



Hietavirta Dóra

Workplace learning in the field of Information Technology: IT professionals' views and beliefs

Master's Thesis in Education
FACULTY OF EDUCATION
Learning and Educational Technology
2019

University of Oulu

Faculty of Education

Workplace learning in the field of Information Technology: IT professionals' views and beliefs
Master's Thesis in Education, 74 pages, 1 appendix

April 2019

The focus of this study is in the area of workplace learning. The changes ushered in by the recent technological and societal developments are disrupting the ways people look at and think about work and the workplaces. Furthermore, these changes demand that workers become adaptable lifelong learners. Therefore, workplace learning has been an increasingly important area for research in several disciplines, including management, organisational development or adult learning. Learners' conceptions of and beliefs about learning and knowledge have been explored within the formal and informal education sector but not so extensively within the context of work, even though beliefs about learning are associated with chosen learning approaches and learning behaviour. Modern knowledge workers, such as people working in the IT industry, need to constantly learn, partly because of the rapid development of the technological solutions, and partly because of the changes affecting the way work is organized, being more collaborative and multidisciplinary. For these reasons, it is important to develop an understanding of how professionals in IT view learning and workplace learning and what factors influence their learning at work.

For conducting this study, a phenomenographical approach was adopted. Data was collected at the end of 2018, through semi-structured individual interviews with ten experienced professionals who were working in the IT field in varying roles and positions at the time, such as software architect, agile coach, or CEO. Interviews were analysed using data-driven qualitative content analysis method to identify IT professionals' views and beliefs of workplace learning. The results from the study show, that learning is mostly seen as continuous personal or professional development, as well as a process that leads to increased self-awareness. Learning is also acknowledged as a ubiquitous part of IT work, that is both an individual and a social process. Factors impacting the learning of IT professionals at work were found to equally represent individual and contextual variables. Based on the findings, it is recommended that learning or development professionals in work organisations consider those variables simultaneously in order to enable high quality learning at the workplace.

Keywords: learning, workplace learning, IT industry, learning conceptions, employee beliefs

Contents

1	Introduction	7
2	Theoretical framework	10
2.1	Conceptual understanding of workplace learning	10
2.1.1	<i>Understanding team-learning</i>	<i>13</i>
2.2	Individual beliefs and conceptions	15
2.3	Factors influencing workplace learning at different levels	19
2.3.1	<i>Factors at the individual level.....</i>	<i>19</i>
2.3.2	<i>Factors at the team level</i>	<i>21</i>
2.3.3	<i>Factors at the level of the organisation.....</i>	<i>25</i>
3	AIM AND RESEARCH QUESTIONS	29
4	METHODS	30
4.1	Context and participants.....	30
4.1.1	<i>Context</i>	<i>30</i>
4.1.2	<i>Participants</i>	<i>32</i>
4.2	Study design	32
4.3	Methods and data collection procedure.....	32
4.4	Data analysis.....	33
5	RESULTS.....	35
5.1	RQ1 - What kind of views do IT professionals have about workplace learning?....	35
5.2	RQ2 - How do IT professionals learn at work?.....	37
5.2.1	<i>Individual activities</i>	<i>38</i>
5.2.2	<i>Social activities.....</i>	<i>39</i>
5.2.3	<i>General processes</i>	<i>40</i>
5.3	RQ3 - What influences learning at the workplace in the IT industry?.....	41
5.3.1	<i>Factors at the individual level.....</i>	<i>42</i>
5.3.2	<i>Factors at the team level</i>	<i>47</i>
5.3.3	<i>Factors at the organisational level</i>	<i>50</i>
5.3.4	<i>Factors beyond the organisation.....</i>	<i>53</i>
5.4	Overview of the main findings.....	54
6	DISCUSSION	56

6.1	Epistemological components of learning conceptions	56
6.2	Procedural components of learning conceptions.....	57
6.3	Individual and context matter together.....	58
6.4	Time – an overarching theme.....	59
7	Conclusion.....	61
7.1	Validity and reliability.....	61
7.2	Limitations	61
7.3	Implications for practice and future research.....	62
	References	63
	Appendix 1	74

List of tables

Table 2.1 Overview of the three metaphors of learning, adapted from Paavola & Hakkarainen (2005)	11
Table 2.2 Levels of epistemological development, adapted from Van Rossum & Hamer (2010)	16
Table 2.3 Features of expensive and restrictive learning environments (Fuller & Unwin, 2004)	28
Table 5.1 Learning processes identified by professionals working in the IT field	38
Table 5.2 Factors influencing workplace learning at the individual level	42
Table 5.3 Factors influencing workplace learning at the team level.....	47
Table 5.4 Factors influencing workplace learning at the organisational level.....	50
Table 5.5 Factors influencing workplace learning beyond the organisation.....	54

List of figures

Figure 2.1 Team Learning Model (Edmondson, 1999, p. 357)..... 22

Figure 2.2 Model of Team learning process (Edmondson, 2003)..... 23

Figure 2.3 Model of team learning beliefs and behaviours (Van den Bossche et al., 2006, p. 503)..... 25

1 Introduction

Several organisations have been aiming to identify driving forces that will be impacting the way people live and work in the 21st century. The OECD report on the ‘Future of Work and Skills’ (2017) have singled out the advances in technology, demographic change and globalisation as the major forces shaping working life in the future.

Fidler (2016), in The Future Skills report listed increased automation and new organisational models, more specifically, that will require different skills from the workforce of the future, including personal skills (resilience), people skills (cross-cultural competence, social intelligence and virtual collaboration), and applied knowledge (novel and adaptive thinking, cognitive load management and sense-making), emphasising the overall need to be ‘*adaptable lifelong learners*’. Interpersonal skills, higher-order cognitive skills and systems skills were also featuring as crucial in ‘The Future of Skills - Employment in 2030’ report by Bakhshi, Downing, Osborne, & Schneider (2017). Davies, Fidler, & Gorbis (2011) suggest the rise of AI, longevity, big data, new media ecology, networked structures and the connected world are the trends that will have the most impact on everyday life and work in the coming decades. The report advocates for transdisciplinarity, instead of multidisciplinarity, as a requirement, bringing about the maturing of the ‘T’-shaped worker whose in-depth knowledge of a discipline is coupled with an understanding of several other disciplines.

All these social, technological and demographic changes are forecasting the development of a new learning economy, where “the most successful people will be those who learn how to learn together” (Jassal & Clark, 2016). The rising importance of informal and deliberate learning is evident (Nerland, 2008; Tyler, Choy, Smith & Dymock, 2014).

Information Technology (IT) is defined as a field that deals with computer-based information systems, including design, development, implementation and management. IT is on the front-line of disruption. Developments in the IT field are both the cause and consequence of the advancement of technology and its role in being identified as a megatrend. More and more companies and organisations are preparing for a digital transformation, increasing demand for technology solutions and thus creating a “Brave new IT world” (Goles, Hawk, & Kaiser, 2009). The role of IT in organisations is also changing, and tasks and assignments in IT are most often ill-defined, ambiguous and non-routine (Dingsøy, Faegri, Dyba, Haugset, & Lindsjorn, 2016). Also the tools of the trade are ever more complex thus requiring extensive teamwork resulting in the changing composition of skills needed in the field. The human factor has become as important as the machines and the processes (Capretz, 2014). Flexibility and the ability to learn,

interpersonal and social interaction skills are all crucial for a successful career (Lavy & Yadin, 2013, Lumbreras, Crespo, Palacios, & Berbis, 2009).

Learning and the knowledge culture in this field is distinctive because the artefacts of the job constitute the conditions for the work and also serve as the subject matter of the professional expertise. In this case, the artefacts themselves have an ambiguous quality, they are “both ready to be used and in a process of transformation” (Nerland, 2008, p60). Furthermore, changes in knowledge practices happen earlier in IT than in other fields, “software development remains an archetype of knowledge work” (Dingsøyr et al., 2016, p. 109).

Learning as an important component of life is nothing new. What has changed, however, is the speed at which one is required to absorb, manipulate and produce new knowledge. This study intends to examine learning in the context of the workplace as understood by the people immersed in that workplace.

Fundamental assumptions about the nature of knowledge and learning, or so-called epistemological beliefs, play a salient role in learning (Hofer & Pintrich, 1997; Schommer, 1990). The kind of theories people have about intelligence, the nature of knowledge or the learning process itself influences the way they engage in learning activities. Attitudes or beliefs largely drive one’s behaviour (Weinberg, 2015).

The relation between epistemological beliefs and learning outcomes or performance have been studied within the formal educational contexts, indicating that having naive conceptions about learning most often lead to lower achievement, while having more sophisticated beliefs result in better outcomes as learners have a more proactive approach and implement more advanced strategies for learning (Cano & Cardelle-Elawar, 2008; Schommer-Aikins, Duell, & Hutter, 2005; Cano, 2005; Lising & Elby, 2005; Schoenfeld, 1983).

The concept of epistemological beliefs in the work context is much less explored. The first notable study in an organisational context was done by Tickle, Brownlee, and Nailon (2005), where they linked transformational leader characteristics to that of constructivist teachers. It is reasonable to presume that workers’ learning and working performance is linked with “the degree of elaboration of their system of epistemological beliefs” (Harteis, Gruber & Lehner, 2006, p126). The socially embedded nature of epistemologies (Hofer & Pintrich, 1997) makes alterations to those beliefs possible if one is exposed to new experiences which in turn causes the re-evaluation of those personal beliefs. Weinberg (2015) also argues that epistemology affects collaborative relationships, which as we saw, underpin modern knowledge work, especially so in the IT industry.

It is, therefore, useful to explore the beliefs of the 'learners' outside of the formal education sector, since the workplace is more and more often seen as a distinct type of learning environment where constant learning is explicitly required and working is seen as representing a different, complex way of learning (Billett, 2004; Smith & Kelly, 2016).

2 Theoretical framework

2.1 Conceptual understanding of workplace learning

At the early stages of workplace learning (WPL) research, studies mostly focused around work efficiency, while towards the turn of the century, human capital development gained prominence, whereas most recent research has started to examine workplaces as context or environments for learning (Olsen & Tikkanen, 2018). The field of WPL research is multidisciplinary, involving the fields of adult education, economics, sociology, management, organisational development, industrial psychology or learning sciences among others. All these disciplines have their own distinct perspectives, concepts or theories and research methodologies and instruments, which contributes to the difficulty of forming a universal definition or theory of WPL (Boud, & Garrick, 1999). Billett and Choy (2013) identify three areas that can assist in understanding learning at work: 1, the recent changes in requirements towards work performance, 2, conceptual understanding of learning and its processes, and 3, the relationship between the individual and social aspects of WPL.

The following section briefly introduces developments on the conceptualisation of learning in the context of work, comparing it to formal ways of learning on occasion and through the presentation of selected theories and concepts.

The most notable view of learning has been one that is associated with the ‘acquisition metaphor’ (Sfard, 1998; Hager, 2004), where learning is seen as a product, the gaining of knowledge or a skill and has been the prominent view shaping formal education, where knowledge is a property of an individual mind. Beckett and Hager (2002) calls this the ‘standard paradigm of learning’ that focuses on the mind, thinking and memory with assessment and progression designed accordingly. Intellectual understanding is seen as superior to other types of learning, thinking is more important than action, and knowledge is considered universal (Hager, 2004). Fenwick (2012) posits, however, that knowledge is not stable, it transforms and gets challenged and so traditional conceptions are limited in understanding current challenges of learning in practice.

In contrast with the ‘standard paradigm’, the ‘emerging paradigm of learning’ is associated with the ‘participation’ and ‘knowledge creation metaphors’ (Sfard, 1998; Paavola, Lipponen & Hakkarainen, 2002). Table 2.1 below provides a summary of the main differences that characterise the three metaphors. The participation metaphor sees learning as a process, where learning is equated to making holistic, context sensitive judgments about appropriate actions in more

or less novel situations, where learning not only changes the learner but also the surroundings and contexts in which the learner is present. The knowledge creation metaphor focuses on mediated processes of knowledge creation. Learning here is understood as a collaborative effort with the main aim of developing (in cases radically) new ideas, practices or conceptual artefacts (Paavola et al., 2002).

Since most learning at work is informal, the emerging paradigm is deemed more suitable for examining WPL (Tynjälä, 2008). Hager (2004) also argues that the standard paradigm only describes a particular case of learning and that it should not be understood as describing all kinds of learning.

Table 2.1 Overview of the three metaphors of learning, adapted from Paavola & Hakkarainen (2005)

	Knowledge acquisition	Participation	Knowledge creation
Main focus	A process of adopting or constructing subject matter knowledge and mental representations	A process of participating in social communities Enculturation, cognitive socialization Norms, values, and identities	A process of creating and developing new material and conceptual artefacts Conscious knowledge advancement, discovery, and innovation
Unit of analysis	Individuals	Groups, communities, networks, and cultures	Individuals and groups creating mediating artefacts within cultural settings

Learning at work is more often seen as being innovative, as opposed to having a reproductive focus that characterises formal learning (Jarvis, 2012). Individual success at work is highly dependent on the activities and performance of others and competences are treated holistically, knowledge and the skills to apply that knowledge are all pertinent (Hager, 1998). Strategic learning at work warrants the utilisation of all relevant and available resources within the workplace (Billett & Choy, 2013). Further distinctions between the two contexts of learning relate to learning outcomes, as they are predictable and concrete in formal education, but are often unpredictable and vague at work. There are, however, signs that the boundaries of the two contexts are getting more and more blurred, making use of the advantages of each and creating the

possibility for new forms of learning to emerge (Tynjälä, 2008), where academia and the industry are collaborating closely. Such forms can be educational institutions providing a collection of module based courses that can be combined to meet company-specific demands; cross-discipline, out-of-the-box projects that build on collaborative work by students from several different faculties being mentored or coached by industry representatives; developing project or problem based learning modules that are aimed at work teams; recognising and accrediting learning programs developed at work; developing academic innovation labs and incubators, and beyond (Boud & Solomon, 2003; Ryan & Tilbury, 2013). Billett and Choy (2013) argue, that experiences at work need to be recognized and approved as learning. Pedagogies that help to gain access to and the sharing of tacit knowledge are needed. In general, WPL is multimodal and complex and is characterised by “(1) incidental and informal learning, (2) intentional, but non-formal learning activities related to work, and (3) formal on-the-job and off-the-job training” (Tynjälä, 2008, p140). Billett (2004) asserts that thinking and acting at work cannot be separated from learning, they are interdependent processes, in addition, the qualities of activities and interactions at work result in rich learning outcomes, which is why workplace affordances for learning need to be examined and negotiated by those present in that (learning) environment. “Workplaces represent a socially constituted and contested learning space whose participatory practices are key pedagogical devices.” (Billett, 2004, p319).

The debate about the values of seeing learning from either the cognitive or the situated or socio-cultural theoretical position is still ongoing, while attempts are also made to resolve the differences between them (Mason, 2007; Hodkinson, Biesta, & James, 2008). Hodkinson, et al. (2008) propose a ‘cultural theory of learning’, where they address the conceptual divisions of a) mind and body, b) individual and social, and c) structure and agency, by looking at the individual as part of a learning culture, and a learning culture as an aggregate of individuals, while keeping time and space in mind. “Learning as becoming transcends individual situations and learning cultures, but is always situational” (Hodkinson et al., 2008).

The works of Marsick and Watkins (i.e. Marsick & Watkins, 1990; Watkins & Marsick, 1992) have contributed to the development of workplace learning theories by analysing and conceptualising informal learning, of which incidental learning is a sub-category. Their focal concepts were experience and reflection, but, more importantly, also included the notions of ‘learning from experience, learning by doing, continuous learning for continuous improvement, accidental learning, self-managed learning or the learning organisation’ (Watkins & Marsick, 1992, p. 287). Informal learning is most often intentional, but, as opposed to formal learning, not

highly structured. It can happen for example through coaching or mentoring and depends heavily on the interests and motivation of the learner (Marsick, 2012). Informal learning is triggered by existing or foreseeable problem situations that require learning to take place before the situation can be solved (Jacobs & Park, 2009). Incidental learning is an unintended by-product of some other activity and is rarely recognised as learning by either the learners themselves or others as it cannot be confirmed instantly (Marsick, Watkins, Scully-Russ, & Nicolaidis, 2017). Both informal and incidental learning has the benefit of being embedded in work, thus having a clear connection to the actual activities, but they lack the advantage of formal learning in terms of awareness and conscious recognition of learning.

Argyris and Schön (1978) introduced the concepts of single- and double-loop learning. Their approach was influenced by organisational psychology and management theory. Single loop-learning refers to the actions taken when an error is detected and efforts are made to find alternative strategies to reach the given goal, within the given conditions, which means that the learner reacts and adapts to changing circumstances. Double-loop learning, on the other hand, requires the learner to re-examine those given goals and conditions. The role of reflection in single-loop learning is to make the techniques or strategies more effective or efficient. In double-loop learning, reflection is used to question the underlying ideas and principles. In an organisational context this would mean confronting the basic, governing ideas and policies that are taken for granted.

