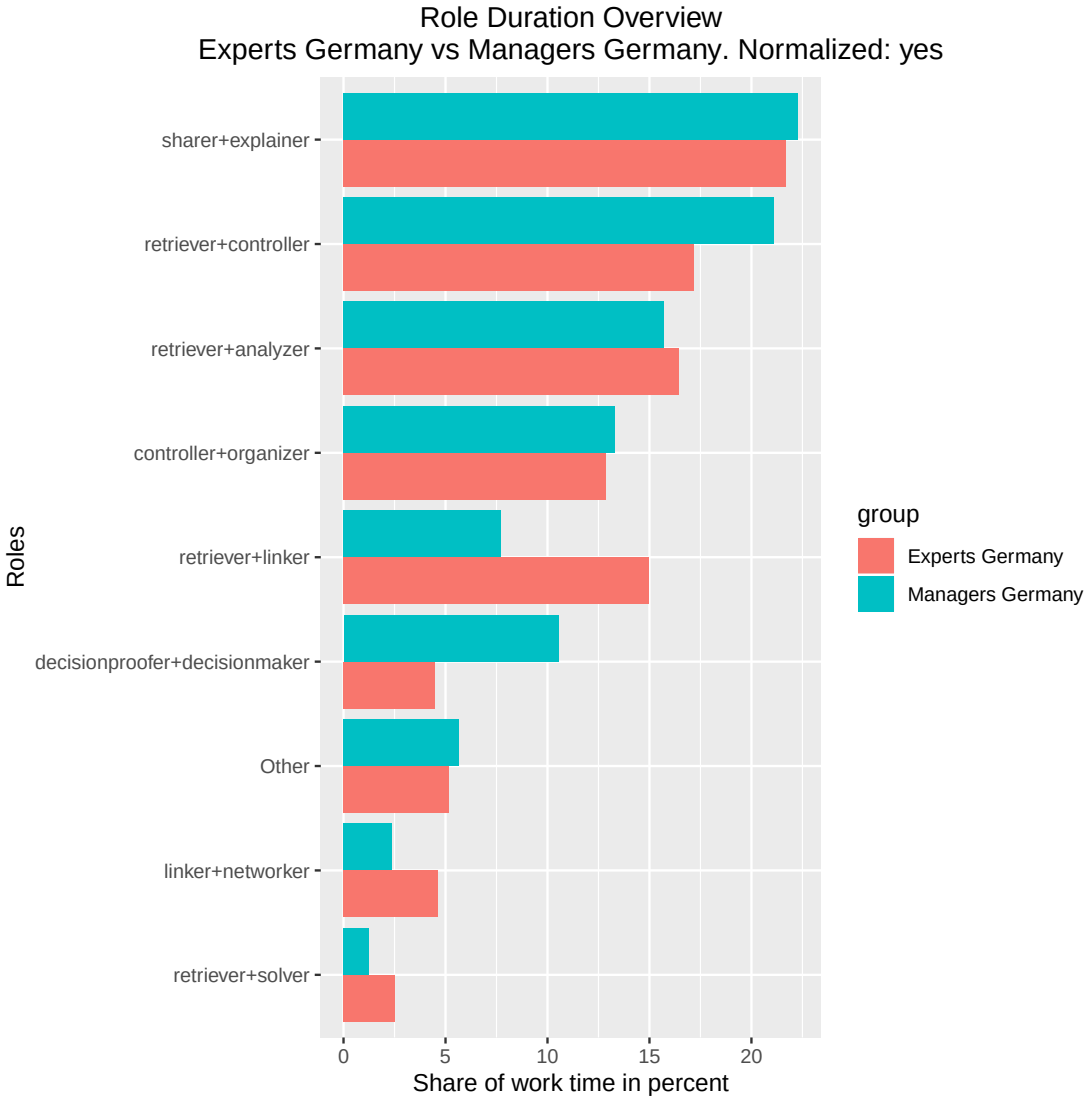

Figure 11.10: Roles: Managers vs Experts

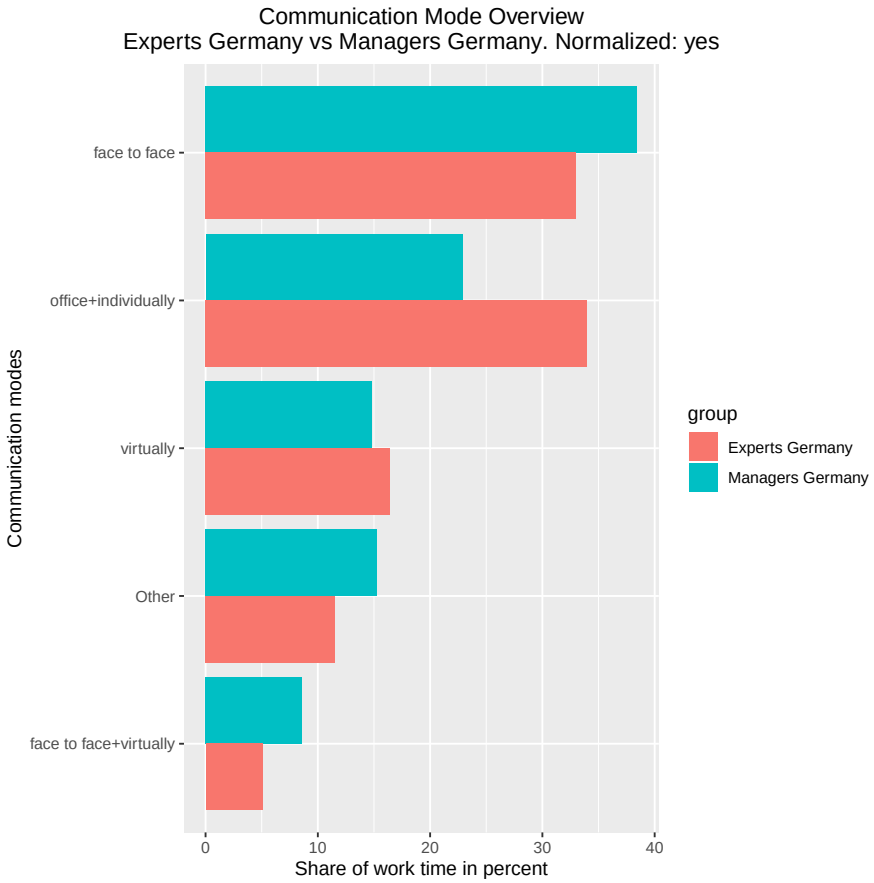

Figure 11.11: Communication Modes: Managers vs Experts

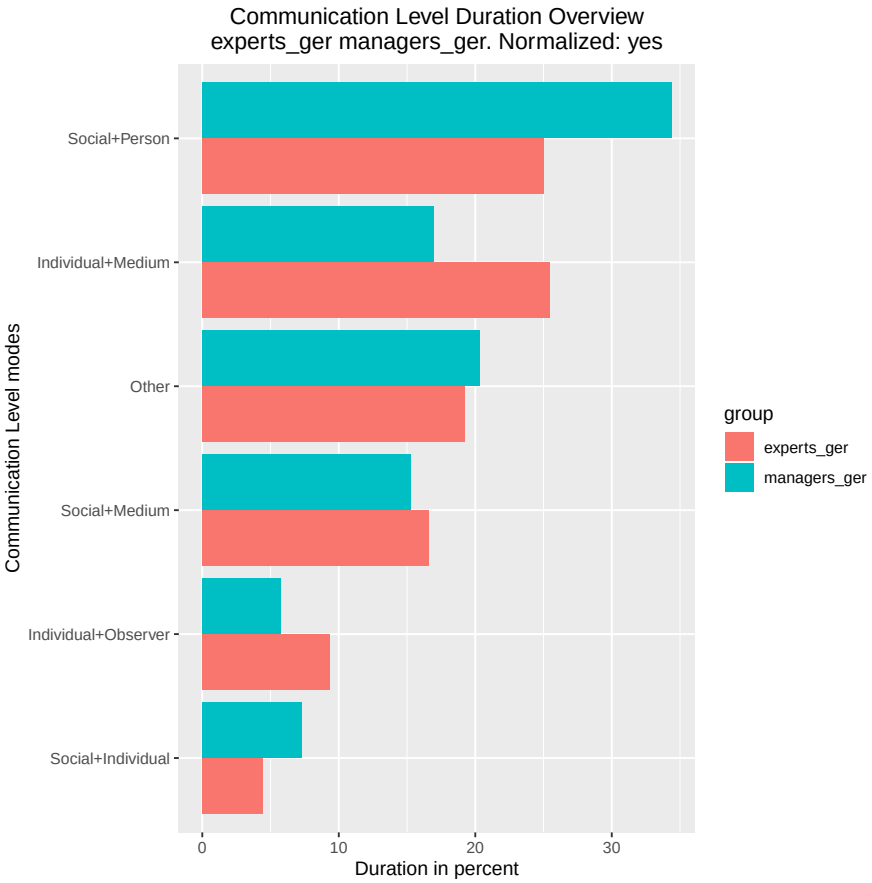

Figure 11.12: Communication Level: Managers vs Experts

direct work determines how people work and how they share or acquire the information they need.

