Team learning in education and professional organisations

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Filip Dochy*, David Gijbels°, Elisabeth Raes* & Eva Kyndt°*

*University of Leuven, Belgium
°University of Antwerp, Belgium

1. Introduction: Team learning and collaborative learning

The importance and use of teamwork increased dramatically in the past three decades both in professional organisations and in the context of education. Across Europe teamwork has been incorporated into companies' overall strategy as a core element in new forms of work organisation (European foundation for the improvement of living and working conditions, 2007). Within the US the study of Lawler, Mohrman, and Ledford (1995) demonstrated how 68% of Fortune 1000 companies reported to use self-managing work teams in 1993 as compared to 28% in 1987. A team can be defined in many different ways, in this chapter, we use the 'team' definition of Cohen and Bailey: *"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 (…), and who manage their relationships across organisational boundaries"* (Cohen & Bailey, 1997, p. 241).

The growth of teamwork in modern organisations shows to be unstoppable as there is scientific evidence that teamwork can help organisations to deal with more complex tasks and a changing environment (Brousseau, 1997; Mathieu, Maynard, Rapp, & Gilson, 2008; Senge, 1990; Zaccaro, Ely, & Shuffler, 2008). However, although teamwork is often used as a 'positive' word, it only 'works' under certain conditions (West, 2004). Recent research shows that for teams to work effectively, one of the 'key' conditions is that they engage in team learning processes and learn how to work effectively (Mesmer-Magnus & DeChurch, 2009;

Savelsbergh, van der Heijden, & Poell, 2007; Savelsbergh, van der Heijden, & Poell, 2007; Van Den Bossche, Gijselaers, Segers, & Kirschner, 2006; Van Woerkom & Croon, 2009).

Also in education, working and learning in small groups has been used for many decades and still becomes more and more popular. Many different forms of collaborative or cooperative learning became popular since the 1960's. Problem-based learning and project-based learning can be considered as one of the few curriculum-wide educational innovations that are still surviving and still increase in popularity (Gijbels, Van den Bossche & Loyens, 2012; Schmidt, van der Molen, te Winkel, & Wijnen, 2009). Also competence based learning in educational programmes is mainly based on collaborative learning and assessment formats.

The current book chapter will start by presenting an overview of the origin and history of team learning. This section will elaborate on how team learning is related to collaborative learning within educational settings while at the same time having its distinct features (2.). In the following section, more background is provided about collaborative learning in education (3.). Empirical evidence is provided and specific attention is given to problem based and project-based learning. Subsequently, different theoretical models of team learning in professional contexts are introduced (4.) and empirical research on the antecedents and outcomes of team learning are presented (5.). Finally, the conclusions and directions for future research are discussed (6.).

2. History of team learning

The term 'team learning' was introduced to a wider audience in the beginning of the nineties with Senge's bestseller 'The Fifth Discipline' (1990; Edmondson, Dillon, & Roloff, 2007). It was argued that not individual learning, but team learning is the true motor in creating a learning organisation. By means of dialogue and thinking together about complex issues, innovative and coordinated action, and good communication with members from other teams within the organisations, teams were hypothesised to create a potential basis for continuous organisational growth and change.

But is team learning really such a new phenomenon? Or is the new word 'team' used here as a permit to separate research on team learning from research on collaborative or cooperative learning? After all, the subject of education through collaboration or cooperation in interdependent small groups is certainly related to the field of team learning. And this field of research is certainly blessed with a long and prosperous history: *"Cooperative learning is an old idea. The Talmud clearly states that in order to learn you must have a learning*

partner. In the first century, Quintillion argued that students could benefit from teaching one another. The Roman philosopher, Seneca advocated cooperative learning through such statements as, "Qui Docet Discet" (when you teach, you learn twice). Johann Amos Comenius (1592-1679) believed that students would benefit both by teaching and being taught by other students." (Johnson & Johnson, 1989, p. 12)

At the end of the 18th century Lancaster and Bell wrote the first articles about cooperative learning groups in education (Salmon, 1932). The first scientific work on the subject is traced back to the beginning of the 20th century with the early writings of influential thinkers such as John Dewey, Lev Semenovič Vygotsky, Kurt Lewin and Jean Piaget (Johnson & Johnson, 1989). John Dewey (Dewey, 1936; Dewey, 1940) promoted the use of cooperative learning groups as part of his project method in instruction. Vygotsky (1979) defined human learning as fundamentally social and the zone of proximal development as the distance between someone's original development level and the level of his potential development when collaborating with more capable peers. Lewin (1939; Lewin & Grabbe, 1945) wrote his field theory and experimentally showed the importance of groups for education.

According to Johnson and Johnson (1989) both practice and research on cooperative learning fell out of favour in the build-up to the Second World War, losing its attraction for about 25 years. Interpersonal competition and individualistic learning regained popularity until a renewed interest in cooperative learning was cultivated in schools at the beginning of the eighties.