Schön (1983) has also made the concept of the ‘reflective practitioner’ an important part of the professional development discourse. In his view, the ability to ‘reflect-in-action’, which means that one examines their feeling, thinking or acting in a given situation and decides to make prompt corrections to their practice is a significant skill to have for any practitioner. In fact, this can be seen as an account of workplace learning, ‘with the focus on knowing occurring during the heat of practice actually happening, together with underpinnings that are spontaneous and, in part, unconscious, Schön advanced an innovative epistemology of professional practice’ (Hager, 2013, p. 19).

2.1.1 Understanding team-learning

Research on team learning has rapidly increased in the past few decades (Decuyper, Dochy & Van den Bossche, 2010) following the escalation of the use of teamwork as a base for organising work. Teams are now ubiquitous units in terms of both working and learning in organisations (Caldwell & O’Reilly, 2003; Kozlowski & Bell, 2012) because they are viewed as being

more appropriate for dealing with complex and changing contexts by utilising cross disciplinary knowledge, and are used more and more often in formal education as well at all levels (Millis & Cottell, 1998; Johnson, Johnson, & Smith, 2007; Hmelo-Silver, Chinn, Chan, & O'Donnell 2013; Gijbels, Van den Bossche & Loyens, 2013). To understand the different aspects of teamwork and team learning, it is useful to define what constitutes a 'team', and for that Cohen and Bailey's (1997, p. 241) description is adopted here: "A team is a collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and are seen by others as a social entity embedded in one or more larger social systems". A few different terms are used in the literature to refer to the learning taking place in a set-up like that, dealing with slightly different constructs and learning processes included, such as 'group learning', 'small group learning', 'cooperative learning', 'collaborative learning' or 'team learning' (Wilson, Goodman, & Cronin, 2007; Davidson & Major, 2014). In order to avoid confusion, the term 'collaborative learning' will be used to refer to group-based learning in educational settings, and the term 'team learning' will be used to refer to group-based learning in a work setting.

Through an extensive review, Johnson & Johnson (2003) identified several benefits of learning collaboratively (in comparison to individual learning or learning in a competitive arrangement) that relate to both social and individual aspects, including improved decision making, better performance, greater social support, better social relationships, critical thinking, deeper level learning, better knowledge acquisition or higher level of self-esteem (Laal & Ghodsi, 2012). As Dillenbourg (1999) argues, having more than one person included in the learning process provides opportunities for different types of cognitive mechanisms to be activated (knowledge elicitation, internalisation, etc), compared to mechanism that are triggered through activities conducted individually (induction, deduction, compilation, etc), thus enhancing the learning of the individuals involved. However, there is no guarantee that these mechanisms automatically occur or result in effective learning when a group is established. There is ample evidence provided by both formal education (Cohen, 1994; Barron, 2003; Van den Bossche, Gijbels, Segers, & Kirschner, 2006; Järvelä et al, 2014) and workplace learning research (Raes, Kyndt, Decuyper, Van den Bossche, & Dochy, 2015) indicating that achieving successful collaborative or team learning in complex, real world situations is neither easy, nor straightforward and requires certain conditions to be present. While collaborative learning and team learning are both concerned with these conditions and processes, Dochy, Gijbels, Raes and Kyndt (2014) argue that there is a key difference between them, as collaborative learning is more concerned with learning outputs at the individual level in the forms of academic achievement, self-esteem or

transfer of learning, while team learning regards learning outputs at the team level, such as shared vision, mutually shared cognition, group efficacy or improved team productivity. Senge (1990) views team learning as a process leading to desired team outputs through the alignment and development of the capacity of the team, identifying the presence of shared vision and individual mastery as key conditions. Decuyper et al. (2010) explain team learning as a process of action, reflection and boundary crossing.

2.2 Individual beliefs and conceptions

Pratt (1992) defines conception as having “specific meanings attached to phenomena which mediate our response to situations involving these phenomena” (p 204). One’s conception of knowing and learning has an effect on one’s approaches to learning and consequently on the outcomes of learning (Hofer & Pintrich, 1997; Bromme, Pieschl, & Stahl, 2009; Van Rossum & Hamer, 2010).

Individuals’ beliefs of learning (and teaching) and knowing have been extensively studied within the formal education sector, including high-school and university students (Metallidou, 2012; Tsai, Ho, Liang, & Lin, 2011; Dahl, Bals, & Turi, 2005), students in teacher training (Chan, 2009; Horgan & Gardiner-Hyland, 2019), in-service teachers at secondary and tertiary levels (Donche, De Maeyer, & Van Petegem, 2007), adult learners in distance education (Makoe, Richardson, & Price, 2008) and even second-career teachers (Tigchelaar, Vermunt & Brouwer, 2014).

Van Rossum & Hamer (2010) developed a six-stage model of epistemological development that charts people’s varying understanding of learning in an inclusive hierarchical way, that is, conceptions of a higher level include and expand upon the lower levels (Table 2.2). Table 2.2 shows how learning conceptions develop from learning being equated to gaining knowledge about the world without learning having a specific purpose (level 1), which is well in line with the acquisition metaphor. At level 2, the purpose of learning is to reproduce knowledge, during exams or tests in an educational setting. Level 3 represents a selective approach, where the purpose of learning is the possible usefulness of the knowledge gained, that may be applied in the future. At level 4 the focus is on the process of abstracting meaning. The conception of level 5 is different from the previous level, because at this point learning acquires personal meaning, that is, the purpose or result of learning is “seeing things differently, a different view of the world, a – provisional – personal and contextuated view of reality” (Van Rossum & Hamer, 2010, p. 7). The product of learning at the level 6 conception can be interpreted as self-realisation, where the main focus of reflection is the individual itself. Levels 1-5 can be understood as

‘learning to know’, with level 6 relating more to ‘learning to be’ (Van Rossum & Hamer, 2010). It is argued, that age does not necessarily contribute to reaching higher levels and that “the least sophisticated ways of knowing [levels 1-3] can persist into advanced adulthood” (Van Rossum & Hamer, 2010, p572).

Table 2.2 Levels of epistemological development, adapted from Van Rossum & Hamer (2010)

Learning conceptions	
Level 1	Increasing knowledge
Level 2	Memorising
Level 3	Reproductive understanding / application or Application foreseen
Level 4	Understanding subject matter
Level 5	Widening horizons
Level 6	Growing self-awareness

Tynjälä (1997), on the other hand, identified seven different conceptions, that could not be hierarchically linked: 1) learning as an externally determined event/process, 2) learning as a developmental process, 3) learning as student activity, 4) learning as strategies/styles/approaches, 5) learning as information processing, 6) learning as an interactive process, 7) learning as a creative process.

These two sets of descriptions, however, are not mutually exclusive, as they appear to answer different kind of questions, regarding on the one hand the purpose of learning and on the other hand the actual processes and activities through which learning might occur. This distinction is also visible in research on conceptions of workplace learning, as the aspects of both ‘what’ learning is, as well as, ‘how’ learning happens and what is being learnt appear in the literature. However, perceptions about the processes and activities of learning at work seem to be more apparent.

Collin (2002), for example, examined development engineers’ and product designers’ conceptions of learning at work, with the overall aim to identify practices and situations in which learning is present. Six distinct learning processes were discerned: learning through doing the

job itself, learning through cooperating and interacting with colleagues, learning through evaluating work experiences, learning through taking over something new, learning through formal education and learning through extra-work contexts. These categories were not organised in a hierarchical system, though acquiring knowledge for application and understanding as well as creating knowledge are embedded within these processes, whether learning at work is seen as personal development cannot be determined. However, a crossover between work and personal life can be detected in the last category, learning through extra-work contexts, where a participant refers to applying knowledge gained through hobbies to solve work-related problems (Collin, 2002).

For a more recent study (Smith & Kelly, 2016) to investigate the types of learning that workers experienced and preferred, participants from a variety of industries (transport, tourism, hospitality, etc) were sampled. Workers most preferred ways of learning were a) working and sharing with another experienced worker on the job, b) individual mentoring by a workplace expert and c) group activities on site guided by a trainer or other facilitator (Smith & Kelly, 2016, p 237). Results indicate that learning and working are being regarded as overlapping, while also highlighting the importance of social relationships, and the role of trust and collegiality, as learning from co-workers and peers was preferred over learning from externals in the forms of formal training or other ways (Smith & Kelly, 2016). Learning through experience and from work colleagues was also prominent in a research by Fuller & Unwin (2005) that was conducted with workers in steel manufacturing. Participants in this study expressed the value of 'learning on the job'. Results, however, also uncovered attitudes to learning at work in light of changes made to the organisation of work. With the introduction of more flexible team-based working, employees with lower status saw their learning opportunities expanding (Fuller & Unwin, 2005).

Paloniemi (2006) documented perceptions of workplace learning processes as well as the content of learning at work in the fields of banking, pharmacy and horticulture. Learning from experience and through participation were regarded as the most important ways of learning at work, including learning from mistakes and successes or through problem solving. Knowledge gained through 'learning on the job' included tacit knowledge, such as ways of managing social interaction, communication or certain work processes. Other learning processes included trainings and individual studying of professional literature, or co-operation outside the work community (Paloniemi, 2006).

A study by Pillay, Boulton-Lewis, Wilss & Lankshear (2003) includes references to epistemological beliefs in a more explicit way. The research examined older workers' (around 40 years

old) conceptions of work and conceptions of learning at work in parallel, in a medical service and a public-sector transport organisation. The argument to study both conceptions at the same time was, that “if workers do not consider learning as part of their conception of work then the approaches they adopt in their work practice may not include learning” (Pillay, et al. 2003, p. 96). Based on their results, a hierarchical relation could be established between the conceptions of learning at work, with the category of ‘acquiring skills to survive’ representing the lowest level. This level can be understood as a need to constantly upgrade one’s knowledge and skills because of the changing requirements of work, thus constituting a more surface level approach to learning. ‘Observing and experiencing’ as a second level conception focuses on the application of skills and knowledge and developing understanding as a result. Many participants conceptualised workplace learning as ‘taking formal courses’, but only one person connected it with learning as a ‘continuous lifelong process’ which represents the fourth level, as it relates to learning from all experiences. Only one person evidenced the conception of learning at work as ‘changing as a person’, which is the highest-level conception in this study, where the boundaries between work, learning at work and learning outside work are less distinct and where changes in one aspect are seen to impact attitude and behaviour in the other aspects (Pillay, et al. 2003). More workers reported the lower rather than higher conceptions of learning at work, also including participants with leadership positions and higher academic qualifications. Pillay, et al. (2003) expressed concern regarding this finding, speculating that leaders with lower level conceptions may influence what kind of conception their subordinates are able to develop. Employees with higher level conceptions are few, but they are the ones that tend to think more critically, be more creative and reflective (Pillay, et al. 2003).

If one side of a coin is about workers’ conceptions of learning at work, then the other side is about the conception of those that have the possibility to shape and influence workplace learning for those workers. Slotte, Tynjälä, and Hytönen (2004) studied human resource development (HRD) professionals’ views about learning at work in a successful multinational company. The perspectives covered individual, collaborative and organisational learning. Learning at work was clearly seen as multifaceted and as embedded in everyday work, highlighting the importance of communication and interaction. Participants of the study have raised the important question of assessment, as learning by doing and learning through practical work-related situations in an informal way creates challenges for attempting to validate and appraise the outcomes of such learning, furthermore “it is necessary to take into account people’s different learning needs and conceptions of learning and, more generally, recognize the diversity of professional development activities” (Slotte et al., 2004, p. 494). HRD professionals in this study

also highlighted the importance of raising awareness amongst managers about the principles of and varying ways of individual and organizational learning (Slotte et al., 2004).

Managers were the participants of a study by Ellinger & Bostrom (2002) where the managers' beliefs of their role as facilitators of learning, their beliefs of the learning process and of learners were explored. Managers stressed the importance of learning and described it as an ongoing, iterative process that is best supported by setting challenging goals and expectations and providing feedback for their employees. Furthermore, learning can best be achieved if it is integrated into work where learners accept and take on the responsibility for their own learning and are also held accountable. Participants in this study were purposely chosen as they were regarded to be exemplary 'facilitators of learning' in a learning-oriented organisation and regarded themselves as active, lifelong learners (Ellinger & Bostrom, 2002).

2.3 Factors influencing workplace learning at different levels

As work is becoming more learning intensive, it is important to chart and understand what influences learning at work (Sambrook, 2005). Individual and contextual factors that either support or constrain learning at work are introduced in the following section with regards to individual and team learning. These factors are located at the level of the individual, the team or the organisation. The organisation in this case is considered as a context for individual and team learning, not as a learning entity in itself.

2.3.1 Factors at the individual level

Because of the multi-disciplinary nature of workplace learning research, various overlapping concepts appear in the literature that can be considered as individual factors influencing one's learning directed behaviour at work, such as work-capacity, self-directed learning capacity, agency, motivation, engagement, curiosity, self-efficacy or learning capacity and intention among others.

When discussing delimiters and enhancers of informal and incidental learning Marsick, Watkins, Callahan & Volpe (2008) identified one's work capacity as an individual condition affecting one's learning. Work-capacity is linked to intellectual ability concerning goal-directed behaviour and problem solving and the ability to deal with increasing complexity. Informal learning requires that one is able to navigate along working and learning tasks independently, meaning that they are self-directed in their learning endeavour (Kegan, 1994). Being self-directed entails that one's behaviour is goal directed in such way that they are able to appraise a situation

for its learning potential in relation to their learning goals and therefore consciously engage in the identified learning situation (Marsick et al, 2008). Self-directedness is considered to be essential for life-long learning, including learning at work as career development, and it “(a) is changeable, (b) is an active approach, (c) centres on the attainment of the individual’s goals, (d) has a long-term focus and (e) is dynamic” (Raemdonck, Thijssen, & de Greef, 2017, p. 402).

A related concept that features in the literature about professional learning and development is agency, or professional agency. While the concept itself does not have an agreed upon definition, individuals are considered agentic when they are able and willing to make choices or decisions and act on those decisions and by doing so exerting control over their lives and their surroundings (Goller & Paloniemi, 2017). Agency and agentic behaviour are also discussed in relation to proactivity, creativity and innovation (Eteläpelto, Vähäsantanen, Hökkä & Paloniemi, 2013) as well as in relation to participation and learning through work, by seeing work as participatory practice requiring and depending on personal engagement (Billett, 2011).

Creativity and proactivity are seen as enhancers of informal learning by Marsick & Watkins (1990). Creativity helps people to expand and adapt their existing mental models, while proactivity means that people are able and willing to recognise and take up learning opportunities when they arise. Marsick, et al (2008) also highlight the importance of reflection, explaining that ‘critical reflectivity is the ability to delve deeply into reasons why (...) desired results do not materialize.’ (p. 576). Furthermore, in a study with workplace learning and performance improvement professionals Berg & Chyung (2008) found that the “level of interest in their current field” was affecting participants’ engagement in informal learning the most. Motivation, whether intrinsic, like curiosity (Reio & Wiswell, 2000) or extrinsic, is a major influencing factor for engaging in work related learning (Sambrook, 2005). Just as individual commitment, self-confidence or self-efficacy (Tynjälä, 2012), empowerment and flexibility are necessary characteristics that support learning (Jamali, Khoury & Sahyoun, 2006; Eraut & Hirsh, 2007).

In addition, Hodkinson et al. (2004) bring attention to the individual dimensions affecting one’s engagement in workplace learning in terms of the workers’ prior knowledge, understanding and skills, their attitudes and its influence on the workplace culture as well as the sense of identity that workers develop in the given context. Evans, Hodkinson, Rainbird & Unwin (2009) further argue, that “learners’ previous and parallel life experiences, such as social and educational backgrounds, financial situation, family life, or prior workplace practices influence and shape their outlooks and dispositions” towards workplace learning (p. 82).

2.3.2 Factors at the team level

Factors at the level of the team are considered in relation to both the learning of individuals as team members, as well as the learning of a team as a unit. This, by definition, requires that the way work is organised relies on a team-based structure, where the complexity of the task necessitates collaboration. Since there are more than one person involved in the learning process, interpersonal and social issues need to be considered alongside task-related factors.

Kayes and Burnett (2006) identified factors supporting team learning in the form of shared beliefs. These beliefs relate to, on the one hand, interpersonal relations including the psychological climate, the level of affective trust and emotional intelligence, and on the other hand to task beliefs, in terms of cognitive trust, team awareness, goal sharing perception and team efficacy.

Carmeli, Brueller & Dutton (2009) found that positive, high-quality work relationships are a key factor contributing to learning behaviours through the establishment of psychological safety, while these relationships also affect the quality of team communication in terms of frequency, timeliness and accuracy (Gittell, 2003).