Linker versus Performer. The role of the retriever-linker focusing on the information collection for self-improvement has a higher share for experts (14,99%) than for managers (7,7%). It cannot be concluded that the managers do not see the necessity or relevance of developing themselves. Based on the notes and field notes, it can be said that professionals working in both work profiles learn a lot, but in a different way, e.g., through listening, asking or reading (see activities overview in table B.7).

The role of the *retriever-linker* can be related to the intrinsic (e.g., learning topic of interest) or to the extrinsic (e.g., learning topic relevant for the work) motivation. Therefore it is relevant to know what the key drivers in learning are – internal or external motivational factors – to be able to address them with specifically tailored learning opportunities.

Comparing Workplace Learning Characterization – Work Process Observation. Communication Modes: Experts (N=16) versus Managers (N=12). There are two main findings that are described below.

For communication modes of workplace learning activities of professionals with the work profiles of managers and experts (see figure 11.11 and the appendix with table B.9), the following interesting differences between these groups could be observed.

Social Interaction via Face to Face. The face-to-face mode of communication has a higher share for managers (38,45%) than for experts (33,03%). This shows a marginal difference (see figure 11.11 and the appendix with table B.9), which suggests that the need to interact is similarly relevant for both managers and experts. This tendency was reinforced by researcher's memos and field notes. The associated communication level of *social-person* (see figure 11.12 and the appendix with table B.10) confirms this in terms of its dominance in comparison with social-medium, which stands for computer-supported communication tools, such as video-audio conferencing via Skype. At this point, an interesting observation is that managers work more face-to-face than with digital mediums for communication. Experts – vice versa – use more media-supported digital tools of communication than face-to-face. This indicates that communication is relevant to both groups. Nevertheless, they apply different communication levels.

Individual Work in the Office. The communication mode of office-individually has a higher share for experts (34,01%) than for managers (22,89%), but this does not mean that managers do not also work concentrated alone in the office. This is much more related to what the actual tasks are in terms of the organizationally defined work profile and the associated work tasks. Thus the mode of communication in work and the embedded workplace learning activities depend on what the actual work profile is, which leads to the context-dependent work and learning form.

11.5.3 Interpretation

The findings of this section show that a superficial distinction between managers and experts is difficult. Both profiles have their work-related focuses and tendencies, but real workplace learning differences can mainly be derived from qualitative methods.

This leads to the assumption that there are deeper-rooted differences between these two groups of managers and experts, and the attempt to differentiate them based on predefined categories is difficult. Rather, it seems much more appropriate to identify communities of practice. These groups do not necessarily follow the structure of professional profiles but are rather structured based on the interaction of a coherent group of professionals.

Another finding of the investigation is related to stereotypes. One example is that managers are extroverted, and experts are introverted. Following this, more interaction oriented learning formats dominate for managers and more individual-focused for experts. Examples from everyday work show the danger of such stereotypes. Instead, new learning techniques and methods are needed to identify and appropriately address the learning needs of groups of professionals who share a learning culture by belonging to the same community of practice.

Another explanation for the findings might be the promotion structure of the investigated company. In most cases, the company's workforce in the investigated domain starts their career as a technical associate. The first promotions will happen in a technical role. Only after two to three promotions can a technical expert become a manager. In other words, most of the managers investigated here were previously technical experts. As a result, it could be assumed, that they align their work to the new role but are still influenced by their previous career.

12 Discussion and Outlook

This thesis has focused on the learning process of professionals at work. Based on the fundamental understanding that learning happens in regular work processes of professionals, the relation between work and learning has been investigated. The theoretical foundations included a perspective towards the individual, including research about knowledge work (see chapter 2), learning theories with a constructivist perspective (see chapter 3), and learning processes (see chapter 4). The second part of the theory has considered organizations as places that establish work and learning culture (cf. chapter 5) and discussed organizational processes to evaluate and support learning (cf. chapters 6 till 8).

The theoretical investigation allowed the characterization of workplace learning but was limited by the rather abstract treatment of the subject. The actual way workplace learning is composed in organizations today remained an open question. Therefore, the thesis has focused on an analysis of how workplace learning is actually lived in organizations. For this purpose, empirical research was conducted (see chapters 9–11).

In this chapter, the results of the empirical research are summarized and discussed with respect to the theory (see section 12.1). Then the implications of this research for organizational approaches towards workplace learning are considered (see section 12.2). The chapter closes with a short discussion of the implications of this work for further research in the domain (see section 12.3) and an outlook (see section 12.4).

12.1 Results of the Study

The results of the investigation suggest that workplace learning is deeply embedded in the work process. Learning in the work process should not be confused with dedicated activities of learning. Only a small share of time is spent with dedicated learning actions and related roles. For example, only 4.57% of the time was spent on the retrieval and learning of material on the internet. The retriever-linker role took only 13.5% of the work time of professionals. In contrast, it showed that learning to a large extent takes place immediately in the work process of realizing work goals. The usual work activities generate situations in which information is analyzed and treated to create new information, happening individually and in groups. This is the main type of learning. The sharer-explainer role has a share of 21.96 % during collaboration-oriented actions of conversation-update, listening asking and conversation reflexion. This perspective has also been supported by the self-report study as the relevance of hands-on learning and informal learning has frequently been mentioned.

Workplace Learning Characteristics. These results strongly support the perspective of Billet that goal-oriented work activities generate workplace learning, as suggested

in different books and papers created by him (Billett, 2002; Billett et al., 2006; Billett, 2001*b*, 2004*b*). People at work do not plan to learn or teach; they plan and execute their work and experience situations of learning and teaching. As Welton (1991) states, the workplace becomes a learning environment. Nevertheless, the degree to which the workplace becomes a learning environment is very different. While all professionals make use of a large variety of actions and roles in various communication modes every day, this should not be confused with similar ways of doing work. The processes of how information is treated, applied and integrated can be very different across professionals. A case observation of the coding shows this, as for some persons, very few roles of information sharing exist, and information collection is dominant, while in other cases, sharing is dominant and collection is not very important. This indicates that the autonomy of the knowledge worker not only affects the way work goals are approached but also how learning is part of the work process. For Boud and Garrick learning is embedded in work, but "work is not necessarily a site of learning at the individual level" (Boud and Garrick, 1999, p. 33). It is not just a decision of a knowledge worker but also depends on his wish and ability to learn.

Cognitive Processes. One major limitation of the study is that no insights into the cognitive processes of participants are collected. Therefore, it is difficult to judge the integration of processes like experience, meta-cognition or assimilation and accommodation into the work process. Nevertheless, some situations observed by the researcher and thoughts added to the observation notes discuss related ideas. In the following, this personal insight developed towards cognitive processes in work processes is described based on the observer role taken in the study. The researcher was impressed with how seamless work processes unfolded. This does not mean that problems did not emerge. There were many situations in which the researcher had the feeling that people faced problems. Sometimes participants interrupted, seemed to think heavily while just staring on their screen or into the air, sometimes mumbling short sentences of surprise and dissatisfaction. Then, suddenly they just continued the work process. The researcher cannot say whether the people really faced issues and started to work on solutions in the work process, but had a strong feeling that this was the case. Here the perspective of action regulation theory which assumes that people see a mismatch between anticipation and reaction and then go for regulation fits quite well. The moment of staring and mumbling is the moment of mismatch and resulting tension, then triggering cognitive processes of re-planning and final regulation in the sense of Hacker and Sachse (1986). Dewey's reflective experience helps to analyze this further (Dewey, 1938*a*). The immediate experience seems to be transformed into reflective experience in the moment of mismatch. The individual starts to rethink the situation and makes the experience to a subject of cognitive treatment. Despite these more usual moments, there were very few explicit situations in which people actually seemed to be unable to solve a problem. In these cases, the researcher investigated more heavy reactions with more explicit statements of dissatisfaction or the use of swear words. Here the researcher assumes that people faced a situation that could not be handled by immediate regulation or that the effort for regulation was very high. The situations in which this was observed were receiving e-mails, doing a web search or other types of interaction with computers. In some

collaborative situations, it seemed like interactions were assumed to be short. Starting with "I want to quickly ask you something" or "Do you have a short moment". Then resulting in the expression of slight dissatisfaction that a separate meeting is required or an immediate longer discussion. Overall, the reactions in collaborative situations were much more controlled and used less explicit language to express dissatisfaction than this was the case in individual, yet observed work situations. Overall, the perspective of action regulation theory seemed to fit very well with the observations (Hacker and Sachse, 1986).

Collaboration played an important role for all participants observed in the study. Here the frequently observed switch of individuals between more a teacher (sharer-explainer) and a learner (retriever-linker) role is relevant. While some cases also showed a disbalance of these roles. One participant in China was asked by colleagues very frequently for information. Colleagues just walked by the office and asked for something. While all this resulted in small interruptions, the main work process of authoring a document was not interrupted and on the other hand, every question was answered in a short and precise manner.

In the process of collaboration, it was sometimes possible to see collaborative situation assessment that reassembled processes of assimilation and accommodation as conceptualized by Piaget (1952). When a situation was analyzed, people started to externalize their initial expectations and the way the situation did not match with these expectations, then explicitly worked on the decision whether their perspective was correct or not. These situations were often short, happening as short collaborative work towards making sense out of the situation and aligning it with the initial assumptions. Observation of these processes for individual work situations was not possible, which is not surprising as typical realignment is probably a purely cognitive process.

Learning Types. Considering the very close integration of learning and work observed shows the limitation of learning type separation, such as given by La Belle (1982); Mocker and Spear (1982). The distinction of information, formal, non-formal can make sense when it is about the development of organizational learning offerings (cf. chapter 8). To understand the learning processes at work, it is limited. Static schemes of what learning at work means show a huge gap between theoretical considerations and real insights into the lived practice of work processes and related learning activities, which is well analyzed by Billett (2002). An analysis of the learning processes triggered in different work *situations* seems to be more suitable to investigate workplace learning (see section 11.1).

12.1.1 Interplay between Work and Learning

The investigation of learning in the work process has focused on collaborative learning processes. The reason has been that only in collaborative situations, the professionals externalized information required for identifying and assessing the learning process. Very complex interaction modes characterize these learning processes. People frequently switched roles and applied several techniques like a loud repetition of facts, questions, loud statements of assumptions. Sometimes whiteboard drawings were created collabo-

ratively. Despite possible hierarchies in the groups, most of the time, open discussions emerged which, on the one hand, strived for solving a work problem, on the other hand, generated knowledge. This complex type of learning was much more dominant than simpler question and answer situations (17.33% for integration-oriented consensus building, 7.63% for sharing information). The observer frequently had the situation that initially, it was assumed that a simple question-answering situation was triggered, but that this was just the entry point to a more complex discussion. Only 2.89% of the work time was consumed by immediate answers (represented by elicitation).

The analysis of the field notes showed that solving specific problems typically characterizes collaborative learning situations with which the group was not familiar. Therefore, they worked collaboratively to find solutions – taking into account their experience and the available facts. This supports a strong representation of the cognitive level of synthesis in the coded data, which is associated with this interaction (14.35% for synthesis together).

Each work episode also requires professionals to apply some of the abilities they learned earlier. In analyzing this question, two things were dominant. On the one hand, complex abilities such as evaluation, which lead professionals to deal with new and unseen data. On the other hand, rather simple and sometimes repetitive activities such as organizing information artifacts (35.21% of application).

These aspects support the characteristics of knowledge work discussed in the theoretical part of this thesis. There is a dominance of problem-solving activities that are performed autonomously (cf. chapter 2). The observed processes support Drucker's assumption that the individual competence of knowledge workers is a core resource of the company (Drucker, 1996). Still, the emergence of rather simple and repetitive work situations shows that the work is a mixture of different work segments. The observation notes indicate that often the activities of information organization enable later activities, like preparing to report or collecting information for collective decision making.

The application of abilities learned is the application of competence. As mentioned, advanced abilities are important. Based on the variety of content and the very specific problems addressed in the work situations, it is difficult to identify a few abstract competences required in the work processes. The need to analyze problems and generate solutions is part of all considered evaluation and synthesis processes. An observation of the topics noted in the field notes shows that even for the same professional, the domains which require analysis are very broad. Therefore, Garavan's perspective to consider competence to be context-dependent, seems to be suitable (Garavan and Mcguire, 2001). Competence lists, like those summarized by Spencer and Spencer (1993), in contrast, seem to capture only the abstract perspective of work, without embracing the very specific requirements of work situations.

12.1.2 Participant Observation

The empirical research conducted in the context of this work applied participant observation as a research method (Flick, 2014, 1991; Jorgensen, 1989; Atkinson and Hammersley,

1994). Based on the experience collected during the study execution and analysis phase, the application will be discussed in the following.

To investigate workplace learning in companies, several different research methods are possible. The researcher considered two fundamentally different approaches. On the one hand, methods that require knowledge workers to give information about their work and learning process. On the other hand, methods that observe the knowledge worker and derive information based on the observation.

In the preparation phase, the researcher had several informal discussions with professionals and talked about workplace learning. During these discussions, the researcher experienced that professionals tended to focus on explicit learning activities and related organizational learning offerings. To give examples, this included dedicated learning spaces they used for self-directed learning, formal courses and the usage of e-learning. Questions regarding the integration of learning in their daily work were responded in a biased way. On the one hand, most professionals acknowledged that they learn during work. On the other hand, they had obvious problems when they tried to situate learning in their work process. Based on this experience, the researcher decided to apply an observation-based approach.

For observation, purely technical methods were considered. This included consideration of cameras and microphones as well as software sensors on computers that record interaction with the machine. Purely technical solutions were rejected because all considered methods lack functionality when it comes to the need to record work processes that happen in different locations, at the computer, as well as in discussions with people face to face or remotely. Therefore, participant observation using field notes was selected. It was considered to ask people to apply thinking aloud to get insights into cognitive processes but rejected due to the resulting influence on the work process.

The most important effect of the decision is that the researcher was part of the work activities of professionals. As *a familiar stranger* (Flick, 1991) the observation was still likely to influence the work process in some respect. Furthermore, it was not clear to what extent the observation of experienced professionals in the IT domain would be observable by the researcher with a background in humanities. It turned out that apart from two exceptions, the participants familiarized themselves quickly with the observation situation. Furthermore, the different background was supportive, as the researcher was able to focus on the operations of the work process without paying too much attention to the specific work problems.

The researcher still considers participant observation to be a suitable method to investigate workplace learning. The lack of insight into cognitive processes that organize work is a limitation. Nevertheless, insights into work processes were made, which would not have been possible with other considered methods.

The following challenges were faced during the research process. 1) *Participant acquisition.* It was difficult to identify participants willing to participate in an observation study. It was necessary to build up a relationship of trust. For this purpose, the researcher relied on the personal recommendations within the company and an initial meeting to give insights into the plans. Roughly 50% of the persons who were contacted and replied initially decided against participation in the study. 2) *Effort.* The researcher

overall spent 800 hours with participant observation, requiring travel to several locations, taking more than six months in total. Furthermore, all meetings with the participants in the preparation and post-processing phase of the observation notes took additional time. 3) *Missing trust.* While some professionals accepted participation in the study they asked the researcher very frequently to stay outside of a work episode. This had reasons of confidentiality and in some cases also seemed to show that there was a lack of trust regarding the observer – assuming that the activity was some kind of labour inspection. 4) *Coding schemes.* The development of coding schemes applicable for work process coding required a complex sequential process to be applicable to recorded data.