Edmondson (1999) developed a model of work-team learning and conducted a study using both qualitative and quantitative methods with 51 work teams, exploring the constructs in the model, including antecedent, process, and outcome variables of teamwork and learning. The variables in the model are team structures, team safety and efficacy, team learning behaviour and team performance (Figure 2.1). Edmondson introduced the concept of team psychological safety, which she defines “as a shared belief that the team is safe for interpersonal risk taking. For the most part, this belief tends to be tacit - taken for granted and not given direct attention either by individuals or by the team as a whole” (Edmondson 1999, p354). She found that learning behaviour in teams was significantly positively associated with team performance and that team psychological safety significantly predicted team learning behaviour.

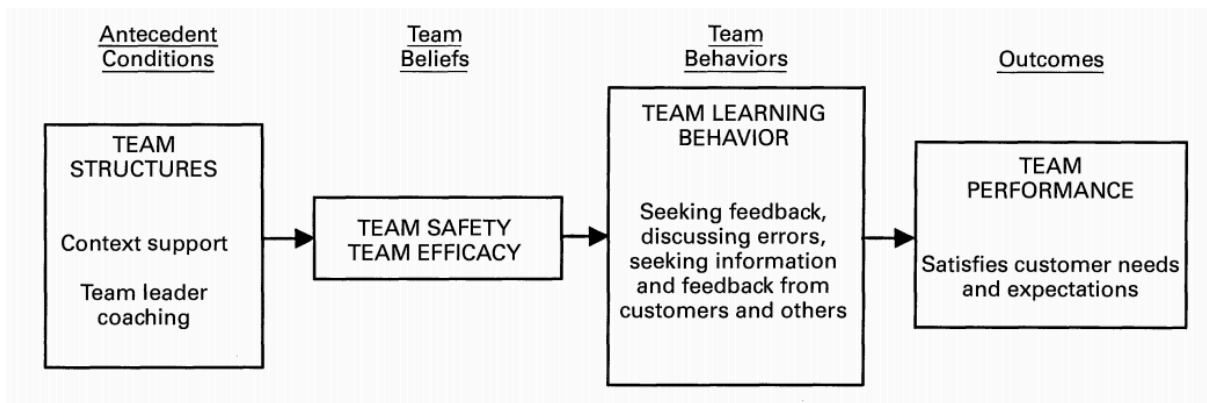


Figure 2.1 Team Learning Model (Edmondson, 1999, p. 357)

Based on this model, aspects of team structures related to clearly defined common goals, contextual support (such as available resources, access to information or reward schemes) and leadership style, coaching behaviour in particular as well as being a role model for learning, are associated with increased team performance. Edmondson (1999) considers these as antecedents of team psychological safety, as they reduce the level of interpersonal risk associated with certain learning processes, such as expressing disagreement or highlighting errors.

Team beliefs consist of two complementary concepts, team psychological safety and team efficacy. Team efficacy is a group level phenomenon based on Bandura's (1997) concept of individual self-efficacy, referring to the level of confidence that the team has about its ability to do its work well and achieve its goals, as well as being able to use team learning to contribute to increased team performance. Team behaviour is a result of the structural features being converted through team beliefs (Edmondson, 1999). Learning in this model is conceptualised as a process of reflection and action. Learning is enacted through such activities as seeking feedback, reflecting on results, asking questions or experimenting (Edmondson, 1999). The most important finding of the study is "that engaging in learning behaviour in a team is highly dependent on team psychological safety" (Edmondson, 1999, p376).

In her second model, Edmondson (2003) has introduced and explored the role of shared (learning) goal and has described team learning as an iterative process of acting and reflecting and adjusting. Furthermore, the model (Figure 2.2) considers the team leader to be in a critical position to shape the learning process itself.

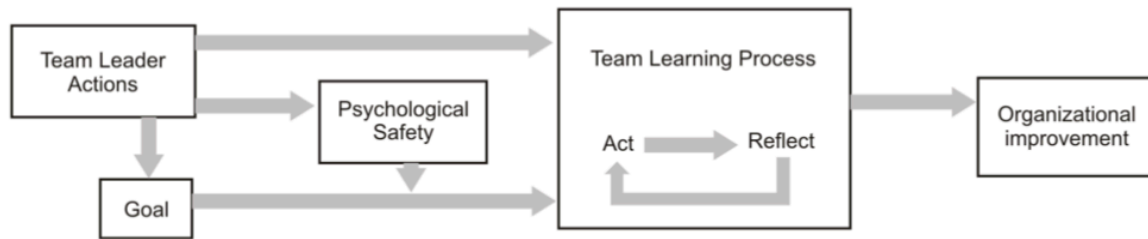


Figure 2.2 Model of Team learning process (Edmondson, 2003)

Psychological safety is further explored here with respect to temporal and focal aspects, contrasting it with the concept of trust. The short-term interpersonal consequences of, for example, pointing out a mistake are judged against the longer-term consequences of not carrying out the action. If the risk of being seen as ignorant, incompetent, negative or disruptive is minimal at that moment, team learning processes are likely to occur. Additionally, the construct of trust relates to the potential actions of others, while a psychologically safe climate allows the focus to be on one's own actions.

During the iterative cycle of learning, reflection requires the teams to possess self-awareness and agency to be able to make adjustments (West, 2000). Team reflection may happen at different times (at mid-point or end of project, etc), with differing frequency (daily or once, etc) and can have different purposes (adjusting along the way or learning for subsequent projects). These cycles of action and reflection provide a structure for team learning (Edmondson, 2003). Having a shared goal provides the bases for reflection and aligns the actions of team members. The role of a (learning) goal is to motivate the team to exert the needed effort for learning and psychological safety can enhance this motivation. Edmondson (2003) asserts that the process of creating a shared goal might even be more important than the actual goal itself, as it leads to the creation of a shared understanding of the task and implies ways of how the team might work together.

Edmondson (2003) believes that effective team learning can be achieved, when the team has established “structure without rigidity” and “safety without complacency” (p. 272), which constitutes the job of the team leader. Hence, it is crucial that team leaders possess adequate interpersonal skills to manage the social and psychological aspects of the learning environment as well as be able to act as role models for the team. The model, however, does not consider situations where leadership is distributed among the members, and the team relies on external coaching to overcome internal challenges.

London and Sessa (2007) examined teams and team learning as part of a bigger system. They adopt the view that learning is a cyclical process that takes into consideration the team's ability and motivation to identify and respond to learning needs, the actual learning experiences and the different ways in which the learning is applied, as well as conditions that affect learning.

The triggers for learning, or stimuli, affect the group in such a way that they cannot continue to work successfully without addressing the impeding issues. This stimulus may emerge internally or in the external environment in the forms of opportunities, challenges or pressures and can vary in strength. These may get detected by a leader or facilitator, or the team members themselves. They become stimulus for learning by disturbing the group's status quo.

Whether and how the team acts upon that stimuli depends on the team's readiness to learn. Readiness is higher if the team has a broader awareness of the demands and concerns of people, groups and systems outside of the team, as well as 'appropriate boundary permeability'. The team's boundaries need to allow information and resources to pass through from the outside or leave the group, but at a level that doesn't overwhelm or drain the team. The more mature a team is, the higher its readiness to learn, as team members are more willing to experiment and collaborate and are more committed to shared goals.

The model also calls attention to the support and resources that need to be available for the team to be able to learn. London & Sessa (2007) remark that learning is a process internal to the group, no outsiders can learn for the group, but outsiders (the organisation, a coach, facilitator, consultants, etc) can provide resources (including time) and can support the team's learning. Support can take the forms of structure, strategies, direction, etc. Interventions, however, will only be accepted, if the team is ready to learn (Hackman & Wageman, 2005) and the intervention is well aligned with the stimuli that the group identified and decided to address. An unwelcome intervention is counterproductive (London & Sessa, 2007).

Van den Bossche et al. (2006) have built a team learning model (Figure 2.3) by examining and combining (socio-)cognitive aspects of collaborative learning and social aspects of successful teamwork. In a study conducted with higher education students working in teams, they examined what types of interactions or types of discourses constitute knowledge-building processes that result in mutually shared cognition, such as a shared conception of a problem. These processes are regarded as team learning behaviour.

Collaboration requires construction and co-construction of meaning (the understanding of a situation or problem) and the use of negotiation to reach an agreement (Van den Bossche et al.,

2006). Diversity in opinions or interpretations may derail the process of forming a shared understanding if those are not associated with the possible variations in the analysis of the given problem, but rather seen as personal dismissal that may result in interpersonal conflict (De Dreu & Weingart, 2003). A conflict that is cognitive in nature, on the other hand, provides the basis for developing a more elaborate insight by considering and respecting others' viewpoints and regarding differences as a source of learning (Engeström, Engeström, & Kärkkäinen, 1995). The foundation for the team learning behaviour is made up of beliefs about the interpersonal context. Similarly, to the team learning model by Edmondson (1999), these beliefs include psychological safety and group potency (group efficacy), but also consider task interdependence, task cohesion (a shared commitment to group effort), and social cohesion (emotional connections among the members).

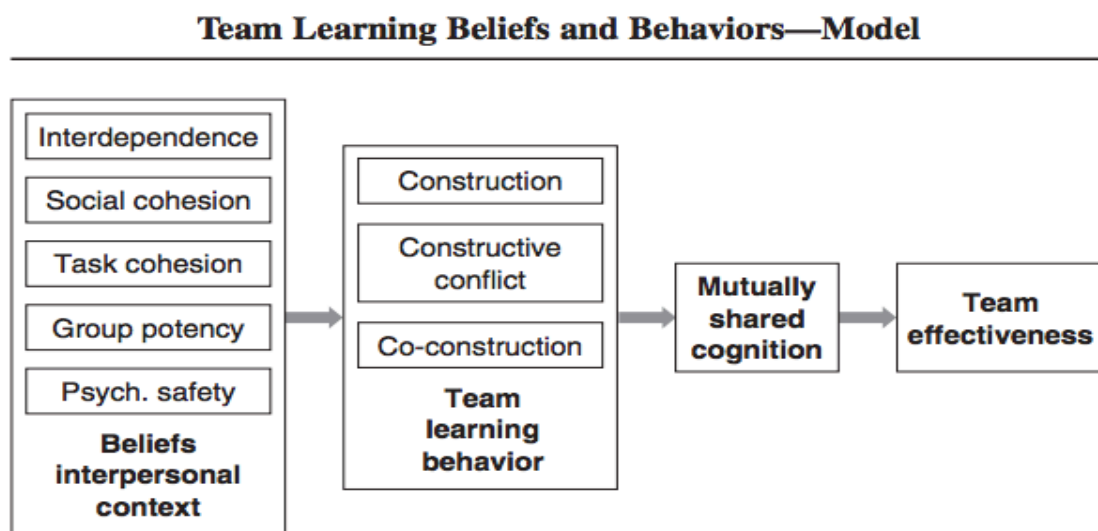


Figure 2.3 Model of team learning beliefs and behaviours (Van den Bossche et al., 2006, p. 503)

The work of Van den Bossche et al (2006) highlights the advantages of combining findings from formal education research and workplace learning or organisational research in advancing our understanding of the learning processes and the conditions that promote successful learning.

2.3.3 Factors at the level of the organisation

At the organisational level alongside the internal culture, the accompanying learning culture, the available networks and communities that provide opportunities for participation (Smith & Kelly, 2016), the leadership style demonstrated by the managers or leaders have an influence

on employees' learning oriented behaviour (Sambrook & Stewart, 2000), with further contextual factors, like time pressure (Svensson, 2009), and other resource constraints that may prevent people from engaging in learning activities (Marsick et al., 2008).

Laiken (2001) argues that a humanist approach is required to support the holistic learning of employees, seeing them as whole learners, including emotional, cognitive, social and physical aspects. Leaders are role models and to encourage employee learning, they also need to be role model learners who establish a no-blame culture, where mistakes are regarded as opportunities and that sufficient amount of time is provided for reflection (Laiken, 2003). As managers, project and team leaders have more responsibility for creating a supportive learning environment, they are becoming 'educational leaders', who need to understand how to align business strategies with appropriate learning activities and processes (Svensson, 2009). Laiken (2003) also suggests that the following activities are core activities for creating a learning culture: the creation of a value-based vision for the organisation, constant monitoring that this vision and values are manifested through the systems and procedures and that the vision gets evaluated in light of the ongoing everyday work-life.

The expansive-restrictive continuum is a conceptual framework developed by Fuller and Unwin (2004) that aims to outline the characteristics of workplace learning environments (WPLE). They posit that learning opportunities at work, are determined by a framework that is based on management decisions and business objectives. Opportunities for learning are affected by how the work is organised, which creates the context and sets the conditions for participation. The identified features of WPLE are related to two broader categories: organisational context and culture and learning opportunities through various forms of participation (Hager, 2013), thus providing some content to the 'participation metaphor', mentioned before.

Learning environments can range from expansive conditions at one end to restrictive conditions at the other. "An expansive feature would regard workforce development as a vehicle for aligning the twin goals of developing individual and organisational capability" (Unwin, 2008 p5). More expansive features would create a richer environment. An individual's experience is then placed somewhere along the continuum. Some indicators of the presence (or absence) of "opportunities to learn broadly as well as deeply" (Fuller and Unwin, 2003, p43) can be seen in Table 2.3, below. The framework was developed based on studies examining apprentices and was later amended to be applicable to a wider range of workplaces and contexts. The features

represent three distinct dimensions: “(1) opportunities for engaging in multiple (and overlapping) communities of practice at and beyond the workplace; (2) access to a multidimensional approach to the acquisition of expertise through the organisation of work and design; and (3) the opportunity to pursue knowledge-based courses and qualifications relating to work’ (Fuller and Unwin, 2004, p126).

Kirby, Knapper, Evans, Carty, and Gradule (2003) examined the relationship between employees’ perception of their work climate and their approaches to learning and their results indicated, that the aspects of good supervision and choice-independence are positively associated with deep-level approaches to learning, while real or perceived high workload resulted in more surface-level learning. Other contextual factors, such as organisational structure or hierarchy also affects employees’ learning opportunities, in terms of access to information or the possibility to accumulate knowledge and skills either within a discipline or about the organisation itself (Ashton, 2004). The impact of organisational hierarchy on employees’ opportunities for and engagement in learning was also shown in a research by Bryson, Pajo, Ward & Mallon (2006), where people positioned higher in the organisation experienced a more expansive learning environment. While, according to Ellinger (2005), organizational culture is the contextual factor having the strongest impact on informal learning, alongside unsupportive leaders and manager and micromanagement behaviours.

Table 2.3 Features of expensive and restrictive learning environments (Fuller & Unwin, 2004)

EXPANSIVE	RESTRICTIVE
Participation in multiple communities of practice inside and outside the workplace	Restricted participation in multiple communities of practice
Primary community of practice has shared ‘participative memory’: cultural inheritance of workforce development	Primary community of practice has little or no ‘participative memory’: no or little tradition of apprenticeship
Breadth: access to learning fostered by cross- company experiences	Narrow: access to learning restricted in terms of tasks/knowledge/location
Access to range of qualifications including knowledge-based VQ	Little or no access to qualifications
Planned time off-the-job including for knowledge-based courses and for reflection	Virtually all-on-job: limited opportunities for reflection
Gradual transition to full, rounded participation	Fast – transition as quick as possible
Vision of workplace learning: progression for career	Vision of workplace learning: static for job
Organizational recognition of, and support for employees as learners	Lack of organizational recognition of, and support for employees as learners
Workforce development is used as a vehicle for aligning the goals of developing the individual and organizational capability	Workforce development is used to tailor individual capability to organizational need
Workforce development fosters opportunities to extend identity through boundary crossing	Workforce development limits opportunities to extend identity: little boundary crossing experienced
Reification of ‘workplace curriculum’ highly developed (e.g. through documents, symbols, language, tools) and accessible to apprentices	Limited reification of ‘workplace curriculum’ patchy access to reificatory aspects of practice
Widely distributed skills	Polarized distribution of skills
Technical skills valued	Technical skills taken for granted
Knowledge and skills of whole workforce developed and valued	Knowledge and skills of key workers/groups developed and valued
Team work valued	Rigid specialist roles
Cross-boundary communication encouraged	Bounded communication
Managers as facilitators of workforce and individual development	Managers as controllers of workforce and individual development
Chances to learn new skills/jobs	Barriers to learning new skills/jobs
Innovation important	Innovation not important
Multidimensional view of expertise	Uni-dimensional top-down view of expertise

3 AIM AND RESEARCH QUESTIONS

The aim of the study is to gain information about how IT professionals understand learning and how they perceive the role of learning in working life.

The specific research questions are:

RQ1: What kind of views do IT professionals have about workplace learning?

RQ2: How do IT professionals learn at work?

RQ3: What influences learning at the workplace in the IT industry?