12.1.3 Learning Culture

The investigation of various factors influencing learning at work indicates the existence of learning cultures. The study results show that the differences in the considered factors do not influence the action, role and communication shares. The considered groups are very similar. Nevertheless, the assumption is that learning cultures exist. Based on the field notes, a different perception of workplace learning in different locations has been identified.

Both managers and experts have a strong communication focus (role of sharer-explainer by experts contains 20.57%, by managers 20.99%), but take different roles in the communications (role of decisionproofer-decisionmaker by managers contains 8.72%, by experts is 4.49%). Accordingly, they have different expectations, e.g., from managers to decide and act as controllers or from experts to supply and act more as linkers.

Based on the participants' self-reports and the researcher's field notes, it could be found that both – managers and experts strive to understand new things. Both strive for personal development, both stress the relevance of interaction with other colleagues with regards to the problem solving-related ad hoc informal learning activities. The differences seem to be more related to *intentions* and organizational goals that guide daily work and therefore learning activities.

The following two examples help to understand the underlying intentions better. One expert located in Germany (id19/E/GER) reflected: "I consider constant learning as essential to the work as a developer or architect in IT. As IT is driven by innovation and a high dynamic environment, where the inability to permanently acquire new knowledge and skills would mean still-stand and missing the requirements of the job" (id9/E/GER). One manager located in China (id32/M/CN) characterized his individual view of learning at work as follows: "Be curious of what is going on and how we can collaborate and co-innovate, and the most important – how we can change something".

This is consistent with the constructive social point of view, which characterizes culture as *never static* (Young, 2014), as *learned, social, adaptive and integrative* (Kroeber and Kluckhohn, 1953) and *as a result of social interaction* (Busch, 2009*b*). Therefore, culture cannot only be seen as an influencing factor. Rather, culture manifests as a process (e.g., social mode of integration-oriented consensus building) and product (synthesis as cognitively highest learning outcome which stands for a concrete problem-solving case) at the same time. Culture can be both: 1) Individual *as given* (Busch, 2009*b*), which

includes the totality of beliefs and characteristics of each individual and 2) Social as *constructed*, resulting as *social construction of reality* (Berger and Luckmann, 1966). This understanding of culture refers to *situated learning in communities of practices* (Lave, 1991) and *situated cognition* (Brown et al., 1989) (cf. section 4.1).

The difference in workplace learning perception across locations can be used as an example of this influence. Knowledge workers who were not working in the headquarters of the investigated organization but in satellites across the globe considered themselves to be less important for the organization. As a result, motivation for learning at work was considered low, as this was seen as an organization's desire. The assumption of the researcher is that the perception results in a different quality of workplace learning. The conducted study does not give any insights into the quality or success of workplace learning. To investigate such motivational effects, a separate investigation, focusing on workplace learning quality, would be beneficial.

Overall, the assumption is that learning cultures develop within organizations. The influence of learning cultures will be of various types. Discussion with professionals participating in the study highlighted the relevance of small expert networks, comparable to communities of practice as well. These structures can be considered as one example of a learning culture supporting learning processes. In general, it will be relevant to investigate further which types of learning cultures exist and which positive and negative effects on workplace learning result from the respective cultures.

12.2 Implications for Organizational Learning Support

In the following, organizational learning support is discussed from the perspective of the study findings. The theoretical section has highlighted the organizational goal of developing a competence mix enabling the company to realize its strategy. Companies specify competence goals based on the strategy and implement processes to analyze competence status and to apply people development to the workforce. This process has two limitations (cf. chapter 7). First, competence model development is complex and often results in the reuse of static models, which might miss the requirements of companies. Second, the techniques to derive the competence status within a company are subjective and do not necessarily generate a realistic representation of the competence status. Another aspect to be considered are the means of learning support. Organizations often rely on strict classification schemes for learning offerings with a preference for formal learning offerings. These aspects are investigated based on the study in the following.

Competence Models. The work of Erpenbeck and Grote (2013) summarizes competence models used in different large companies (see section 7.2). The models focus on generic competences. One example is the competence *strategic-innovative orientation* in the Siemens competence model. The model distinguishes seven stages of strategic-innovation orientation. The stages range from knowledge of the individual work environment up to the ability to develop strategies for a complex company. Erpenbeck also reports Porsche, who distinguishe individual competence, social competence and cognitive competence based on three to four individual characteristics. The older analysis

of competence models of Spencer and Spencer (1993) presents a similar understanding. Spencer and Spencer (1993) integrate 286 competence models resulting in 21 competences, including analytical thinking, flexibility, initiative. Even more recent work towards novel competences for working in the 21st century such as Pellegrino and Hilton (2012) or projects like NextSkills (Ehlers and Kellermann, 2019) provide this abstract understanding.

Careful consideration of the application of competence in the workplace identified in the study points to the limitations of abstract competence models. The investigation of work processes and workplace learning at first glimpse matches many of the elements identified in the competence list. As summarized earlier in this section, evaluation and synthesis are very important for knowledge work, relying on analytics and conceptual thinking. This match between workplace learning lived, and competence models are only superficial. For aspects like motivation, this might be sufficient, but for more specific work-related competences, the domain embedding of competences is ignored. Observation of the analytics skills applied at work showed situation and job-related influences into what analytical thinking is. The researcher observed managers who analyzed workforce planning, experts working on software patches as well as people developing new functionality for software tools. While all worked collaboratively on investigating situations and heavily applied analytical and conceptual thinking, the actual methods and knowledge integration processes differed significantly. The applied analytics methods came from domains like business research, computer science, legal, and others.

Garavan and Mcguire (2001) note that competence models often lack contextualization and propose the application of field observation to develop more specific competence models. On the one hand, this approach matches well with the workforce-oriented study conducted in the course of this work. On the other hand, limitations with respect to the alignment of an organization with strategic goals might result. An integration of both perspectives in a respective competence model seems relevant. Competence models integrating strategic needs and a contextualized understanding of specific competences applied in the organization with embedded revision processes might address the requirements of organization and workforce as well. This could be a topic of future research.

Competence Need Investigation. The theoretical part mentions different techniques applied to investigate competence needs according to the organizational competence models (cf. section 7.3). Only the rarely applied technique of 360° feedback integrates multiple perspectives into the competence status analysis. Other methods rely on the performance understanding of the direct manager. The resulting aggregation of subjective assessments can result in capturing competence needs wrongly.

Furthermore, abstract competence models complicate the identification of needs. This perspective is supported by the McKinsey study and LinkedIn studies mentioned in the introduction of this work (cf. section 1.2). Skill gap identification is described to be one of the most important needs with existing organizational support often missing the actual needs of workers.

While the observation process of the study could support the development of competence models, the actual assessment of competence needs is not given. In contrast, during discussions, the study participants often mentioned their needs and requirements.

This hints at a high level of meta-cognition that experienced professionals have. They seem to know what they do not know. The involvement of professionals into the analysis of competence needs can therefore be considered beneficial. This perspective is further supported by the McKinsey study (Gryger et al., 2010), which identified training agendas generated by senior executives to be more efficient than agendas generated by human resource departments.

Learning Support. The conducted study shows that professionals live very strong learning processes during their daily work. Work goals guide to individual and collaborative learning, typically immediately while working towards the work goals, sometimes also in a self-directed manner of explicit learning activities. The organizational approaches towards learning support considered in the theoretical part describe different learning types. Theory suggests that organizations often capture workplace learning as informal learning (Marsick and Watkins, 1990; Cross, 2007). Informal learning and workplace learning are considered to be synonyms in the following. The dynamic and mostly implicit nature of workplace learning complicates the development of organizational processes to facilitate it.

Theoretical concepts of the modes of informal learning of Schugurensky (2000) and Bennett (2012) could be observed and validated by professionals in their daily work processes. Schugurensky (2000) created a concept of informal learning and differentiated between three modes of 1) Self-directed learning, b) Incidental learning and c) Socialization. Bennett (2012) extended the concept of Schugurensky (2000) by recommending four types of informal learning, namely 1) Self-directed (see section 4.4), 2) Incidental standing for conscious and unintentional, 3) Tacit, instead of socialization by Schugurensky (2000), nonconscious and unintentional, and 4) Integrative, being nonconscious and intentional.