4 METHODS

4.1 Context and participants

4.1.1 Context

Information technology is a complex field, and there is a big variation in work environments and roles. This study was conducted in the context of eight organizations, where the number of employees varied between three and several hundred. Teamwork in this study is present in all organisations and working in teams happens either on a full-time basis or in combination with solo work or assignments. Teams often consist of people from several different disciplines or organisations. The teams themselves are in many cases multinational and on occasions geographically distributed. Tools, platforms and technologies and work procedures are evolving rapidly, and work is frequently carried out within tight timelines. The content of the work in the context of this study includes green field development, meaning the creation of completely new product or services, white label product with customisation, meaning the upgrade of an existing product with modifications to address specific needs as well as maintenance. Industries in this study cover retail, digital financial services, telecommunication, and software and hardware services. Work is carried out both as inhouse development work as well as at the client organizations' premises as consultant work.

One prominent way of organising work in the IT industry relies on the agile methodology. The participants in this study mostly work in assignments where management principles are derived from this type of project management and product development approach. Agile is a set of methods and practices that is underpinned by a particular mindset. While the methods and practices are used to increase productivity by changing the way how teams work, adopting the mindset creates the possibility for major transformation by opening the way to more extensive knowledge sharing and shared decision making (Stellman & Greene, 2016).

The agile approach is based on short iterative cycles, and rely heavily on the use of tacit knowledge, making collaboration and communication an essential part of work during product development (Palmquist, Lapham, Miller, Chick, & Ozkaya, 2013). Three principles of agile that are of particular interest from a learning sciences perspective are related to collaboration and regulation:

- Build projects around motivated individuals. Give them the environment and support they need and trust them to get the job done.
- The best architectures, requirements, and designs emerge from self-organizing teams.
- At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.

The four most used agile approaches or methods in software project management are Scrum, extreme programming (XP), Lean, and Kanban (Stellman & Greene, 2016). In the context of this study Scrum and Kanban are the most commonly used. The following section describes the features and flow of activities using Scrum.

In theory, the most important ideas underpinning Scrum are collective commitment and self-organization (Schwaber, 2004). Work is organised around a ‘sprint’, which is a 2 to 4-week time-period, containing all relevant events, such as meetings and workload management actions and can be regarded as a short-term project with the team working to achieve a commonly agreed goal within the sprint timeframe, aligning individual actions. The typical meetings included in a sprint are: the sprint planning, the daily meetups, the review and the retrospective. During *sprint planning* the team collectively decides what they are going to do in the given sprint based on pre-agreed priorities (chosen from the project backlog that contains product development tasks), taking into account the available resources and learnings from previous sprints about how much time it requires to accomplish particular tasks. This provides the possibility for monitoring how well the team is able to make estimates from sprint to another.

The daily meetups are very short, typically, 5 to 10 min meetings that are used for providing status updates to optimise team collaboration and performance by sharing issues that hinder individuals’ progress.

The review happens towards the end of the sprint where the team demonstrates the work that has been done and receives feedback from stakeholders. There is an assessment of the project backlog and evaluation of priorities, which can be adjusted to reflect changes in requirements or the market in general. The outcome of the sprint review informs the next sprint planning in terms of possible development task to be included.

During *the sprint retrospective* (or retro), the team discusses its ways of working, identifying what went well and what needs to improve, regarding both processes and relationship or other people related issues. The team devises an improvement plan to use during the following sprint.

While improvements can be implemented at any point during the sprint, the retro serves as a formal opportunity for the team to evaluate itself and adapt based on that evaluation.

Apart from these formal events, the team members are in constant contact via online communication channels, which are used for not only discussing work-related matters, but also for building and maintaining social relations.

4.1.2 Participants

The participants of this study were selected purposefully to represent a group of people that can provide information to be used to answer the research questions of this study, as they have relevant, rich insight, representing distinct views and perspectives. Four of the participants have learning and development responsibilities within their organisations, three participants work as senior software developers and three participants are entrepreneurs, being the CEO and/or founder of an IT start-up.

The participants represent four nationalities, nine are male and one is female. All of them have a minimum of seven years (maximum twenty years) of work experience in the field of IT and all have a higher education degree (one BSc, and nine MSc).

The anonymity of the participants is protected, so that no individual participant can be recognized when reporting the results.

4.2 Study design

This study follows the approach of phenomenography (Marton, 1986). “Phenomenography is an empirical research tradition that was designed to answer questions about thinking and learning” (Marton, 1986, p28). This approach was selected because it focuses on experience as the subject of the study, with the aim to explore the qualitatively different ways in which people perceive or understand a certain phenomenon and its various aspects. The roots of phenomenography are in educational research practice being concerned with how students understand learning. Correspondingly, workplace learning is a phenomenon that is informed by people’s everyday experiences and a phenomenographical approach helps to capture the multiple conceptions that people have.

4.3 Methods and data collection procedure

Semi-structured interview was chosen as a data collection method, because it allows to explore the participants’ experiences, accounts or feelings in more depth, by adapting or rephrasing the

questions, and probing further (Gibson, 2010). Additionally, the advantage of using semi-structured interviews is that the participants might bring up issues that were not previously considered, allowing the researcher to be responsive to the flow of discussion (Basit, 2010).

Data was collected during the months of november and december in 2018. An interview guide was developed with open ended questions to maximise flexibility, covering the broader topics of the workplace and tasks, motivation and skills, teamwork, and the social environment at work.

Data was collected through 10 semi-structured individual interviews that were held in English. English is a foreign language for all participants as well as the researcher but is a commonly used language in the domain field and participants had the necessary fluency to express themselves, so conducting the interviews in English was deemed appropriate for the purposes of this study. The interviews lasted between 40 minutes and 1,5 hours. Six interviews took place face to face, either at the workplace of the participants or at places suggested by them to ensure the highest level of comfort and familiarity possible. Three interviews took place through Skype and one through phone due to travel or timing issues. All interviews were audio recorded.

The participants were told to answer the questions based on their personal experiences and preferences and it was pointed out that there were no ‘right answers’. Many of the participants expressed afterwards that the interview provided them an unusual and welcome opportunity to reflect on their work and their views on learning within it.

4.4 Data analysis

Data was transcribed using the Sonix.ai web-based software. Sonix.ai uses artificial intelligence to convert speech to text. The accuracy of the transcribed material varied from 60 to 85%, with the skype and telephone recordings reaching considerably lower level of exactness. All recordings required further editing which was made possible by the in-built editing features of the software.

Data driven qualitative content analysis was chosen as an analysis method, because it “is context sensitive and therefore allows the researcher to process data texts that are significant, meaningful, informative, and even representational to others.” (Krippendorff, 2004, p41) The steps of qualitative content analysis were followed (Schreier, 2012). In line with the purposes of the study and the research questions, complete thoughts constitute the unit of analysis that range from short sentences to whole paragraphs. First, utterances relevant for the topic at hand were

identified and were given labels based on the content and meaning of the utterances. To determine different themes for the following stages of analysis the interviews were then considered as a whole to create a pool of meanings instead of attributing them to individual participants. For the next step the same process was repeated for the separate research questions. After the creation of a preliminary coding frame, following open coding (Hsieh & Shannon 2005), the data corpus was examined again for allowing the emergence of information that was previously not considered. Concepts were derived from the data, as the phenomenon under study is complex and previous research related to it is fragmented (Elo & Kyngäs, 2008). It is fully acknowledged, that the creation of the codes and the interpretation during analysis reflects the subjective choices made when constructing the structure and theoretical background of the study (Sipe & Ghiso, 2004).

5 RESULTS

The results of this study are presented according to the specific research questions. IT professionals conceptual understanding of learning and workplace learning contain both epistemological as well as procedural elements, that are introduced separately through RQ1 and RQ2 respectively. Results for RQ3 contain information about IT professionals' views on factors that demand, support or constrain their learning at work that are present at the individual, team and organisational level, while some of the factors are characteristics of the industry in general.

5.1 RQ1 - What kind of views do IT professionals have about workplace learning?

The answers to this question reveal beliefs about the purpose or essence of learning, characteristics of workplace learning or the subject matter or content of learning. Results show that learning is deeply embedded in everyday work, and as such can arouse both negative and positive feelings. Learning is mostly understood as continuous professional or personal development, that, in one case, is described to contribute to increased self-awareness. The need for a more sophisticated understanding of learning amongst employees in general was also raised as an issue.

All participants were of the same opinion, that learning is a major component of their work, or that learning and work cannot be separated in their profession. Learning is essential from both an adaptive and a generative point of view. Adaptive in the sense, that acquiring new knowledge and skills is required to keep up-to-date in the rapidly evolving field, with the growing number of available technological solutions and emerging roles, and generative in the sense, that being successful or staying competitive entails creating new knowledge through the process of developing unique solutions to unique problems. Thus, learning, especially when it happens through working in a diverse team, leads to better outcomes in terms of both performance and products. Apart from learning being seen as necessary, participants' personal accounts or accounts about their colleagues revealed varying attitudes or feelings towards workplace learning, or how they would like it to be as opposed to how they experience it at present. The more negative descriptions referred to learning being hard or tiresome, or *"usually just a struggle to find a solution for a problem that you have at hand."* (P8). Mentioned alongside this were the feelings of fear and resistance, as explained by another participant: *"I know that it can be really difficult for people to... to always embrace new stuff. So they, they fear that, it's really easy to fear the changes. And if you learn new, or need to learn new stuff you can easily get kind of... start*

resisting or create some resistance to.. to new stuff because it's so comfortable being with what you already know." (P3). On the more positive side workplace learning was labeled as something cool or fun. It was also observed, that it is often something that happens unconsciously and it is also something that is hard to describe, especially if one never thinks about it or if one doesn't have the proper vocabulary to talk about it.

For some participants, learning, as continuous improvement, was seen in relation to career development, or growing one's expertise by gaining knowledge about technological tools, developing personal skills, extending one's understanding of various business domains or industries, or building a more refined view of an issue through dialogue with a range of different people. Others reflected on what team learning might entail, as in this case, *"I don't know if that is learning or not but, every time we have a new project and we have a new team, because the team is assembled newly with every new project, we don't have like fixed teams in any way, so then you spend probably the first few weeks on just getting to know each other and figure out how you work together. Like, what are the preferred tools maybe or how do you talk to each other, how often do you meet. In a sense maybe that is also learning, team learning in a way."* (P8).

Others had a more holistic view of learning, describing it as a process of becoming a better person. One participant made reference to work and life being tightly connected, explaining, that *"most of the things that I do is somehow related to learning anyway, because I think every time you have this interpersonal meeting between, you know, a group of people or two people, I think you learn something new. And I think that for me workplace learning is a lot about getting the perspectives and experiences of others. And somehow that... incorporate that into your own experiences. And I sort of learn from that to grow as a person"* (P9). Another participant described how one's 'working persona' and the 'non-working persona' cannot be detached from each other, and so there are no clear boundaries between learning that is meant for work and learning that is not, *"When you are thinking about learning, always think about all the aspects of learning and you cannot, kind of, like separate, okay I will now only learn technologies and only learn people skills for the work, but also I would try to, kind of, like become a better human being and kind of get better,... kind of like husband as such or something."* (P10).

There were a couple of references made also in relation to learning in formal education. While it is evident that learning happens at work, it is rarely labelled as such. Hence, a lot of people

still associate learning with the ways they used to study in school, *“they are kind of like somehow imprisoned by the ways that the school system was training them at early age and then they are trying to adopt the same ways that they used during their school years so therefore people are having quite outdated concepts or an understanding of learning.”* (P10), and this was considered to be a ‘challenge’.

Most participants in this study, however, had more ‘updated’ understanding of learning, like the one, who made the following comparison as an illustration, which can easily accommodate the metaphors of acquisition, participation as well as the metaphor of becoming: *“If you’d like to learn to play piano, then it’ll make sense to practice, rehearse alone sometimes. And then,.. and then try these skills in a team like a band, together with other musicians, see how this works in a different context. And then you will probably learn a lot from a lot of other musicians. Yeah,.. but you need to do your homework too and just the first time you play piano you can’t be part of a group, because you need to know the basics. That’s the same thing I think, it is like programming. You cannot work in a team if you don’t,.. if you can’t use an editor. Yeah. I fully realize there are so many different ways to learn.”* (P1).

5.2 RQ2 - How do IT professionals learn at work?

This question was concerned with discovering the different learning activities or processes that IT professionals engage in at work or for work related purposes. Informal learning was dominant throughout all the discussions, while formal learning was mentioned only in a couple occasions. A variety of both individual and team learning processes were identified, with ‘learning by doing’ being the most common and most favoured way.

No one activity can solely be placed in one category, but to be able to answer this question, I organised the data along a continuum from individual to gradually more social activities involving one or several other people, as shown in table below (Table 4).

Table 5.1 Learning processes identified by professionals working in the IT field

INDIVIDUAL	ONE-ON-ONE	GROUP
REFLECTING	GIVING AND RECEIVING FEEDBACK	TEAM REFLECTION
FORMAL LEARNING		THINKING TOGETHER
TEACHING	LEARNING FROM PEERS	
HOBBIES	LEARNING FROM EXPERTS OR MORE KNOWLEDGABLE PEERS	
LEARNING BY DOING		
INCIDENTAL LEARNING		

5.2.1 Individual activities

Reflection featured in several of the discussions, when participants made references to how they evaluated or appraised their actions, knowledge, experiences or thinking that helped them develop their competencies or skills further, *“It’s kind of a somehow natural to me or I find it very important. That’s probably why I pay attention to it... trying to kind of analyze after the situation what went well and what didn’t and how should I, you know, next time if I am in a similar situation how should I do.”* (P2). Interestingly, all the participants who talked about the importance of reflection were the ones who had responsibilities concerning the development of others.

Formal learning was most often taking the form of some kind of internal training or course, only one participant mentioned taking part in a course provided by a higher education institution. There was no reference made to learning collaboratively in a formal setting.

An interesting approach that was put forward by a participant is regarding teaching. One can argue that teaching is not a solitary process, however, in this case it refers to learning with the deliberate intention to later train others. The participant explained this approach in the following way: *“So the most effective way to learn, actually, is to teach to others. So, best way to learn new things is to teach it... So I was, basically because when you kind of like, when you are teaching something for other people then you need to kind of like fully understand the concept or the thing and then you need to kind of like conceptualise it and clarify it and then kind of like convey the message, or teach.”* (P10). Learning this way requires the person to not only understand the basic concepts, but also gain a deeper understanding of the issue by looking at it from different perspectives regarding the different possible audiences and questions that might be posed, and so discovering connections to other issues or gaps in one’s own understanding.

In a couple cases, it was described how things people learn through their hobbies or free-time activities can be useful for work too. *“It's part of their hobbies. So there is a lot of like special skills that they searched out or learned during their free time also.”* (P7), which then gets shared within the team or organisation. These concern mostly technology or engineering matters that are not core part of the daily assignments, like branching out to other areas in the field, but also including different views or mindset or understanding gained outside of work, as explained by a participant, *“It might be coming from totally different book or something that I'm reading and then I'm just connecting and hey, actually... Yes. Even though I would be totally,... yeah something different I wasn't expecting, but yeah connecting different things in my head.”* (P2).

5.2.2 Social activities

Processes around feedback can be split into two different types. One is most often part of the official appraisal procedure within organisations that is about one's performance in a given period, for which feedback is mainly given anonymously. This, however, can be accompanied by more instant and direct feedback from colleagues or peers, that couple of the participants proposed as a good way to learn, *“It will help people to see, get the feedback and then learn from the feedback that they own the feedback. They are the ones who go and talk to people and then they can learn from that.”* (P2). The other is part of the product development process and is more focused on the work that has been done, the quality of the service or the recently developed features of a product, which are then sought from clients or customers on a regular basis.

Learning from peers or experts is one of the most common ways to learn in IT. I decided to split these into two categories. Learning from peers mostly include discussing problems and solutions from different perspectives, like experiences with a certain technology or procedure that were also used or have been used by others, which can mean individuals or teams within the same organisation or even outside of it. This kind of learning can happen through internal or virtual communities of practice, or between project teams working with the same issue, but at different locations, like in this case, *“So we had, like months ago, we had a sharing session. We got together, physically together, in one place and we were sharing some of our experiences from from our projects and ... where the things that we're working and what were the things that that were not working, where were we failing or we didn't feel like it was working well enough and we were sharing those in order to to kind of, yeah, get the learnings from other people”* (P2). Knowledge-sharing during work was also seen as team learning by some participants, if for example the knowledge or use of some specific technology was required from all

team members. Meaning, that a team member created a new module or feature that other team members had to incorporate into their own work or for executing their own tasks.

Experts, on the other hand, clearly possess a much deeper understanding of specific topics or aspects of an issue. This kind of learning happens through face-to-face meetings or reading books, listening to podcasts, or accessing information using the internet in some other way, including the use of knowledge-sharing platforms, such as Stack Overflow.

Surprisingly, there was no remark made about conferences from any of the participants, even tho there are several established conferences taking place in close proximity, which are organised annually and where the presenter list includes well-known industry experts. At this point, the reason for the lack of mention cannot be given.

The most clearly recognisable team-level learning activities include team reflections and ‘thinking together’ events. Retrospectives or retros are regular, formal opportunities for teams to reflect on how they work, a time to discuss what went well, what didn’t go well and what kind of improvements can be made. This is also a time where they can discuss what the team has learnt, what experiments have been beneficial and what should be left out in the future. As there are no standards to be applied in a retro, the quality of the learning depends on the team’s and individual team members’ abilities, goals and motivation. ‘Thinking together’ is either a feature of a problem-solving process where inputs are needed from the whole team, *“we usually have like a one hour session where we do either brainstorming or we just stand at some whiteboard and draw some lines and squares and discuss, like discuss, the problem in detail.”* (P8) or during the scheduled planning meetings of the sprint, or other project planning events.

5.2.3 General processes

By far the most references were made to learning by doing. It can include carrying out any work process or task, be it individual or team-based at any point. It wasn’t only the most common, but was also the most preferred way of learning. Such learning occurs by engaging with a new subject through trial and error, or being in a situation that requires improvisation and thinking on one’s feet. For example, figuring out how to resolve a difficult conflict between people, which in turn increases one’s experience and knowledge. It can also mean experimenting with new things in a more deliberate way, like in the following case, *“Usually what I’m encouraging the team to do is to create experiments for the next let's say, sprint or the next two weeks of work about what do we want to do differently or how do we want to work differently for the next couple of sprints or couple of weeks, and trying new things.”* (P3).

It can also be understood as implementing one's theoretical knowledge, whether it is about the use of certain technology, or service design or other work practises in different settings, working with different people. Some of the participants have deliberately moved into untried roles, or placed themselves in unfamiliar situations in order to learn, as shown in the following example, *"And then I don't like sticking to routines so much. So then I end up finding myself in new different situations where I need to learn that 'OK now it looks like this' and then I need to, .. what do I need to accomplish then. And what do I need to understand and then learn from that."* (P2).

A couple references were made to learning happening incidentally, for example by overhearing other people's discussions, or seeing or reading something on the internet and only realising or remembering at a later time, that there was something useful learned. Taking part in interesting conversations can also trigger learning, as pointed out by a participant, *"It makes me think a little bit about the things that I haven't thought about before. And that's always interesting. Also that's part of this, you know, learning journey as well. Right? Because you start thinking about things that you haven't really thought about before. So then you wonder, okay, why have I never thought of this or start thinking *even more...* So that's interesting."* (P9).

5.3 RQ3 - What influences learning at the workplace in the IT industry?

To answer this question, I created a matrix of factors, based on the way they influence learning as well as the structural level where they are present, resulting in 12 categories, including a) driving factors, b) supporting factors, c) constraining factors at the level of the 1) individual, 2) the team, 3) the organisation or 4) the industry (or beyond the organisation). A general overview of the categories is presented as a table in Appendix 1.

The different factors at the different levels may reinforce, act against or complement each other in a fluid manner, but they are separated here for the sake of easier organisation and illustration. The factors' placement in the categories was decided by how it appeared in the discussions, being either present or not, for example, the existence of a 'language barrier' was regarded as constraining, while the direct reference to the 'lack of language barrier', would be considered a supporting factor. Also, in the cases of start-ups or small organisations, the levels of teams and organisations could be merged, as they represent the same structural work unit.

5.3.1 Factors at the individual level

Individual factors describe attitudes, skills or competencies that individuals possess as well as contextual factors in one’s personal life.

Table 5.2 Factors influencing workplace learning at the individual level

Driving-factors	Supporting-factors	Constraining-factors
Career safety Reputation	Learning orientation Personal mastery Sense of purpose Sense of competence Interest High level learning skills High level collaboration skills	Personal circumstances

Driving factors

The category of driving factors contains different reasons that participants mentioned that propels them personally for engaging in workplace learning. This category includes mostly extrinsic motivational factors. These factors were only mentioned by a small number of participants.

One example is career safety and getting a reasonable level of income, that was put forward by three participants:

“... at that time I thought that, well digitalisation and the IT is hundred percent sure choice, because it's just growing and you will never ever get unemployed if you are doing that.” (P7)

Another factor that belongs to this category is reputation, and the need to be seen as capable and competent, which was expressed to be a motivation for learning:

“I like to know what I'm talking about. Right? Which also goes to, basically, my reputation inside the company. That I want to be regarded as a professional software developer. ... I want to be good at what I'm doing. And I want to be perceived as such also. And that's why I have to learn those things.” (P8)

Supporting factors

This category contains factors that represent individual views, attitudes, competencies or skills that are supporting and positively influencing individual or team learning at work. These factors include different types of intrinsic motivational factors, communication and collaboration skills and learning skills.

One of the factors featuring most prominently in the discussions was the view that engaging in work and thus learning has to have a meaning. Seven participants expressed a strong desire for their work to be useful for others or contributing to the development of others, at varying magnitude. For some it is through their immediate surrounding, like assisting the development of colleagues, *“I'd feel more.. more kind of like motivated by the people not the kind of the devices or by the software. So. I was more motivated about the abilities to help others to kind of like perform and others to kind of like overcome their challenges rather than kind of overcoming my own challenges or technical problems or any problems.”* (P10).

For others the focus was on their partners or clients, through offering something useful and not wanting to engage in doing business for monetary benefits exclusively. While some participants looked even further, wanting to create something beneficial for the wider society or humankind in general, *“I'm enjoying that we get,... especially when we get the meaningful projects, that for example we are helping out the.. well, one cool project we are now leaving an offer for at the end of this year is concerning handicapped people... Well I would say that what would be the best way to live your life than you want to make a change, you want to help this society and you want to help the world. So it's just the best way to use your time that you are trying to push us forward.”* (P7).

The other most common feature was having a deep interest in the domain that originated from childhood, mostly by being good at mathematics or computing, which was then fuelled by taking part in different competitions, or having an access to personal computers and writing codes already at a young age, *“We have already, we are already negotiating with some pretty interesting stuff considering space exploration. And if that would happen that would be for me a dream come true. Like no matter how much money that would bring or anything, but that would be something that if I get to work with any space exploration or space technology or anything that's like a dream come true for me.”* (P4).

However, interest might be a too natural and generic expression, as most participants used the words ‘passion’ and ‘love’ that shows a more emotionally charged relation to their chosen profession as well as admiration, *“Well nowadays you don't even have a box but you have a cloud somewhere that does something for you and MAGIC happens.”* (P5). Enjoyment and having fun don’t only relate to working with technology, but also to the people side of work, as stated by a participant *“It's unpredictable, people are unpredictable. So that's, challenging and that's.. that's what I enjoy.”* (P3)

Engaging in learning has been linked to curiosity and proactivity by several of the participants. Being curious is not only about work-related issues but having a general disposition to wanting to know and understand new things and subjects. Some people described themselves as being curious and that helping them learn, while others referred to it as something beneficial to have to have a successful career in IT. Proactivity is mentioned in relation to developing and driving one’s ideas forward, *“[people] should be brave and go and volunteer to do some new,.. new stuff”* (P3) or regarding taking the initiative to learn during one’s free-time, *“I could also do it in my free time. I really did that because I had like zero knowledge about [technology] when I.. when I started. So I started doing that and kind of tried every possible VR solution that was there to be tried.”* (P4). Spending time with learning outside of working hours seems to be a common feature and an implicit expectation towards IT professionals, and the attitude to engage with learning in one’s free time can make a difference in one’s career, as expressed by one of the participants: *“I like the IT as field and I think everybody can make a success in it if they are motivated enough but those who are not motivated to learn in their free time I don't think they have a future in this field”* (P6).

Other factors that motivate an individual to learn relate to the feeling of being competent and the satisfaction and pride it brings when one solves a particularly challenging problem, as well as realizing the possibilities for learning and the desire to get better *“I tend to think that there's always something you can improve and learn in every situation.”* (P2).

When it comes to individual skills and competencies that can be regarded as conditions for successful learning at work, all the participants mention the ability to communicate and the ability to collaborate. Both are clearly influenced by changes in how the work is organised and the developments in the field, but not everyone seems prepared or willing to respond to those changes, who are rather protective of their own work or believe that their solution is the best and want to keep it separate, which in turn affects the quality of the work-outcome. There are a

few terms used to describe such individuals who may lack these skills, such as a ‘cowboy coder’ or someone with a ‘lonely coder syndrome’. One participant described their impact this way: *“Like if they don't get their mouth open, they just hide in the corner, they might be super technical experts but it doesn't help anyone.”* (P8) at best, at worst it can lead to social-emotional conflicts, as one participant described a situation where a ‘lonely coder’ has spent extra time rewriting someone else’s work, because he deemed it of lesser quality, so they upset others, made the other coders feel useless and so caused frictions in the team. So having respect for others and the willingness to understand their way of thinking is important. On the other hand, this requires that one is able to formulate and express their thoughts, regarding not just technology, but interpersonal issues as well, as highlighted by one of the participants: *“If you don't communicate then people get inside their minds their own opinions about what's going on and usually that's wrong. And so to have open communication and doing it often is the most important thing I guess.”* (P5). The other side of the coin is the ability to listen and understand or listening with the intent to understand. *“There has been many occasions when there's two guys .. arguing about something and they are not getting it that they are talking about the same thing. They just use different words. And then I need to clarify that ‘Hey guys calm down, you are meaning exactly the same thing. You just see it from a different angle.’ This kind of stuff. Yeah. I think that is like super important.”* (P8). Communication of course is present in all directions, with team mates, colleagues with different background, clients, customers, users, etc all posing different challenges and requiring a different approach, as acknowledged by a participant *“And if this is my view then how can I kind of.. How do others see it? And how can I have a dialogue within the whole company? And then of course towards our clients and the rest of the world.”* (P2). Furthermore, in international settings, communication skills need to be coupled with cultural understanding, as not all communication is verbal, or even the lack of communication mean different things, as pointed out in this case: *“you know in [country] if you're... if you don't hear anything from your boss in a couple of days then you're pretty much screwed. But if you don't hear anything from your boss in [other country] then it's fine because your boss will let you know that you do something wrong.”* (P9).

The ability to build valuable and productive personal relationships are also becoming more important, as the organisational structures that used to help define one’s role and provide the basis for interactions taking place at work are changing. With less hierarchy and less direct instruction, people are increasingly left to their own devices to make work work. In a team setting, one’s people skills can have direct impact on the quality of the work, because *“It's about how you utilise others' experiences and others' skills. ... the whole team performance*

could be outstanding” (P10). Being empathetic, honest, authentic and respectful have been mentioned under the term ‘people skills’ or ‘interpersonal skills’, as well as the ability to correctly interpret people's feelings. Because of the heavy reliance on teamwork in the industry, some participants also highlighted the need for having the skill to motivate others to perform better or develop in general, “The recent one is coaching or mentoring. This one to one discussions we keep with everyone. And making those meaningful or making the most out of them, so the person you are coaching will feel like he or she gets somewhere or get something out of that. That's a skill that is currently quite highly appreciated or highly valued.” (P3).

Almost all participants observed the need for one or more skills related to self-directed or self-regulated learning. The ability to balance the demands of work was brought up in two cases from two different perspectives. In the first case it is about performance: *“I usually just end up burning myself out and getting stuff ready but then I'm also super exhausted after that. I might not have helped the project anyway because it's anyway delayed. But I'm trying to get better at that.” (P8)*, in the second it is about learning: *“So it's a lot of balancing, because there are so many interesting things that I could do. But I have limited amount of time and limited brain capacity for handling so many different things that are happening all the time. Yeah, so I think that's something that I should still improve.” (P1).*

It is widely accepted that IT professionals need to learn new things on a daily basis, however, it is less evident, that learning doesn't only concern gaining knowledge about technology, but also about different ways of working, so the ability to adapt to changing circumstances, new kind of challenges and more diverse kind of work is also of importance, *“I kind of maybe have grown habits or opinions about how those things should be done. You really have to get rid of all that in order to, kind of,... if you really want to make big steps then you have to break your own rules.” (P4).* One thing that can help with making these adjustments is being driven by a personal goal. Some of the participants referred to having or developing their own goals, *“I had a very very, kind of, systematic approach for my development. ... I basically took this HR competency framework, I needed to define what's the... what are the missing gaps. So what I know and what I don't know, then I designed a career path” (P10)*, while others were more focused on helping someone else to be more goal driven, by identifying what is important for each of them and thus establishing a strong ownership over their development path. While these goals are more long-term, focusing on the task at hand and directing one's efforts to finding a solution or reaching a desired outcome in day-to-day situations was also part of the discussion in most cases, but these are more often guided and structured through team level activities.

Constraining factors

Factors in this category are related to personal circumstances that limit one's possibilities for engaging in work related learning.

Issues here were raised solely by participants who have some kind of responsibilities towards family. However, two different attitudes could be discovered here. In the first case, the lack of possibility for development was pointed out, *“So I would love to say that I also do stuff during my free time but I don't have any free time because I have two small kids.”* (P5), while in the other case the necessity to learn outside of working hours was considered unwelcome, *“Unfortunately, usually my days are so busy that [learning] often goes to my free time, which is like somewhere at night when the kids are sleeping. I try to avoid it. But usually it's not avoidable. ... It is kind of doing over time or working time.”* (P8).

5.3.2 Factors at the team level

Factors at this level focus on what makes teamwork and team-learning successful, looking at variables beyond the individual.

Table 5.3 Factors influencing workplace learning at the team level

Driving-factors	Supporting-factors	Constraining-factors
	Psychological safety Self-organization Diversity Cognitive conflicts Shared goals Social cohesion	Language barrier Cultural differences Interpersonal conflicts Tight project deadlines

Supporting factors

Supporting factors at the team level are concerned with both social and cognitive aspects of teamwork that makes a team effective and successful, such as the quality of the relations between team members, team composition, the team atmosphere or psychological safety.

The most prominent influencing factor in this category is diversity. Having a team where people have diverse skills and knowledge is seen, by all participants, as extremely beneficial not just for learning, but also for leading to better quality outcome or performance, as people approach

the same situation from different angles thus bringing unique insights that enhance the team's and team members' understanding. While diversity is applauded, it is also recognised as a source of conflict. Even so, if the conflict is of a socio-cognitive nature, it will advance the teams' capacity for problem solving and building a shared understanding, *"Often when you have conflicts you can evaluate the problem from various angles and kind of like viewpoints. So therefore, you come up with the better solution."* (P10), but this outcome, though desirable, is not always achieved, if the situation leads to someone from outside interfering and making a decision for the team.

Getting the team composition just right can also be a challenge, not only because team members should have complementary skill sets in the present, but their desired future states need to be taken into account as well, creating possibilities for learning and benefiting from working with more knowledgeable peers, as explained by a participant: *"You need to think about competence. You need to also think about chemistry between people. You need to think about what people want to learn... So it's not about what their current abilities are it's also where they want to develop so that they get into projects that are interesting and where they can kind of work towards their personal growth goals."* (P1).

The following factors all originate from the fact that agile teamwork relies on self-organisation, so if these conditions are present, they support individual and team-learning to a great extent. Self-organising teams work like a mini democracy, where members together make decisions about what they do or how they work, even if one member is more senior, he is she doesn't have the authority to dictate. This can, of course, present new challenges, as illustrated by one of the participants: *"[The team] really need to make decisions together and that's it. There is no process. There's no... There are no written rules."* (P1). As a consequence, the importance of having a shared goal and a common understanding about that goal to align individual actions was raised by almost all participants, as described here: *"Well, knowing what to do, the shared and well understood common vision is quite important. So if there is a mismatch between the team members of what we are after or why we do exist or something, that's a good way to get something going wrong. If the vision is shared and well understood and what to do next and what not to do, that helps. Then the team gets to keep the focus better."* (P3). If the end result is clear then the members have a better leverage to decide for themselves how to reach that goal, whether it requires the team structure to evolve, the certain actions that need to be taken, or decisions made about the technology tack to be used, etc. This also creates the basis for the development of mutual trust, that everyone in the team is contributing to reaching that common goal. There is one peculiar aspect to having or developing this goal, caused by the very different

settings that are present in the field. While some teams, especially startups or internal project-teams, have a high degree of freedom to create that vision for themselves, others, in a consultant capacity are bound by goals set by their clients or customers and have no or very little opportunity to influence those, *“We don't have any like inner goals in our team. We just have the requirements from the client, that are basically our goals, how we achieve those. ... Well, [the goals] are not up to us but it's our responsibility to achieve those goals.”* (P5). But even these teams have high autonomy to affect their working conditions and the environment, with the possibility to accommodate individual preferences regarding, for example, flexible working hours or location independent working. Nonetheless, more than half of the participants expressed the view, that having a shared physical space, or having the chance to work in a face-to-face setting is needed for effective teamwork, as these can provide opportunities for incidental learning or building trust easier, *“I mean what you miss in the virtual team are these, you know what, from around the coffee machine type or conversations.”* (P9), *“it's better if people meet in person so you can build up trust much more easier if you see somebody in real life other than just through the Internet.”* (P6).