Organizational support of informal learning also was considered relevant in the self-report study of professionals. In the following, different support options which can be derived from the study and theory are briefly mentioned. Especially Billet's considerations about limitations of workplace learning are important input sources for the following list (Billett, 1996*b*).

Learning Environments. The environment of professionals can be optimized to support those processes of workplace learning which are most relevant. If more knowledge about efficiency is gained, this should be considered as well. The study showed that such processes exist in a variety of facets. Support should target more than one facet. *Collaboration.* Generating environments that support collaborative problem solving, even remotely, would support the integrative consensus building and synthesis identified in the study. *Individual work.* More than one-third of the workday of professionals happens in individual work situations. Environments should support this type of work. Especially the possibility to avoid interruptions for focused work sessions is important. *Dynamic community building.* Study participants frequently highlighted the relevance of small networks of experts with comparable expertise used for planning and validating plans. These groups often developed earlier in professionals' life and remained intact, even if people switched teams or locations. To get together, coffee and lunch breaks

were often used, resulting in informal but business-oriented discussions. Building coffee corners and the appropriate design of canteens can support these processes.

Learning Quality. Workplace learning often targets support of the learning goal at hand. As a result, only the quality of the learning goal is subject to active reflexion. The learnings made in the work process are not assessed. During the study, experts sometimes mentioned in collaborative situations that they did something *just good enough*. The researcher established the feeling that the participants sometimes were aware of a better way, but decided against it because they did not have enough time to apply it or do the required learning. Such situations are difficult. If better approaches exist, but the work goal orientation in the work process denies a substantial treatment of the subject to realize the other approach. Even worse, people might learn something wrong (Billett, 1996*b*).

Organizational structures could target on improving the quality of workplace learning. Further research is required to consider different approaches. Focus on work results and the included components could be one option of achieving this. Some software companies have established collaborative code reviews (Müller et al., 2012). The software engineer who produced software code explains what he did and experts comment and suggest. Similar reviews could be implemented for other work outcomes and result in a collaborative process of guaranteeing the quality of the learning and its application in a work product.

Culture of Openness. The influence of culture on the success of workplace learning has been mentioned in the learning culture discussion (cf. chapter 5). The example of satellite organizations was given. The study showed that the individual willingness to share information and continuously switch between teacher and learning is important. Especially hierarchies should be ignored in those situations. Organizations can investigate existing cultures more closely. If convictions exist which have a negative influence on learning, organizational initiatives should actively strive for cultural change.

Influence on Formal Learning. The participant observation did not include any observation of participation in formal training. On the other hand, the observed work processes showed that the actual applicability of learning outcomes in work processes is significant for professionals. The self-report study included some mentions of limits of the workplace learning offering and its relation to the individual work processes.

Beyond the mentioned challenge of contextualized competence modeling and extended competence need investigation, the work process indicates improvement opportunities for formal learning offerings of organizations.

Formal learning offerings often provide full courses taking several hours to complete. The courses are designed to realize a number of learning outcomes relevant to the course domain. The work goal dominance and related resource constraints deny the application of this kind of course in the work process. One participant mentioned in the self-report study that participation in formal training is difficult because of the time required and the unclear relevance to the work.

Considering the work process with problem-based learning need identification sketched using action regulation theory, another type of formal learning could be considered. Formal learning, which is structured in more fine-grained components to address problems

at hand. One participant mentioned that he typically has very specific requirements and that it is difficult for him to find answers to his replies. The usage of communities like StackOverflow for computer scientists was one of the techniques applied to address these needs. Such communities give a good example of how learning content can be structured to be immediately applicable to the work process at least in the software engineering domain.

Another aspect is the applicability. Formal learning does not necessarily target the applicability of the learned results in daily work. Techniques like blended learning address this limitation by integrating the learning later into the daily work of professionals (Bersin, 2007). Still, blended learning artificially does this by asking people to do training based activities later in their work. A closer alignment of learning offering outcomes with applicability in the daily work of professionals would be more suitable to support the work-embedded learning needs of professionals.

12.3 Implications for Future Research

Workplace learning processes of professionals in organizations is an important research topic. The investigation conducted in the course of this work has extended the body of knowledge regarding workplace learning in two respects. On the one hand, existing theoretical work from the educational and the organizational domain has been integrated. This has shown differences in the understanding and realization of learning which results in tensions present in organizations today. The core outcome has been a framework-like understanding of how learning at work is likely to happen, based on existing theories. On the other hand, empirical research was conducted to investigate the framework-like understanding of workplace learning. Workplace learning was analyzed for one knowledge-intensive software company working with a multi-national workforce in different countries. The characteristics of workplace learning, the interplay between competence application and development and influence factors on learning were analyzed.

The gained understanding of workplace learning supports the expectations gained in the theoretical work. Workplace learning has shown as very relevant, emerging in individual and collaborative settings as well. Next to the relevance of problem-solving activities, the presence of many simple activities on Bloom's cognitive level of the application were also identified. The presence of a learning culture was acknowledged and discussed taking motivational factors into consideration.

Different fields for future research can be derived from the insights gained in the study. Three of them are briefly sketched in the following. First, *tensions and related cognitive modes in the workplace.* Second, *quality assurance for workplace learning.* Third, *organizational workplace learning support and institutionalization.*

A limitation of empirical research is the lack of insight into *tensions and related cognitive modes in the workplace.* The theoretical perspective generated the assumption that a mismatch between anticipation and effect triggers tensions which are regulated in terms of identification of a learning need. After conducting the research, the researcher

still supports this perspective. Unfortunately, the study does not include information about this process, as tensions and the related cognitive processes like meta-cognition for need analysis were not captured. Capturing this information in a normal workplace setting is obviously difficult. Therefore a more controlled study set up in a lab might be appropriate to investigate the process further. The researcher did not analyze sequences of activities in the collected data set. This could also give deeper insights into the processes of addressing tensions and be relevant to understand the materialization of cognitive processes in actual work operations.

In the context of discussing workplace learning processes, *quality assurance for workplace learning* is an important goal. Professionals who learn during work mainly assess learning based on the outcome of work. Software code review has been mentioned as a mechanism that allows assessment of the learning success based on work outcome. Future research should investigate the mechanisms of this type more closely. Especially an investigation of techniques that assure learning quality in the work process, which is independent of the work process outcome, is likely to improve workplace learning. Ad-hoc collaboration in the work process could be one mechanism to realize this. The influence of culture on workplace learning quality is of interest as well. Especially, mechanisms which improve workplace learning quality by improving motivation and valuation of learning. These activities need to consider the expert culture of knowledge work as well, to focus on mechanisms that are likely to be accepted by professionals (cf. the work by Schultze and Boland (2000)).

Organizational Workplace Learning Support and Institutionalization. The gained insights suggest that organizations should reflect the existing workplace learning activities much more. This idea is not new. The idea of learning companies (Senge, 1990) targets this. The resulting transformation needs to identify appropriate means of how the organization interacts with the existing learning structures. The autonomy of the professionals in structuring not only their work, but also their learning should be maintained. The discussion of Huysman (2002) on challenges in realizing learning companies support this perspective (cf. chapter 5). An institutionalization of learning processes shaped by individual professionals and communities should be avoided. The interplay between organizational processes and their tendency to institutionalization and workplace learning in the organizations should be investigated further.

12.4 Outlook

The support of workplace learning in organizations is likely to be relevant in the future. Even considering that the relevance of knowledge work increases and the work situations gain increased flexibility. Work can happen anytime, anywhere in individual and collaborative setups. Especially in these setups, it is important that workplace learning enables seamless work processes that generate work results and learning results of high quality. Therefore, the transfer of insights into workplace learning to improve the way organizations handle learning support is important. Here the workforce should

not be considered to be homogeneous, but the differences which result from different educational backgrounds, different habits or work locations should be considered.

For this integration, it is important that organizations are able to align the individual needs of the workforce and the strategic needs. This document closes with the sketch of a process to improve the alignment between individual needs and strategic goals for learning offering development in an organization. This example served as the outlook for future activities towards improved workplace learning in organizations and increased support of learning through the organization.

For this purpose, the reflexion portfolio is introduced. The portfolio is a process for learning needs, using empirical methods to derive learning needs in an organization and align them with strategic needs. The process aims at informed decisions that consider top-down and bottom-up requirements towards competence needs and the existing learning culture. The reflexion portfolio allows for the identification of local practices and provides an overview of the existing competence levels in a target group. The specific benefit of this process is the creation of learning offerings as dedicated learning mixes to address the different learning forms in an organization. Workplace learning is one type of learning which can be supported by this process, but also other forms of learning would be included. The process should support learning need identification and derivation of the most promising learning technique to address it. As a result, companies could allow more individual portfolios and thus take a more bottom-up approach rather than focusing on top-down.

Participant Observation as Basis for Building a Reflexion Portfolio. The goal is to create a process for the design of learning offerings that are capable of integrating the differences in a globally distributed and diverse target group. Inspired by the beneficial insights gained during the observation study, the decision taken is to stimulate a process of reflecting empirical data, which represents local learning behaviors and local competence profiles. At the same time, the effort required for collecting data and to reason about data should be small. The chosen approach is the use of reflexion portfolios, which help in making the intangible workplace learning processes tangible. To make this more explicit, a short background on portfolios is given in the following. Then, the learning design process is described.

A portfolio can be described as “a purposeful compilation and reflexion of one’s work, efforts and progress” (Milman, 2005, p. 375). According to Baumgartner’s taxonomy of e-portfolios (digital form of a portfolio), a reflexion portfolio involves two sub-types of portfolio: 1) Learning portfolio, to show the learning products and processes. This type on the individual level includes the learning products (summative: objectives) and learning processes (formative: activities – individual and/or collaborative) of professionals; 2) Evaluation portfolio, to evaluate the skills and competences by e.g., curriculum in the form of exams of professionals (Baumgartner and Himpsl, 2006).

In this work, a reflexion portfolio can be understood as a living document that focuses a competence of interest and structures information about the competence from one or more locations, communities, individuals. This kind of document aims to show and especially to reflect competence development across different locations and target groups.

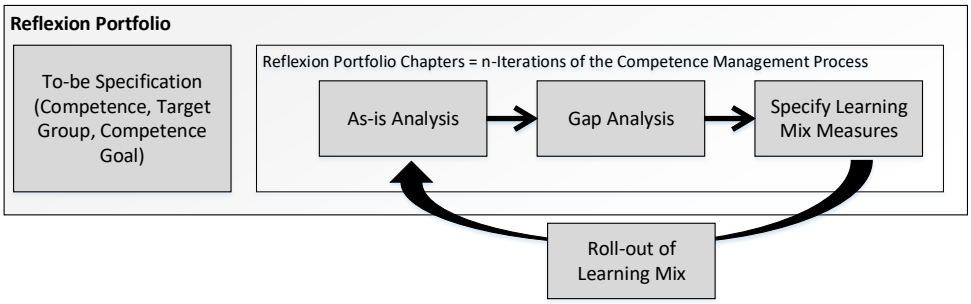

Figure 12.1: Global Reflexion Portfolio Process

Reflexion Portfolio for the Evaluation of Competences in Companies. The reflexion portfolio is a living document that collects competence related information for specific competence in a target group with respect to a chosen competence goal (see figure 12.1). It is maintained by a competence manager – probably human resources staff. First, a target section of the portfolio specifies the competence, target group and competence goal. The remaining portfolio is governed by an iterative process of competence management which is supported by the portfolio. This process is composed of three steps: as-is analysis, gap-analysis and measures. Each iteration forms one chapter of the reflexion portfolio, including the following information: 1) The *as-is* section offers information about the state of competence within the target group at a given point in time. This section allows to gain detailed information about the target group where a competence of interest is located (locations, local learning groups/communities, individuals); preferred methods in working and learning with this competence of interest; local and cultural aspects as factors influencing the handling of this competence; 2) *Gap-analysis* aims at exploring the status of a competence of interest within the target group. This in-depth analysis allows exploring a lack of this competence on the macro (locations), meso (learning communities) and micro (individuals) levels of an ecosystem. The findings gained in this section enable to derive suitable measures; 3) *Measures* to address the identified gaps in the phase before can be formal (e.g., formal training programs), non-formal (e.g., learning communities, virtual forums) and/or informal (e.g., learning spaces).

Typically one iteration can have a duration between a couple of months and one year. It depends on what kind of competence is needed, who the target group is and how long it takes to gain and evaluate the data and derive suitable measures.

The described competence development process builds on the collection of data about local competence profiles and learning preferences. This topic is the subject of ongoing research activities of the author of this thesis.

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13 Appendix

Appendix A Questionnaire

	Demographic Questionnaire (Sample f. Participant Observation Informal Learning)
1	What is your **age ?** *(please select an option from the list)*
	25 or under
	26-30
	31-40
	41-50
	51 or older
2	Please select your **Gender** *(please select an option from the list)*
	Female
	Male
	Other:
3	What is your **Nationality?** *(please insert text)*
4	What is the **highest level of education** you have achieved? What is the highest level of education you did reach? *(please select an option from the list)*
	Bachelor's degree
	Master's degree
	Doctoral degree
	Professional degree
	Other:

Figure A.1: Self-report Study Questionnaire (Part 1)

5	What is your **work focus & job title** in your company? *(please insert text)*
6	Please select your **job level your company**: *(please select an option from the list)*
	Senior
	Manager
	Expert
	Senior Manager
	Chief Expert
	Other:
7	What is your **Experience your company** / How long are you at your company? *(please select an option from the list)*
	1-5 years
	6-10 years
	11-15 years
	16-20 years
	21-25 years
	other..
8	What is your **work time model** your company? *(please select an option from the list)*
	full time: 100%
	part time:
	50%
	60%
	80%
	Other..
9	What does "**Learning**" during your daily work mean to you? *(please insert text)*

Figure A.2: Self-report Study Questionnaire (Part 2)

Appendix B Tables

No	Action name	Average share of time in %	Std
1.	information organization	16,49	6,74
2.	conversation + update	15,68	6,20
3.	listening + asking	12,04	6,12
4.	conversation + reflexion	11,52	7,45
5.	analyze + dissemination	10,82	7,23
6.	other (e.g., observation break, lunch)	10,57	7,23
7.	conversation + feedback	9,46	6,41
8.	information search + reading web	4,57	4,86
9.	authoring + coauthoring	4,05	5,89
10.	expert search	2,08	3,47
11.	monitoring + controlling	1,71	6,17
12.	information search + reading print	0,79	4,59
13.	information search + reading web and print	0,27	1,62
		Sum = 100	

Table B.1: Derived Scheme of Actions.
Co-occurrence of actions in episode indicated by +.

No	Role name	Average share of time in %	Std
1.	sharer + explainer	21,96	6,68
2.	retriever + controller	18,88	7,93
3.	retriever + analyzer	16,15	5,76
4.	controller + organizer	13,05	5,55
5.	retriever + linker	11,85	11,12
6.	decisionproofer + decisionmaker	7,08	5,89
7.	other (e.g., observation break)	5,39	4,76
8.	linker + networker	3,67	6,31
9.	retriever + solver	1,95	5,16
		Sum = 100	

Table B.2: Derived Classification Scheme of Roles.
Co-occurrence of roles in episode indicated by +.

No	Communication mode	Average share of time in %	Std
1.	face to face	35,37	15,58
2.	office + individually	29,26	16,99
3.	virtually	15,7	12,25
4.	other	13,09	9,61
5.	face to face + virtually	6,58	7,29
		Sum = 100	

Table B.3: Share of Communication Modes in Percentage.
Co-occurrence of communication modes in episode indicated by +.