Psychological safety was put forward in a couple of discussions directly, but were referred to in a couple others too, in connection with having cognitive as well as affective trust between team members, the quality of social relationships or the acceptance of making mistakes. A participant provided the following explanation of why it is important: *“when you have the higher psychological safety then you're better able to say for example that I don't understand a thing. Than somebody else can join and help you out because you have the courage to say it out loud.”* (P2). It was pointed out in several cases though, that it is not at all easy to achieve such a state. Two things were clearly articulated that can assist in the process of building a high level of psychological safety. One was having already established personal relationships, the other being embedded in a supporting organisational environment, which will be presented in more detail amongst the organisational-level influences.

Working in an agile way doesn't necessarily mean that the team has embraced the agile mindset and uses the structure to facilitate high-quality learning, nevertheless, the affordances of the method are recognised, *“The team in the agile culture,... they hold retrospectives about the thing or the work that they have done. And that is in my opinion one of the key places where the team is supposed to learn.”* (P3).

Constraining factors

Constraining factors at the team level are characteristics of a team that form barriers to successful teamwork or prevent individuals or teams from spending time engaging with learning. These include issues related to project schedules, interpersonal conflicts, or differences in language or culture.

One factor that influences learning in this category is having demanding schedules to work with, which means that a big part of the learning related to everyday work eats up one's working hours, or even extends beyond that in cases, leaving no chance to engage with learning that is not seen as directly contributing to the ongoing project. This was an issue for half of the participants, *"There is a lot of [trainings and presentations] for all kinds of subjects, be it technical or not technical, but I personally never have time to attend those, because the projects are too busy."* (P8).

Diversity in teams can lead to disagreements or even conflicts, as several participants mentioned, but it will only become a barrier to learning in cases where the conflict grows into an interpersonal issue that the team members are unable to solve, and so it damages the social cohesion in the team. It was, however, considered to be extremely rare.

The other two issues were only mentioned by participants who are not in their native environment. Namely cultural differences and the presence of a language barrier can affect one's learning chances, especially in preventing incidental learning to occur.

5.3.3 Factors at the organisational level

Factors at this level relate to issues that are beyond the influence of single teams or groups of people but describe the reality where teams function.

Table 5.4 Factors influencing workplace learning at the organisational level

Driving-factors	Supporting-factors	Constraining-factors
	Culture (trust, transparency, open communication) Enabling leadership style Values (people, learning, continuous improvement) Flat hierarchy Shared ownership	Restricted access to information or resources Controlling leadership style Slow decision making

Supporting factors

Supporting factors at the organisational level include contextual factors, that are beyond the scope of the team, but their existence can positively influence both individual and team learning at work. The participants highlighted the followings: people and learning focused values, organisational culture based on trust, transparency and open communication, short power distances or flat hierarchical structure, enabling leadership style revolving around mentoring and coaching, and the possibility of shared ownership and decision making.

The most references regarding the influence of the organisational level were made in connection with its culture and values. Most participants highlighted the positive effect of a culture where people are the most important thing. Leaders of the organisation have to act in accordance with the values they claim are important. Authenticity and credibility is key, as pointed out in this example: *“It has to be the company who is driving that. And for example in [company] this is super nice. They are driving it by hiring the right people and setting an example. Like the bosses,.. basically they give like.. and everything what they are doing, they are setting examples for us.”* (P8). Hiring the right people doesn’t mean domain expertise here, but a fit between organisational and personal values. The specific values that were mentioned in the discussions were ‘continuous improvement’, ‘transparency’, ‘trust’ or ‘care’.

Innovation and continuous learning are an attribute of the field in general, but organisations vary greatly in how they understand the role of learning and what resources they provide for cultivating it. Especially consultants face this challenge when they are hired to coach a team in an organisation that has a markedly different culture than their own, and are unable to establish long-lasting changes, or introduce practices that would, for example, lead to the development of psychological safety, because *“People don't see the value in it. That's I think that's the most common thing. ... When we leave and they continue by themselves they don't they don't know how to facilitate it or it doesn't feel natural or something. So they drop it off.”* (P2). An organisation that has established a learning focused culture will attract people who see continuous improvement a value in their personal lives as well. *“Yeah, the culture was part of why I joined [company] back then... Suddenly I was kind of part of a bunch of rebels. ... It is the constant questioning of the current status and kind of trying to improve.”* (P1). This focus can also be seen in the way that people in the organisation react when somebody makes a mistake. If failures or mistakes are regarded as sources for learning they do not result in a ‘blame game’, accountability is shared, and people will come together to correct the mistakes made.

Transparency in practice means open communication and shared decision-making in organisation-wide matters, where employees are listened to and can have an influence, as described in this case: *“So what [the managers] usually say, ‘Hey we have a problem, and we have maybe suggestions or maybe we don’t, now everybody can say what they think about this’.”* (P8) and the whole process of the decision-making is conducted publicly. One organisation goes even further, by providing full access to information about the organisation’s finances, *“And of course for the finances we have total transparency everybody knows each other’s salaries and everybody knows how much revenue we are doing each month. What are the cost structures. Even we share all the information about my salaries. So transparency is hundred percent for the finances.”* (P7).

Having flat hierarchy was also regarded as supporting learning at the workplace, especially so, when it is coupled with a leadership style that is enabling, which means a lot of mentoring and coaching and empowering people, as explained by this participant *“At some point my manager told me in [country] that he’s job is that I’m able to do my job very well. So if I have any problems then please ask this from me. This model works very well I think, enhances productivity in a good way.”* (P6).

A friendly, relaxed atmosphere at work, supported by both organised and unorganised social events was also favoured by many, having the possibility to talk about non-work-related things, like having regular morning coffee together or pulling jokes made people feel comfortable. Having smaller power distances within the organisation can also contribute to the wellbeing of the employees and make them feel valued and more engaged, *“Everybody is on those [company] events even from the higher management, so you can just sit down and have a beer with the CEO and discuss about the day stuff.”* (P6).

Constraining factors

Contextual factors beyond the team level that inhibit workplace learning were identified as the leadership style focusing on controlling and micromanaging or having limited access to information or resources as well as slow decision making resulting from hierarchical structural complexity.

Several participants expressed the view that learning, be it individual or team learning, takes time, and the organisation needs to recognise that and somehow support people to have time for learning. It can be in relation to taking part in formal learning, or when learning is embedded

in everyday work, thus being affected by project schedules or certain business views or practices that could be described as having a short-term focus. Since monetary bonuses within the organisation are often linked with predetermined performance indicators some of which may not allow much room for experimenting or innovation. A participant described such situation the following way: *“In big companies it's always, even if you are talking about a few thousand euros, it's really hard to get the acceptance from the steering groups and from the top management that okay I have this artificial intelligence try-out please give me ten thousand euros. And the top management of course they are asking, that OK why, but you have the daily job and you have the daily project going on so focus on that.”* (P7).

Another factor in this category is concerned with the lack of, or low level of information sharing. If the organisation itself is the subject, working in ‘silos’, be it departmental or disciplinary, can severely restrict learning. In another case, describing a multi-supplier work setup (when one project team can have members from several different organisations), the dependencies within that network were referred to as the main challenge for effective teamwork, *“We are working in networks and then of course when there is 10 companies everybody have their own rules or their own boundaries. And then there is also need to be thinking what are these security and.. what is the.. what information can be sent to who and there might be really tight restrictions, that OK, we cannot give access to all of the systems for that supplier and it limits the possibilities to help the project.”* (P7).

Leadership style can also pose challenges for learning, when it is about controlling and micromanaging employees’ work. This, however, seems to be a thing of the past, or at least the participants’ past, as all references were made to it as how things used to be, meaning that it is not a feature in any of the participants’ current employment situation.

5.3.4 Factors beyond the organisation

The factors at this level are concerned with issues that are beyond the influence of any single organisation and are more characteristics of the industry in general as a reason for learning. These are all considered to be driving-factors, no supporting or constraining factors at this level were mentioned by the participants.

Table 5.5 Factors influencing workplace learning beyond the organisation

Driving-factors	Supporting-factors	Constraining-factors
Rapid tech evolution Complex tasks Unique, open problems Diverse settings		

Driving factors

The most identified feature of the industry that impacts workplace learning is that it is rapidly evolving, affecting domain knowledge with the exponential growth in available tools and resources, as well as functional roles, possible career paths or the ways of working, “... nowadays it's more about collaboration than I would have ever imagined in those days. Or like ten years ago still. So the culture has changed to be more.. more collaborative and open.” (P3). As technology is becoming a ubiquitous feature of all industries, the need for understanding very different domains is also highlighted, “The people who have the ability to take multiple roles in the project and they know multiple business domains or multiple different kind of projects... is really appreciated” (P7). As a result of this, the settings in which IT professionals work are also becoming diversified.

Tasks have also become very complex and have a unique nature that require customised, local solutions, in most cases involving work with several people having different backgrounds, like in the following case, “Good artistic visual touch combined with great technological skills combined with project management that makes everything happen and then communications with the client and all that so it's.. it's just not possible. So there's no way around [collaboration].” (P4).

5.4 Overview of the main findings

Results of this study show that regarding the conceptions of workplace learning participants are fully aware of the need to constantly learn in or at their work, and they hold sophisticated conceptions of learning, though differ slightly in their views about the nature or purpose of learning in general. Mostly learning is considered to be continuous professional development or as a process of self-discovery.

IT professionals in this study identified several ways of learning at work, but primarily prefer to learn through their work and to learn by doing. Participants described learning as being heavily characterised by participation and where social relation are particularly important in influencing learning.

The factors that participants described as having an influence on workplace learning were evenly distributed among the three levels of the individual, the team and the organisation. While all organisations in the study highlight the importance of continuous learning and improvement and have established or are aiming to have a culture that is supporting employees' learning at work, the immediate work context of the employees, such as the way in which daily work is organised, the structure or the specific roles employees hold or employees' personal beliefs or circumstances may limit the extent to which the learning potential of the work environment is realised or fulfilled.

Among the factors, time was an issue that appeared in relation to all three levels, indicating that it is an important matter to address in relation to workplace learning in the IT field.

6 DISCUSSION

The aim of this study was to explore the views and beliefs of professionals working in the IT field about learning and how they perceive the role of learning in working life considering the changes that have taken place and continue to affect working in the 21st century in general, while looking at the characteristics of the IT field, as a high-end knowledge practice, in particular. The results of the study provide answers to the research questions from the perspectives of what kind of views IT professionals have of workplace learning, the ways in which IT professionals learn at work and about the factors they consider influencing learning at work.

6.1 Epistemological components of learning conceptions

In general, participants in this study considered workplace learning as a process of personal or professional self-development, which constitutes a sophisticated level of learning conception according to Van Rossum & Hamer (2010). Seeing workplace learning this way seems to echo the views of Edwards (2005) when he describes the development of expertise “as a capacity to interpret the complexity of aspects of the world and have the wherewithal to respond to that complexity. ... This view of expertise acknowledges that there are bodies of knowledge, ways of thinking, sets of values and expectations of behaviour that are associated with particular culturally derived forms of practice and that these features of practice are themselves open to change.” (p60).

Participants with organisational development responsibilities thought of workplace learning to reach beyond the scope of work and learning from outside of work to filter into work, or had difficulties pointing out what might not constitute learning or separating their working and non-working personas. It was particularly evident in two cases, where learning was associated with self-discovery and developing self-awareness, or with becoming a better version of oneself. These conceptualisations go beyond the metaphors of acquisition, participation or knowledge creation and seem to be more closely aligned with the metaphor of becoming, put forward through the fusion of the theory of learning cultures and the cultural theory or learning by Hodgkinson, et al. (2008). Nailon, Delahaye, & Brownlee (2007) interviewed people in leadership positions and found that those having a more sophisticated belief about the nature of knowledge were also more likely to support their staff emotionally as well as intellectually and encourage their active learning.

Other previous research that set out to explore how employees conceptualise workplace learning using qualitative methods (Collin, 2002; Slotte et al., 2004), however, did not explicitly study epistemological beliefs, which makes it difficult to put the findings of the current study in perspective.

Professionals in this study saw participation and experience as indisputable in terms of developing social or intercultural skills and competencies. Working in teams and with several stakeholders provide opportunities for the employees to learn about interpersonal relationships and grow their knowledge and experience through managing these relations, which was also recognised and was regarded as beneficial learning by most participants. This is in line with the views of Billett (2004) and Hager (2013) and the findings of Collin (2005), according to what, work and learning at work should be seen as a shared practice, “highlighting the relationship between learning and the social situations in which it occurs” (Lave & Wenger, 1991, p. 14).

6.2 Procedural components of learning conceptions

The learning processes that were recognized to be present in the work of the IT professionals in the current study represent a wide variety of activities and processes that are both individual and social in character, involving one or several others. Workmates were seen as important sources of learning whether it concerned general domain knowledge, unique problem-solving processes, or behaviour patterns in the given context. These findings are consistent with the results of the studies by Coetzer (2007) and Vähäsantanen & Eteläpelto (2017), indicating the social relationships are central to learning.

Furthermore, the processes described in this study are highly compatible with those found in the work of design engineers employed in electronics manufacturing (Collin, 2002) as learning by doing, learning through interaction with others, through evaluation and life experience, incidental learning, formal education, and learning from out of work activities were features of both contexts. While present, formal learning did not feature strongly as a form of learning in this study, a finding that seem to replicate the results of a study by Fenwick (2012), which could indicate that professionals, with a considerable experience, are more selective of the ways they spend on learning and are less motivated by qualifications or courses generally.

6.3 Individual and context matter together

There are several factors that drive, support or constrain workplace learning. The ones presented in this study can be found spread out on both the individual, the team and the organisational levels, or even beyond, suggesting that looking at the synergy or alignment of those factors might provide useful insights about how to enhance the quality of learning at work. As each factor affects another, it might be the relationship between them that ultimately determine learning at work (James & Biesta, 2007). Vanthournout, Noyens, Gijbels, and Van den Bossche (2014) share the view that it seems important to take into account a combination of contextual and individual variables to get a more nuanced understanding of workplace learning.

The interaction of the factors at different levels can be observed as most participants in this study expressed that their organisations valued continuous learning and improvement, which was elaborated further, when participants talked about the high level of trust that was placed on them and the high level of autonomy they had regarding their work, while also pointing out the wide range of learning opportunities made available for them. However, the level at which different participants were able to make use of these opportunities was determined by either individual or other team or organisational level factors. The slightly differing accounts of workplace learning activities and less favourable attitude towards them in this study might on the one hand indicate a mismatch between what organisational circumstances and conditions make possible as opposed to what individuals would prefer in an ideal situation. Or, on the other hand, it can also be a result of individual differences regarding learning orientation or personal beliefs regarding the nature of knowledge and the purpose of learning. It is in line with the findings of Collin, Paloniemi, Virtanen, & Eteläpelto (2008), when they describe how individual and social factors are deeply intertwined, but maintaining, that some individual factors, such as the ability to detect learning opportunities at work, or one's proactive attitude might have a stronger influence. When considering individuals preparedness for learning, contextual variables may not determine employees' learning possibilities completely, as was also observed by Bryson et al. (2006), when they discovered that an employee with a proactive attitude perceived a restrictive learning environment as more expansive, and a more unwilling individual perceived an expansive environment as more restrictive. Clearly, there is a reciprocal nature between contextual influences and individual agency. Vanthournout et al. (2014) also pointed out that individual factors, such as one's efficacy level may moderate the effects of negative contextual factors, for example, that of a perceived high workload.

Therefore, it is important to also keep the individual in focus, as their views, attitudes and learning behaviours are determined by unique life experiences (Bloomer & Hodkinson, 2000; James & Biesta, 2007), that have the potential to influence the learning culture where they are present and influence it in ways that may or may not be in line with the team or organisational objectives (Hodkinson et al., 2008).

6.4 Time – an overarching theme

The results from this study call attention to time being a central issue regarding workplace learning in the IT field. The daily work for programmers is often characterised by inquiry followed by specific problem solving in a short-term, iterative manner, which is likely to provide opportunities for types of learning more indicative of surface learning, as opposed to developing a deeper understanding or engagement with knowledge (Nerland, 2008). The focus on development in such a quick, iterative fashion, as also found by Hoda, Babb, and Norbjerg (2013), makes it likely, that “practices most closely related to learning were also those most often sacrificed or poorly implemented over time” (p96).