No	Social Mode of Co-Construction of Knowledge in Social Learning	Average share of time in %	Std
1.	Not applicable (= individual activities)	35,45	17,67
2.	Integration-oriented Consensus Building	24,77	15,59
3.	Other (e.g., observation break)	20,49	9,47
4.	Externalization	11,16	11,62
5.	Elicitation	5,58	5,56
6.	Quick Consensus Building	1,67	1,16
7.	Conflict-oriented Consensus Building	0,85	6,01
		Sum = 100	

Table B.4: Share of Social Modes of Co-construction of Knowledge in Social Learning

Level	Cognitive level	Average share of time in %	Std
6.	Synthesis / Creation	18,07	14,99
5.	Evaluation	13,04	13,32
4.	Analysis	3,35	3,72
3.	Application	29,07	16,16
2.	Comprehension / Understanding	15,45	9,43
1.	Knowledge	0,4	2,81
	Other	20,57	9,46
		Sum = 100	

Table B.5: Share of Cognitive Levels

Communication Mode	Median Germany (%)	Median Global (%)
face to face	38,5 (std: 15,7)	32,5 (std: 12,2)
office + individually	24,7 (std: 17,0)	26,0 (std: 13,1)
virtually	17,3 (std: 12,3)	9,6 (std: 8,0)
other	13,8 (std: 9,6)	18,5 (std: 14,18)
face to face + virtually	7,8 (std: 7,3)	15,3 (std: 12,5)

Table B.6: Comparison of Communication Modes: Germany vs Global

No	Action	Average share in% of Managers	Average share in% of Experts
1.	information organization	18,36 (std: 6,57)	15,05 (std: 6,72)
2.	conversation + update	16,95 (std: 6,10)	14,72 (std: 6,30)
3.	listening + asking	13,74 (std: 5,81)	10,77 (std: 6,37)
4.	analyze + dissemination	12,06 (std: 6,64)	9,93 (std: 7,76)
5.	conversation + feedback	10,86 (std: 5,87)	8,44 (std: 6,80)
6.	other (e.g., observation break, lunch)	9,12 (std: 3,59)	11,63 (std: 9,04)
7.	conversation + reflexion	8,26 (std: 7,12)	13,97 (std: 6,89)
8.	information search + reading web	4,33 (std: 5,68)	4,71 (std: 4,35)
9.	authoring + coauthoring	2,85 (std: 8,19)	4,96 (std: 4,58)
10.	monitoring + controlling	2,13 (std: 7,96)	1,39 (std: 5,32)
11.	expert search	1,15 (std: 2,39)	2,76 (std: 3,91)
12.	information search + reading web and print	0,18 (std: 0,01)	0,34 (std: 2,24)
13.	information search + reading print	0,06 (std: 0,37)	1,34 (std: 5,10)
		Sum = 100%	Sum = 100%

Table B.7: Comparison of Actions: Managers vs Experts. Co-occurrence of actions in episode indicated by +.

No	Role	Average share in% for Managers	Average share in% for Experts
1.	sharer + explainer	22,3 (std: 6,99)	21,69 (std: 6,67)
2.	retriever + controller	21,11 (std: 5,38)	17,2 (std: 9,51)
3.	retriever + analyzer	15,73 (std: 5,41)	16,44 (std: 6,15)
4.	controller + organizer	13,33 (std: 5,61)	12,87 (std: 12,05)
5.	decisionproofer + decisionmaker	10,54 (std: 5,17)	4,5 (std: 5,69)
6.	retriever + linker	7,7 (std: 8,47)	14,99 (std: 5,25)
7.	other (e.g., observation break)	5,67 (std: 4,29)	5,17 (std: 7,86)
8.	linker + networker	2,39 (std: 2,15)	4,63 (std: 5,50)
9.	retriever + solver	1,23 (std: 7,10)	2,51 (std: 5,21)
		Sum = 100%	Sum = 100%

Table B.8: Comparison of Roles: Managers vs Experts,
Co-occurrence of roles in episode indicated by +.

No	Communication Mode	Average share in% for Manager	Average share in% for Experts
1.	face to face	38,45 (std: 14,26)	33,03 (std: 17,41)
2.	office + individually	22,89 (std: 14,77)	34,01 (std: 16,74)
3.	other	15,25 (std: 10,90)	11,49 (std: 15,22)
4.	virtually	14,82 (std: 7,65)	16,39 (std: 8,55)
5.	face to face + virtually	8,6 (std: 7,86)	5,07 (std: 7,02)
		Sum = 100%	Sum = 100%

Table B.9: Comparison of Communication Modes: Managers vs Experts.
Co-occurrence of modes in episode indicated by +.

No	Communication Level	Average share in% for Managers	Average share in% for Experts
1.	Social + Person	34,38 (std: 11,88)	25,01 (std: 18,04)
2.	Other	20,32 (std: 9,27)	19,26 (std: 9,82)
3.	Individual + Medium	16,96 (std: 10.37)	25,43 (std: 13,72)
4.	Social + Medium	15,28 (std: 9,57)	16,56 (std: 13,13)
5.	Social + Individual	7,32 (std: 7,52)	4,43 (std: 3,36)
6.	Individual + Observer	5,72 (std: 6,21)	9,34 (std: 6,87)
		Sum = 100%	Sum = 100%

Table B.10: Comparison of Communication Levels: Managers vs Experts,
Co-occurrence of communication level in episode indicated by +.