Adaptation for the participants in this study is a must and keeping up with the advancements in the field already consumes a big part of an IT professional’s time. Generative or transformative learning, which requires reflection, not just on a personal but also on a team level, is much harder to put into practice under pressure. Annosi, Magnusson, Martini & Appio (2016) examined time-pressure in agile teams theorizing that imposed structures and practices that are present in Scrum, or other agile methodologies, with relation to high task-interdependence or the shared list of to-do tasks in the backlog, can lead to an internally created belief of time-pressure. In this case, task-interdependence and the sprint actions serve as control systems. In order to effectively balance time pressure, be it external or internal, to be productive and learn and innovate, team members or teams need to have a high level of self-efficacy or group-efficacy as well as an organisational culture that is supportive of learning (Hoda et al., 2013; Annosi et al, 2016). This seems to mirror the views and experiences described by the participants in the current study, who were employed in varying roles and contexts within IT.

There is, however, an important difference regarding the setting in which professionals work. Software developers who work as consultants are, essentially, ‘full-time on loan employees’ to the client company for shorter or longer periods of time and are hired for making use of their existing knowledge and skills in the client’s running project, for both getting the work done and

for advising decision makers. The characteristics of this type of relationship may partly explain the difficulties these developers face concerning having available time for learning as opposed to developers who work on the development of internal products or services. Lynn, Mazzuca, Morone, and Paulson (1998, p8) stated, that “The key to developing really new products successfully is the degree to which teams are able to learn from prior steps - frequently in unpredictable ways - and act on that information.”, which, arguably, needs to be supported by the allocation of the appropriate resources. Furthermore, Hoda et al. (2013) assert, that management as well as customers could be educated about the value of learning. Having to learn during the time off work was a responsibility that some of the participants in this study were less willing to take on due to personal circumstances.

7 Conclusion

With the purpose of understanding how IT professionals view learning at work and what beliefs they have about learning, this study contributes to the growing literature on workplace learning as it is experienced by the knowledge workers themselves. The results confirm the current understanding and provide further evidence that learning at work is mostly informal, embedded in the daily tasks of work, and relies heavily on both individual and social forms of learning. Furthermore, the study presents a comprehensive overview about the factors that influence learning at the workplace in the IT industry by combining variables from the individual level, the team level and the organisational level.

7.1 Validity and reliability

The validity of the study was ensured by establishing consistency between the object of the study, the research questions and the study design, as the chosen methods and the diversity among the participants served the purpose of the study well.

Furthermore, attention was paid to avoid research bias as much as possible during data collection, and during data analysis, as transcripts as well as the audio recordings were revisited several times during the process. The results are presented fully and honestly.

7.2 Limitations

This study has, however, potential methodological limitations. First, because of the small number of participants, and the great variety of roles held by them, as well as due to the purposive sampling method the findings do not exhaust the diversity of views and perceptions of IT professionals in general. However, the findings do point out some commonalities and differences that can be explored further.

Second, as the data analysis was carried out by a sole coder, involving a second coder would limit the researcher bias at an even greater extent.

The third limitation concerns the quality of the data. While using English as the language for the interviews was a practical solution, the fact, that some participants were unfamiliar with the practice of reflection or lacked extensive vocabulary related to the phenomenon of learning could have resulted in articulation or expressions of ideas at a less than desired depth.

7.3 Implications for practice and future research

A few implications for practice as well as areas for future research can be derived from this study. It would be beneficial for HRD or learning professionals in work organisations to critically appraise the opportunities for and the limitations to participation in workplace learning based on actual roles and contexts where IT professionals work, especially so in situations, where employees work away from the internal learning culture of their organisation.

Furthermore, as multidisciplinary team-based work organising is becoming widespread, forms of learning support that focus on teams as learning units should be developed, for example the forms of educational leadership need to be considered carefully in self-managing or self-organising teams or in relation to teams with shared-leadership. Other forms could also include some type of assistance for employees to understand their own learning in the context of work and beyond.

Future research could consider examining the relationship between epistemological beliefs and career choices in learning oriented organisations to investigate whether having sophisticated conceptions may motivate people to take on development responsibilities or whether being in these positions contribute to the advancement of those beliefs.

Another line of research could explore the role of learning conceptions, including epistemological beliefs, and its relation to learning and career development in the gig-economy, taking learning research conducted in project-based environments to the next level.

References

- Annosi, M. C., Magnusson, M., Martini, A., & Appio, F. P. (2016). Social Conduct, Learning and Innovation: An Abductive Study of the Dark Side of Agile Software Development. *Creativity and Innovation Management*, 25(4), 515-535. doi:10.1111/caim.12172
- Argyris, C., & Schön, D. (1978). *Organizational learning: A theory of action perspective*. Reading, MA: Addison Wesley.
- Ashton, D. N. (2004). The impact of organisational structure and practices on learning in the workplace. *International Journal of Training and Development*, 8(1), 43-53. doi:10.1111/j.1360-3736.2004.00195.x
- Bakhshi, H., Downing, J., Osborne, M. & Schneider, P. (2017). The Future of Skills: employment in 2030. Retrieved from <https://futureskills.pearson.com/research/assets/pdfs/technical-report.pdf>
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman.
- Barron, B. (2003). When Smart Groups Fail. *Journal of the Learning Sciences*, 12(3), 307-359. doi:10.1207/s15327809jls1203_1
- Basit, T. N. (2010). *Conducting Research in Educational Contexts*. (1st ed.). New York: Continuum International Publishing Group.
- Beckett, D. & Hager, P. (2002). *Life, work and learning: practice in postmodernity*. London: Routledge.
- Berg, S. A., & Chyung, S. Y. (2008). Factors that influence informal learning in the workplace. *Journal of Workplace Learning*, 20(4), 229-244. doi:10.1108/13665620810871097
- Billett, S. (2004). Workplace participatory practices. *Journal of Workplace Learning*, 16(6), 312-324. doi:10.1108/13665620410550295
- Billett, S. (2011). Subjectivity, self and personal agency in learning through and for work. In M. Malloch, L. Cairns, K. Evans, & B. O'Conner (Eds.), *The international handbook of workplace learning* (pp. 60–72). London: Sage.
- Billett, S., & Choy, S. (2013). Learning through work: Emerging perspectives and new challenges. *Journal of Workplace Learning*, 25(4), 264-276. doi:10.1108/13665621311316447
- Bloomer, M., & Hodkinson, P. (2000). Learning Careers: Continuity and change in young people's dispositions to learning. *British Educational Research Journal*, 26(5), 583-597. doi:10.1080/01411920020007805
- Boud, D., & Garrick, J. (1999) Understandings of workplace learning. In Boud, D., & Garrick, J. (Eds.), *Understanding learning at work*. London: Routledge.
- Boud, D., & Solomon, N. (2003). *Work-based learning: A new higher education?* Buckingham: Society for Research into Higher Education & Open University Press.

- Bromme, R., Pieschl, S., & Stahl, E. (2009). Epistemological beliefs are standards for adaptive learning: A functional theory about epistemological beliefs and metacognition. *Metacognition and Learning, 5*(1), 7-26. doi:10.1007/s11409-009-9053-5
- Bryson, J., Pajo, K., Ward, R., & Mallon, M. (2006). Learning at work: Organisational affordances and individual engagement. *Journal of Workplace Learning, 18*(5), 279-297. doi:10.1108/13665620610674962
- Caldwell, D. F., & O'Reilley, C. A. (2003). The determinants of team-based innovation in organizations: The role of social influence. *Small Group Research, 34*(4), 497–517.
- Cano, F. (2005). Epistemological beliefs and approaches to learning: Their change through secondary school and their influence on academic performance. *British Journal of Educational Psychology, 75*(2), 203-221. doi:10.1348/000709904x22683
- Cano, F., & Cardelle-Elawar, M. (2008). Family Environment, Epistemological Beliefs, Learning Strategies, and Academic Performance: A Path Analysis. *Knowing, Knowledge and Beliefs, 219-239*. doi:10.1007/978-1-4020-6596-5_10
- Capretz, L. F. (2014). Bringing the Human Factor to Software Engineering. *IEEE Software, 31*(2), 104-104. doi:10.1109/ms.2014.30
- Carmeli, A., Brueller, D., & Dutton, J. E. (2009). Learning behaviours in the workplace: The role of high-quality interpersonal relationships and psychological safety. *Systems Research and Behavioral Science, 26*(1), 81-98. doi:10.1002/sres.932
- Chan, K. (2009). Preservice teacher education students' epistemological beliefs and conceptions about learning. *Instructional Science, 39*(1), 87-108. doi:10.1007/s11251-009-9101-1
- Coetzer, A. (2007). Employee perceptions of their workplaces as learning environments. *Journal of Workplace Learning, 19, 7, 417–34*.
- Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research, 64*(1), 1–35.
- Cohen, S.G., & Bailey, D.E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management, 23, 239-290*.
- Collin, K. (2002). Development engineers' conceptions of learning at work. *Studies in Continuing Education, 24*(2), 133–152.
- Collin, K. (2005). Experience and shared practice – Design engineers' learning at work. University of Jyväskylä. Jyväskylä Studies in Education, Psychology and Social Research, 261.
- Collin, K., Paloniemi, S., Virtanen, A., & Eteläpelto, A. (2008). Constraints and challenges on learning and construction of identities at work. Vocations and Learning. *Studies in Vocational and Professional Education, 1* (3), 191-210. doi:10.1007/s12186-008-9011-4
- Dahl, T.I., Bals, M. and Turi, L. (2005) 'Are Students' Beliefs about Knowledge and Learning Associated with their Reported Use of Learning Strategies?', *British Journal of Educational Psychology, 75, 257–73*.

- Davidson, N., & Major, C. H. (2014). Boundary crossings: Cooperative learning, collaborative learning, and problem-based learning. *Journal on Excellence in College Teaching*, 25(3&4), 7-55.
- Davies, A., Fidler, D., & Gorbis, M. (2011) Future work skills 2020. Institute for the Future. Retrieved from <http://www.iftf.org/futureworkskills/>
- De Dreu, C. K. W., & Weingart, L. R. (2003). Task versus relationship conflict, team performance, and team member satisfaction: A Meta-analysis. *Journal of Applied Psychology*, 88, 741-749.
- Decuyper, S., Dochy, F., & Van den Bossche, P. (2010). Grasping the dynamic complexity of team learning: An integrative model for effective team learning in organisations. *Educational Research Review*, 5, 111–133.
- Dillenbourg P. (1999). What do you mean by collaborative learning? In P. Dillenbourg (Ed), *Collaborative-learning: Cognitive and Computational Approaches* (pp.1-19). Oxford: Elsevier
- Dingsoyr, T., Faegri, T. E., Dyba, T., Haugset, B., & Lindsjorn, Y. (2016). Team Performance in Software Development: Research Results versus Agile Principles. *IEEE Software*, 33(4), 106-110. doi:10.1109/ms.2016.100
- Dochy, F. Gijbels, D., Raes, E., & Kyndt, E., (2014), Team learning in education and professional organisations. In Billett, S., Harteis, C., and Gruber, H. (Eds.), *International Handbook of Research in Professional and Practice-based Learning*, Springer, Dordrecht, The Netherlands, pp. 987-1020.
- Donche, V., De Maeyer, S., Van Petegem, P. (2007). Teachers' conceptions of learning and teaching and their effect on student learning. *Education-line*. <http://hdl.handle.net/10067/655210151162165141>.
- Edmondson, A. C. (1999). Psychological safety and learning behaviour in work teams. *Administrative Science Quarterly*, 44(2), 350–383.
- Edmondson, A.C. (2003). Managing the Risk of Learning: Psychological Safety in Work Teams. In M. West, D. Tjosvold, and K.G. Smith (Eds.) *International Handbook of Organizational Teamwork and Cooperative Working*. London: John Wiley & Sons, 255–276.
- Edwards, A. (2005). Let's get beyond community and practice: The many meanings of learning by participating. *Curriculum Journal*, 16(1), 49-65. doi:10.1080/0958517042000336809
- Ellinger, A. D. (2005). Contextual factors influencing informal learning in a workplace setting: The case of “reinventing itself company”. *Human Resource Development Quarterly*, 16(3), 389-415. doi:10.1002/hrdq.1145
- Ellinger, A. D., & Bostrom, R. P. (2002). An Examination of Managers Beliefs about their Roles as Facilitators of Learning. *Management Learning*, 33(2), 147-179. doi:10.1177/1350507602332001

- Elo, S. & Kyngäs, H. (2008) The qualitative content analysis process. *Journal of Advanced Nursing*, 62(1), 107–115 doi: 10.1111/j.1365-2648.2007.04569
- Engeström, Y., Engeström, R., & Kärkkäinen, M. (1995). Polycontextuality and boundary crossing in expert cognition: Learning and problem solving in complex work activities. *Learning and Instruction*, 5, 319-336.
- Eraut, M. & Hirsh, W. (2007). *The Significance of Workplace Learning for Individuals, Groups and Organisations*. Oxford: University of Oxford (SKOPE Monograph 6).
- Eteläpelto, A., Vähäsantanen, K., Hökkä, P., & Paloniemi, S. (2013). What is agency? Conceptualizing professional agency at work. *Educational Research Review*, 10, 45–65. <https://doi.org/10.1016/j.edurev.2013.05.001>
- Evans, K., Hodkinson, P., Rainbird, H., & Unwin, L. (2009). *Improving workplace learning*. London: Routledge.
- Fenwick, T. (2012). Older professional workers and continuous learning in new capitalism. *Human Relations*, 65(8), 1001–1020
- Fidler, D. (2016) Future skills. Update and literature review. Prepared for ACT Foundation and The Joyce Foundation. Institute for the Future. Retrieved from: http://www.iftf.org/fileadmin/user_upload/downloads/wfi/ACTF_IFTF_FutureSkills-report.pdf
- Fuller, A. and Unwin, L. (2003). Fostering Workplace Learning: looking through the lens of apprenticeship. *European Educational Research Journal*, 2(1), 41-53
- Fuller, A. & Unwin, L. (2004). Expansive learning environments: integrating personal and organisational development. In Rainbird, H., Fuller, A. and Munro, A. (Eds) *Workplace Learning in Context*, London: Routledge.
- Fuller, A., & Unwin, L. (2005). Older and wiser?: Workplace learning from the perspective of experienced employees. *International Journal of Lifelong Education*, 24(1), 21-39. doi:10.1080/026037042000317329
- Gibson, W. (2010). Qualitative research as a method of inquiry in education. In D. Hartas (Ed.) *Educational research and inquiry* (pp. 54-64). London: Continuum, International Publishing Group.
- Gijbels, D., Van den Bossche, P., & Loyens, S.M.M. (2013). Student achievement in problem-based learning. In J.A. Hattie & E.M. Anderman (Eds.), *International Guide to Student Achievement* (pp. 282-284). N.Y.: Routledge
- Gittell, J. H. (2003). A theory of relational coordination. In Cameron, K. S., Dutton, J. E., Quinn R. E. (Eds) *Positive Organizational Scholarship* (pp. 279–295). Berrett-Koehler Publishers: San Francisco.
- Goles, T., Hawk, S., & Kaiser, K. M. (2009). Information Technology Workforce Skills: The Software and IT Services Provider Perspective. *Information Systems Outsourcing*, 105-125. doi:10.1007/978-3-540-88851-2_5

- Goller, M. & Paloniemi, S. (2017). Agency at work, learning and professional development: An introduction. In M. Goller & S. Paloniemi (Eds.) *Agency at Work: An agentic perspective on professional learning and development* (1–14). Cham: Springer.
- Hackman, J. R., & Wageman, R. (2005). A theory of team coaching. *Academy of Management Review*, 30(2), 269–288.
- Hager, P. (1998). Understanding workplace learning: General perspectives. In D. Boud (Ed.), *Current issues and new agendas in workplace learning* (pp. 31–46). Springfield, VA: NCVER.
- Hager, P. (2004). The conceptualization and measurement of learning at work. In H. Rainbird, A. Fuller, & A. Munro (Eds.), *Workplace learning in context* (pp. 242–258). London: Routledge.
- Hager, P. (2013) Theories of workplace learning, In Malloch, M., Cairns, L., Evans, K., & O'Connor, B. N. (Eds.) *The SAGE handbook of workplace learning*. London: SAGE.
- Harteis, C., Gruber, H., & Lehner, F. (2006). Epistemological Beliefs and Their Impact on Work, Subjectivity and Learning. In Billett, S., Fenwick, T. J., & Somerville, M. (Eds.) *Work, subjectivity and learning*. Dordrecht, the Netherlands: Springer. Pp 123-140. doi:10.1007/1-4020-5360-6_8
- Hmelo-Silver, C. E., Chinn, C. A., Chan, C. K. K., & O'Donnell, A. (Eds.). (2013). The international handbook of collaborative learning. New York, NY: Routledge
- Hoda, R., Babb, J., & Norbjerg, J. (2013). Toward Learning Teams. *IEEE Software*, 30(4), 95-98. doi:10.1109/ms.2013.90
- Hodkinson, P., Biesta, G., & James, D. (2008). Understanding Learning Culturally: Overcoming the Dualism Between Social and Individual Views of Learning. *Vocations and Learning*, 1(1), 27-47. doi:10.1007/s12186-007-9001-y
- Hodkinson, P., Hodkinson, H., Evans, K., Kersh, N., Fuller, A., Unwin, L. and Senker, P. (2004) The significance of individual biography in workplace learning, *Studies in the Education of Adults* 2004, 36(1), pp. 6 – 24.
- Hofer, B. K., & Pintrich, P. R. (1997). The Development of Epistemological Theories: Beliefs about Knowledge and Knowing and Their Relation to Learning. *Review of Educational Research*, 67(1), 88. doi:10.2307/1170620
- Horgan, K., & Gardiner-Hyland, F. (2019). Irish student teachers' beliefs about self, learning and teaching: A longitudinal study. *European Journal of Teacher Education*, 42(2), 151-174. doi:10.1080/02619768.2019.1576625
- Hsieh H.-F. & Shannon S. (2005) Three approaches to qualitative content analysis. *Qualitative Health Research* 15, 1277– 1288
- Jacobs, R. L., & Park, Y. (2009). A Proposed Conceptual Framework of Workplace Learning: Implications for Theory Development and Research in Human Resource Development. *Human Resource Development Review*, 8(2), 133-150. doi:10.1177/1534484309334269