Appendix C Figures

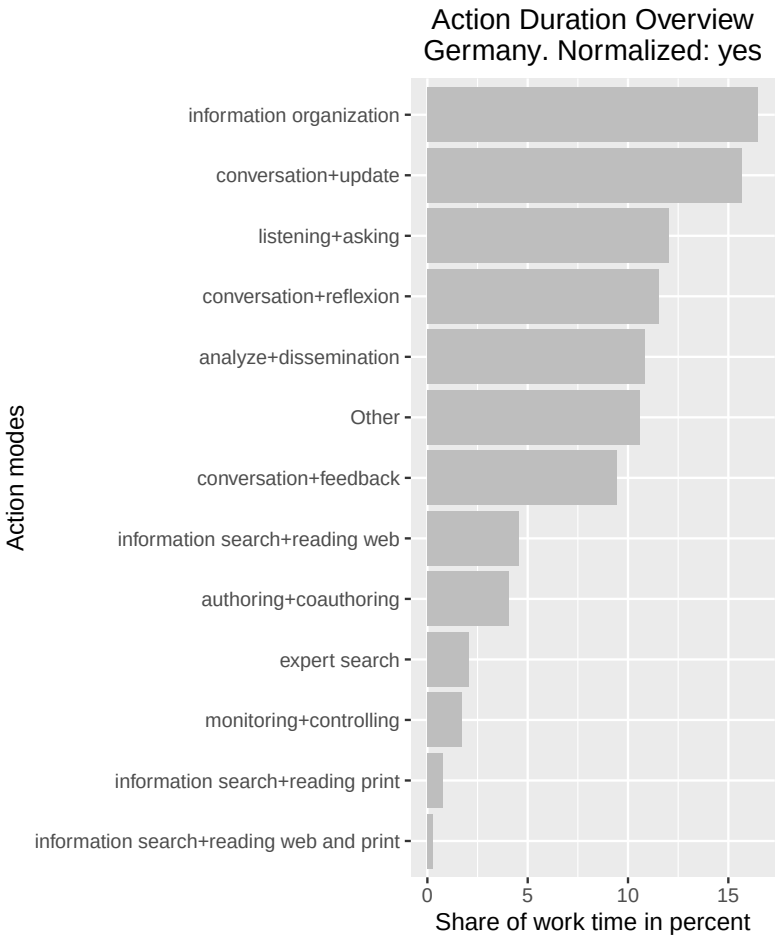

Figure C.1: Actions during Work of Professionals in Germany – Share

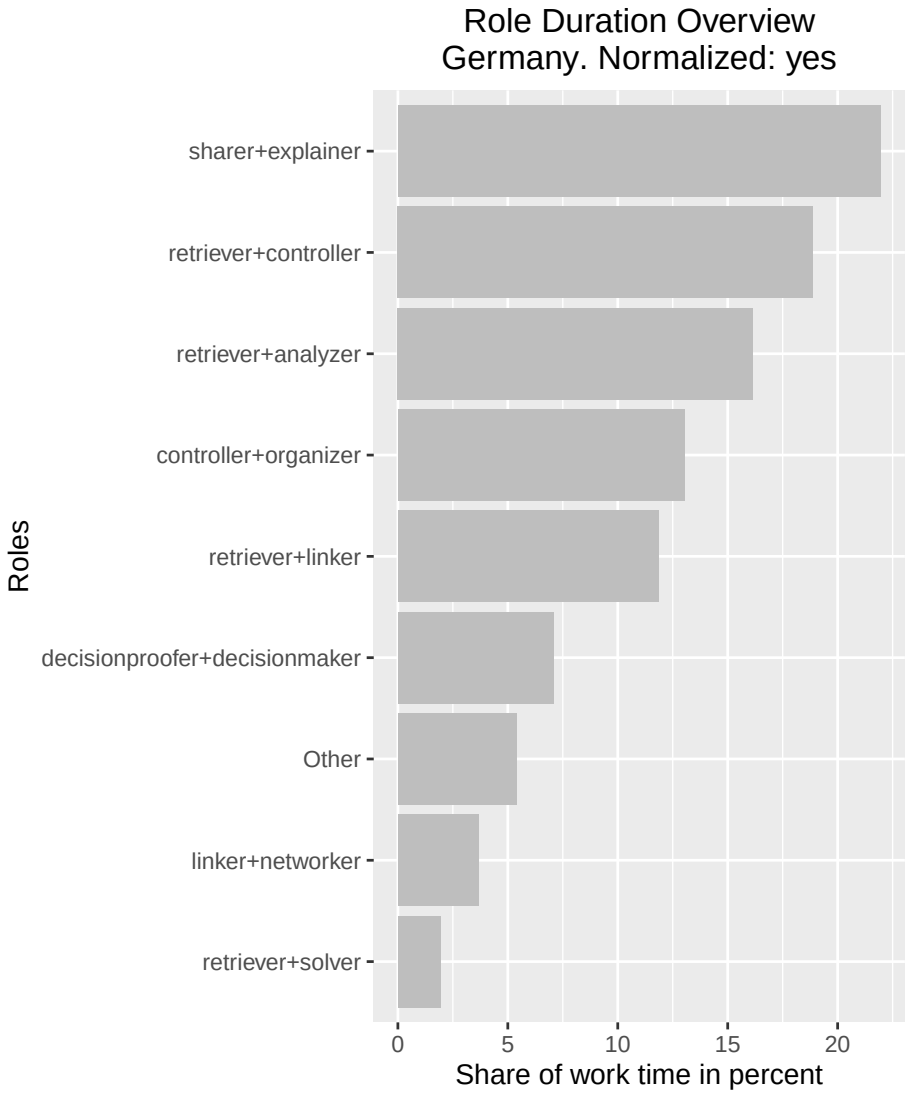

Figure C.2: Roles during Work of Professionals in Germany – Share

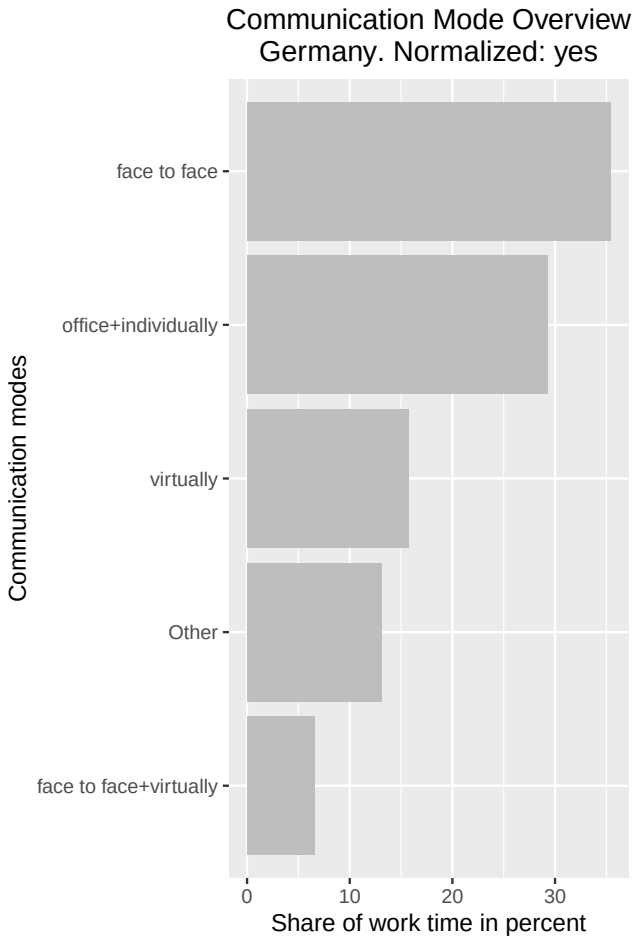

Figure C.3: Communication Modes during Work of Professionals in Germany – Share

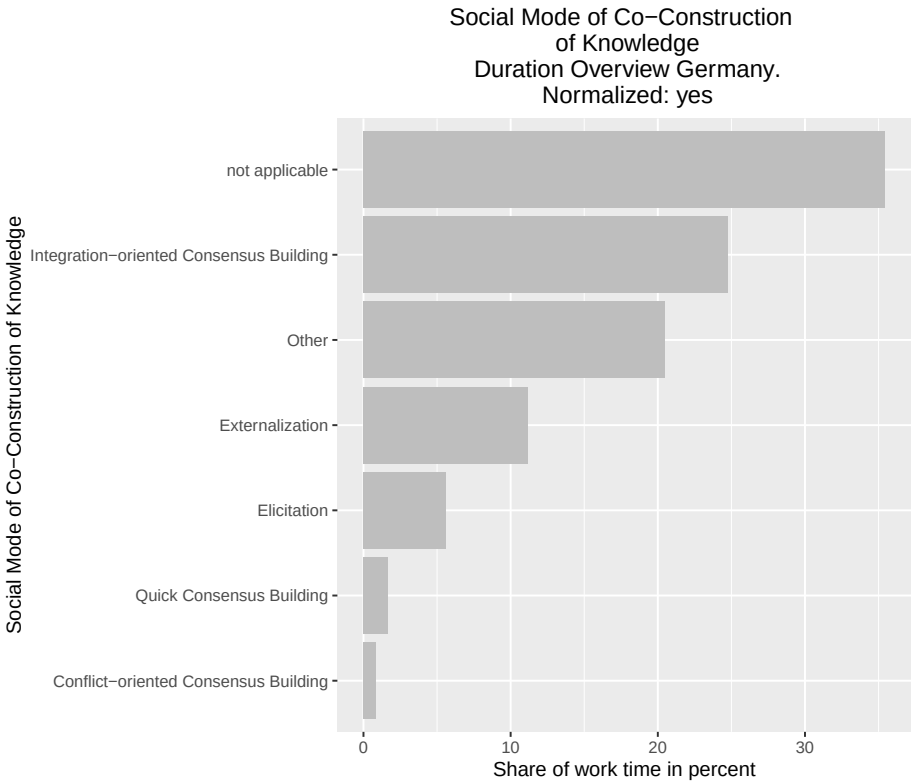

Figure C.4: Social Dimensions of Co-construction of Knowledge in Social Learning – Share

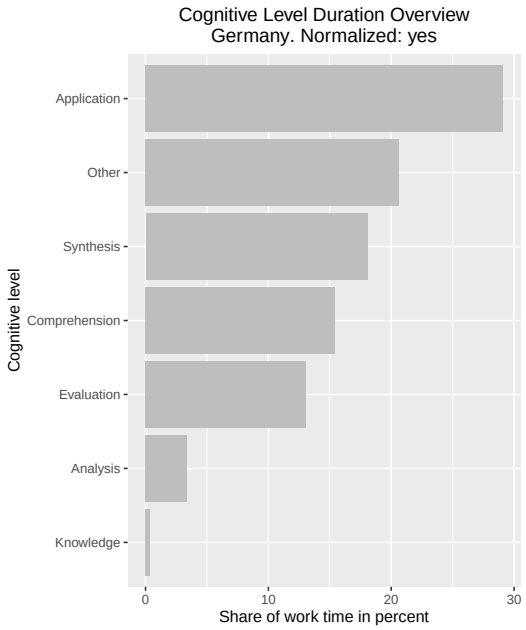

Figure C.5: Cognitive Levels – Share