- Jamali, D., Khoury, G., & Sahyoun, H. (2006). From bureaucratic organizations to learning organizations: An evolutionary roadmap. *The Learning Organization*, 13(4), 337 – 352.
- James, D., & Biesta, G. (2007). *Improving learning cultures in further education*. London: Routledge.
- Jarvis, P. (2012). *Paradoxes of learning: On becoming an individual in society*. New York: Routledge.
- Jassal, P., & Clark, H., (2016). The New Learning Economy and the Rise of the Working Learner. ACT Foundation. Retrieved from http://www.iftf.org/fileadmin/user_upload/downloads/work-learn/RiseofTheWorkingLearner_P.K.Jassal_H.Clark.pdf
- Johnson, D.W., & Johnson, R.T. (2003). Training for cooperative group work. In M.A. West, D. Tjosvold & K.G. Smith (Eds.), *International handbook of organizational teamwork and cooperative working* (pp. 167-183). West Sussex: John Wiley & Sons Ltd.
- Johnson, D. W., Johnson, R. T., & Smith, K. (2007). The State of Cooperative Learning in Postsecondary and Professional Settings. *Educational Psychology Review*, 19(1), 15-29. doi:10.1007/s10648-006-9038-8
- Järvelä, S., Kirschner, P. A., Panadero, E., Malmberg, J., Phielix, C., Jaspers, J., Koivuniemi, M., Järvenoja, H. (2014). Enhancing socially shared regulation in collaborative learning groups: Designing for CSCL regulation tools. *Educational Technology Research and Development*, 63(1), 125-142. doi:10.1007/s11423-014-9358-1
- Kayes, D.C., & Burnett, G. (2006). Team learning in organizations: A review and integration. Working Paper. Washington: The George Washington University
- Kegan, R. (1994). *In over our heads: The mental demands of modern life*. Cambridge: Harvard University Press.
- Kirby, J., Knapper, C., Evans, C., Carty, A. and Gadula, C. (2003). Approaches to learning at work and workplace climate. *International Journal of Training and Development*, 7, 1, 31–52
- Kozlowski, S. W. J., & Bell, B. S. (2012). Work groups and teams in organizations. In N. W. Schmitt & I. B. Weiner (Eds.), *Industrial and organizational psychology Vol. 12: Industrial and organizational psychology* (2nd ed., pp. 413–469). Hoboken, NJ: John Wiley & Sons, Inc.
- Krippendorff, K. (2004). *Content analysis: An introduction to its methodology* (2nd ed.). Thousand Oaks, CA: Sage.
- Laal, M., & Ghodsi, S. M. (2012). Benefits of collaborative learning. *Procedia - Social and Behavioral Sciences*, 31, 486-490. doi:10.1016/j.sbspro.2011.12.091
- Laiken, M. E. (2001). Adult education in organizations. In T. Barer Stein & M. Kompf (Eds.), *The craft of teaching adults* (3rd ed., pp. 287 – 305). Toronto, Ontario, Canada: Irwin.
- Laiken, M. E. (2003). Models of organizational learning: Paradoxes and best practices in the post industrial workplace. *Organization Development Journal*, 21(1), 8 – 19.

- Lave, J., & Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Lavy, I., & Yadin, A. (2013). Soft Skills – An Important Key for Employability in the "Shift to a Service Driven Economy" Era. *International Journal of E-Education, E-Business, E-Management and E-Learning*. doi:10.7763/ijeeee.2013.v3.270
- Lising, L., & Elby, A. (2005). The impact of epistemology on learning: A case study from introductory physics. *American Journal of Physics*, 73(4), 372-382. doi:10.1119/1.1848115
- London, M., & Sessa, V. I. (2007). How groups learn, continuously. *Human Resource Management*, 46, 651-669.
- Lumbreras, C. C., Crespo, A. G., Palacios, R. C., & Berbis, J. M. (2009). Emotions and interpersonal skills for IT professionals: An exploratory study. *International Journal of Technology Enhanced Learning*, 2(3), 215. doi:10.1504/ijtel.2010.033578
- Makoe, M., Richardson, J. T., & Price, L. (2008). Conceptions of learning in adult students embarking on distance education. *Higher Education*, 55(3), 303–320. doi:10.1007/s10734-007-9056-6.
- Marsick, V. J. (2012). How organizations can support and facilitate informal workplace learning. In J. Gairín (Ed.), *Gestión del conocimiento y desarrollo organizativo: formación y formación corporativa [Knowledge management and organizational development: Corporate education and training]* (pp. 74–93). Madrid: Wolters Kluwer.
- Marsick, V. J., and Watkins, K. (1990) *Informal and Incidental Learning in the Workplace*. London and New York: Routledge
- Marsick, V. J, Watkins, K., Callahan, M.W. & Volpe, M. (2008). Informal and Incidental Learning in the Workplace, in Smith, M. C. (Ed.), *Handbook of research on adult learning and development*. New York, NY: Routledge.
- Marsick, V. J., Watkins, K. E., Scully-Russ, E., & Nicolaides, A. (2017). Rethinking informal and incidental learning in terms of complexity and the social context. *Journal of Adult Learning, Knowledge and Innovation*, 1(1), 27-34. doi:10.1556/2059.01.2016.003
- Marton, F. (1986). Phenomenography: A research approach to investigating different understandings of reality. *Journal of Thought*, 21, 28–49.
- Mason, L. (2007). Introduction: Bridging the cognitive and sociocultural approaches in research on conceptual change: is it feasible? *Educational Psychologist*, 42(1), 1–7.
- Metallidou, P. (2012). Epistemological beliefs as predictors of self-regulated learning strategies in middle school students. *School Psychology International*, 34(3), 283-298. doi:10.1177/0143034312455857
- Millis, B. J., & Cottell, P. G. (1998). *Cooperative learning for higher education faculty*. Phoenix, AZ: Oryx Press.

- Nailon, D., Delahaye, B., & Brownlee, J. (2007). Learning and leading: How beliefs about learning can be used to promote effective leadership. *Development and Learning in Organizations: An International Journal*, 21(4), 6-9. doi:10.1108/14777280710758790
- Nerland, M. (2008). Knowledge Cultures and the Shaping of Work-based Learning: The Case of Computer Engineering. *Vocations and Learning*, 1(1), 49-69. doi:10.1007/s12186-007-9002-x
- OECD (2017) Future of Work and Skills. Retrieved from https://www.oecd.org/els/emp/wcms_556984.pdf
- Olsen, D. S., & Tikkanen, T. (2018). The developing field of workplace learning and the contribution of PIAAC. *International Journal of Lifelong Education*, 37(5), 546-559. doi:10.1080/02601370.2018.1497720
- Paavola, S., & Hakkarainen, K. (2005). The Knowledge Creation Metaphor – An Emergent Epistemological Approach to Learning. *Science & Education*, 14(6), 535-557. doi:10.1007/s11191-004-5157-0
- Paavola, S., Lipponen, L., & Hakkarainen, K. (2002), 'Epistemological Foundations for CSCL: A Comparison of Three Models of Innovative Knowledge Communities', in G. Stahl (ed.), *Computer supported Collaborative Learning: Foundations for a CSCL Community*. Proceedings of the Computer-supported Collaborative Learning 2002 Conference. Erlbaum, Hillsdale, NJ, pp. 24-32.
- Palmquist, M. S., Lapham, M. A., Miller, S., Chick, T., & Ozkaya, I. (2013). *Parallel worlds: Agile and waterfall differences and similarities*. Software Engineering Institute. Technical note CMU/SEI-2013-TN-021. Retrieved from <http://repository.cmu.edu/cgi/view-content.cgi?article=1761&context=sei>
- Paloniemi, S. (2006). Experience, competence and workplace learning. *Journal of Workplace Learning*, 18(7/8), 439-450. doi:10.1108/13665620610693006
- Pillay, H., Boulton-Lewis, G., Wilss, L., & Rhodes, S. (2003). Older and Younger Workers Conceptions of Work and Learning at Work: A challenge to emerging work practices. *Journal of Education and Work*, 16(4), 427-444. doi:10.1080/1363908032000093049
- Pratt, D. D. (1992). Conceptions of teaching. *Adult Education Quarterly*, 42(4), 203–220.
- Raemdonck, I., Thijssen, J. & de Greef, M. (2017). Self-directedness in work-related learning processes. Theoretical perspectives and development of a measurement instrument. Teoksessa M. Goller & S. Paloniemi (Eds.) *Agency at Work: An agentic perspective on professional learning and development* (pp. 401-423). Cham: Springer.
- Raes, E., Kyndt, E., Decuyper, S., Van den Bossche, P., & Dochy, F. (2015). An exploratory study of group development and team learning. *Human Resource Development Quarterly*, 26, 5-30. doi: 10.1002/hrdq.21201
- Reio, T. G., & Wiswell, A. (2000). Field investigation of the relationship among adult curiosity, workplace learning, and job performance. *Human Resource Development Quarterly*, 11(1), 5-30. doi:10.1002/1532-1096(200021)11:13.0.co;2-a

- Ryan, A. & Tilbury, D. (2013) *Flexible Pedagogies: new pedagogical ideas*, London: The Higher Education Academy
- Sambrook, S. (2005). Factors Influencing the Context and Process of Work-Related Learning: Synthesizing Findings from Two Research Projects. *Human Resource Development International*, 8(1), 101-119. doi:10.1080/1367886052000342591
- Sambrook, S., & Stewart, J. (2000). Factors influencing learning in European learning-oriented organizations: Issues for management. *Journal of European Industrial Training*, 24(2), 209–221.
- Schoenfeld, A. H. (1983). Beyond the purely cognitive: Belief systems, social cognitions, and metacognitions as driving forces in intellectual performance. *Cognitive Science*, 7, 329–363.
- Schommer, M. (1990). The Effects of Beliefs about the Nature of Knowledge on Comprehension. *Reading Research Quarterly*, 25(4), 340. doi:10.2307/747695
- Schommer-Aikins, M., Duell, O., & Hutter, R. (2005). Epistemological Beliefs, Mathematical Problem-Solving Beliefs, and Academic Performance of Middle School Students. *The Elementary School Journal*, 105(3), 289-304. doi:10.1086/428745
- Schreier, M. (2012). *Qualitative content analysis in practice*. London: Sage.
- Schwaber, K. 2004. *Agile Project Management with Scrum*. Microsoft Press.
- Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.
- Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York, Ny: Doubleday/Currency.
- Sfard, A. (1998). On Two Metaphors for Learning and the Dangers of Choosing Just One. *Educational Researcher*, 27(2), 4. doi:10.2307/1176193
- Sipe, L. R., & Ghiso, M. P. (2004). Developing Conceptual Categories in Classroom Descriptive Research: Some Problems and Possibilities. *Anthropology Education Quarterly*, 35(4), 472-485. doi:10.1525/aeq.2004.35.4.472
- Slotte, V., Tynjälä, P., & Hytönen, T. (2004). How do HRD practitioners describe learning at work? *Human Resource Development International*, 7(4), 481-499. doi:10.1080/1367886042000245978
- Smith, R., & Kelly, A. (2016). Workers' perspectives and preferences for learning across working life. In S. Billett, D. Dymock, & S. Choy (Eds.), *Supporting learning across working life: Models, processes and practices* (pp. 231-247). Dordrecht, The Netherlands: Springer.
- Stellman, A., & Greene, J. (2016). *Learning Agile*. Sebastopol, CA: O'Reilly.

- Svensson, L. (2009) Learning Environments of Employees in Knowledge-Intensive Company Units, in Velde, C. R. (Ed). *International perspectives on competence in the workplace: Implications for research, policy and practice*. Dordrecht: Springer.
- Tickle, E.L., Brownlee, J. and Nailon, D. (2005), “Personal epistemological beliefs and transformational leadership behaviours”, *Journal of Management Development*, Vol. 24 No. 8, pp. 706-719.
- Tigchelaar, A., Vermunt, J. D., & Brouwer, N. (2014). Patterns of development in second-career teachers conceptions of teaching and learning. *Teaching and Teacher Education*, 41, 111-120. doi:10.1016/j.tate.2014.04.001
- Tsai, C., Ho, H. N., Liang, J., & Lin, H. (2011). Scientific epistemic beliefs, conceptions of learning science and self-efficacy of learning science among high school students. *Learning and Instruction*. doi:10.1016/j.learninstruc.2011.05.002
- Tyler, M. A., Choy, S., Smith, R., & Dymock, D. (2014). Learning in response to workplace change. In C. Harteis & A. S. Rausch, J. (Eds.), *Discourses on Professional Learning* (pp. 159-175). Dordrecht, Netherlands: Springer.
- Tynjälä, P. (1997). Developing education students conceptions of the learning process in different learning environments. *Learning and Instruction*, 7(3), 277-292. doi:10.1016/s0959-4752(96)00029-1
- Tynjälä, P. (2008). Perspectives into learning at the workplace. *Educational Research Review*, 3, 130-154. doi:10.1016/j.edurev .2007.12.001
- Tynjälä, P. (2012). Toward a 3-P Model of Workplace Learning: A Literature Review. *Vocations and Learning*, 6(1), 11-36. doi:10.1007/s12186-012-9091-z
- Unwin, L. (2008): *Learning at Work: Opportunities and Barriers*. Foresight Mental Capital and Wellbeing Project: Making the most of ourselves in the 21st century: State-of-Science Review SR-A2. UK Govt Office for Science
- Van den Bossche, P., Gijssels, W., Segers, M., & Kirschner, P. A. (2006). Social and cognitive factors driving teamwork in collaborative learning environments. *Small Group Research*, 37(5), 490–521.
- Van Rossum, E. J., & Hamer, R. (2010). *The meaning of learning and knowing*. Rotterdam: Sense.
- Vanhournout, G., Noyens, D., Gijbels, D., & Van den Bossche, P. (2014). The relation between workplace climate, motivation and learning approaches for knowledge workers. *Vocations and Learning*, 7, 191–214.
- Vähäsantanen, K., & Eteläpelto, A. (2017). Agency and Learning in the Work of Software Professionals. *The Impact of Digitalization in the Workplace Professional and Practice-based Learning*, 161-179. doi:10.1007/978-3-319-63257-5_11
- Watkins, K. E., & Marsick, V. J. (1992). Towards a theory of informal and incidental learning in organizations*. *International Journal of Lifelong Education*, 11(4), 287-300. doi:10.1080/0260137920110403

- Weinberg, F. J. (2015). Epistemological beliefs and knowledge sharing in work teams. *The Learning Organization*, 22(1), 40-57. doi:10.1108/tlo-11-2013-0067
- West, M. A. (2000). Reflexivity, revolution, and innovation in work teams. In M. M. Beyerlein, D. A. Johnson, & S. T. Beyerlein (eds), *Advances in Interdisciplinary Studies of Work Teams* (Vol. 5, pp. 1–29). Greenwich, Conn.: JAI Press.
- Wilson, J. M., Goodman, P. S., & Cronin, M. A. (2007). Group learning. *Academy of Management Review*, 32(4), 1041–1059

Appendix 1

Factors influencing workplace learning

	Individual-level	Team-level	Organisational-level	Industry-level
Driving-factors	Career safety Reputation			Complex tasks Rapid tech evolution Unique, open problems Diverse settings
Supporting-factors	Learning orientation Personal mastery Sense of purpose Interest High level learning skills High level collaboration skills Sense of competence	Psychological safety Self-organization Diversity Cognitive conflicts Shared goals Social cohesion	Enabling leadership style Culture (trust, transparency, open communication) Values (people, learning, continuous improvement) Flat hierarchy Shared ownership	
Constraining-factors	Personal circumstances Low level learning skills Low level collaboration skills	Language barrier Cultural differences Interpersonal conflicts Tight project deadlines	Restricted access to information or resources Controlling leadership style Slow decision making	