It would be tempting to argue that the term 'team learning' is just a new fashionable term used by modern organisations for something that has been part of educational practice and research for a very long time. However, there is something different about the team learning concept Senge introduced. In contrast to the strands of collaborative and cooperative learning, team learning was theorised in terms of conditions and processes that lead to learning outputs at the level of the team, such as mutually shared cognition, shared vision, specific team products, innovations, increased team productivity, group-efficacy, etc. Certainly cooperative and collaborative learning are primarily about conditions and processes that lead to learning outputs at the level of the individual, such as academic achievement, higher-level reasoning, retention, creativity, achievement motivation, intrinsic motivation, transfer of learning, self-esteem, social competencies, psychological health, etc. (Johnson & Johnson, 2003).

In the past 20 years, several authors have contributed significantly to the theoretical development of this team-level learning concept. As noted above, a first important theoretical contribution was the work of Senge (1990; Edmondson et al., 2007), who developed the team

learning concept in the footsteps of the emerging discipline of the learning organisation. He constructed a double learning cycle, connecting learning of individuals (reflecting, connecting, deciding and doing) to learning processes at the level of the team (public reflection, shared meaning, joint planning and coordinated action).

In 1993, Dechant, Marsick, and Kasl did a second theoretical effort to capture team learning, and developed a team learning model with five central team learning processes: framing, reframing, experimenting, crossing boundaries and integrating perspectives. In contrast to Senge's work, they did not focus on learning at the level of the organisation, but really focused on learning at the level of the team. Also, they were the first to model how team learning develops in the course of time. In the same year developed a multi-level system perspective on team learning. She opened the door to a 'learning curve' conceptualisation of team learning, in which learning by doing is considered to be a valuable aspect in the gradual collective adaptation towards improved team performance.

In 1994, Brooks increased our understanding of team learning by distinguishing between on the one hand reflective work, which is essentially about problem posing, sharing knowledge and information, and integrating shared knowledge, and on the other hand active work, which is essentially about gathering data from outside the team boundaries. Although Senge (1990), Argote (1993), and Dechant et al. (1993) discussed barriers for team learning, she was the first to truly focus on the role of power.

In 1997, Hinsz, Tindale, and Vollrath highlighted a paradigm-shift in small-group performance research and described the emerging view of groups as information processors. They were the first to extensively review research on processing objectives, attention, encoding, storage, retrieval, processing, response, feedback, and learning in teams. Whereas, the previously mentioned authors discussed team learning primarily from a socio-cultural perspective, where the emphasis is placed on the alignment of social interactions between group members (e.g., development of group mind in Weick & Roberts, 1993), these authors were the first to integrate research regarding team learning from a cognitive tradition (e.g., team mental models in Klimoski & Mohammed, 1994; transactive memory systems in Wegner, Erber, & Raymond, 1991). From this cognitive tradition, they put the emphasis in group learning on what happens within the minds of individual group members, and how individual cognitions can be coordinated and adapted between group members in the pursuit of increased group effectiveness and improved group learning.

In 1998, Tannenbaum, Smith-Jentsch, and Behson described the team learning processes as a cyclical process of pre-brief, team activity and post-action review. Moreover, they were

the first to really focus on the role of facilitators in supporting team learning. In 1999 Edmondson wrote an influential article about psychological safety and learning behaviour in teams in which she similarly described team learning as an on-going process of action and reflection, characterised by asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors or unexpected outcomes of actions. The major contribution from her work is that she showed how team leaders can create an environment in which team members are not afraid to contribute ideas, ask questions, admit mistakes, give feedback, etc. if they wish to support team learning.

From the turn of the millennium onwards, theoretical research on the subject of team learning flourished enormously (Argote, Gruenfeld, & Naquin, 2001; Decuyper, Dochy, & Van den Bossche, 2010; Edmondson, Dillon, & Roloff, 2007; Gibson, 2001; Homan, 2001; Kayes & Burnett, 2006; London & Sessa, 2006; London & Sessa, 2007; London, Polzer, & Omoregie, 2005; Rupert & Jehn, 2006; Savelsbergh, Storm, & Kuipers, 2008; Sessa & London, 2008; Wilson, Goodman, & Cronin, 2007). Similarly, the number of empirical studies on the topic grew exponentially. Decuyper, Dochy, & Van den Bossche (2010) for example introduced the interdisciplinary approach that led to the recognition of 8 team learning processes (see further, Figure 5).

Due to this increased interest in and execution of team learning research, we can state today that the complexity and dynamism of the subject turned into a hallmark of the field. Currently, the field of team learning spans the disciplines of learning sciences, labour, social and organisational psychology, sociology, management, communication, political science, labour pedagogy, information science, and organisational theory (Poole, Hollingshead, McGrath, Moreland, & Rohrbaugh, 2004; Van Den Bossche, 2006). Nevertheless, although many authors contributed to the theoretical development of the team learning construct, only few crossed the boundaries of their discipline.

3. Collaborative learning in education

In today's learning environments in education a more active role for learners is stimulated. Learning becomes more central and is not a side effect. Because of the swift changes in knowledge it is important that the students learn to learn (meta-cognition). Learning is not pre-planned and organised by an outsider. The learners decide themselves how and what they learn (Simons, van der Linden, & Duffy, 2000). Cooperative learning becomes more and more important to facilitate learning and higher order thinking (Cohen, 1994). *Cooperative learning* is a setting where people learn together in a group that is small enough to allow

active participation of each group member (Krause, Stark, & Mandl, 2009). One can see this group process as cooperative learning or collaborative learning. In *cooperation*, partners split the work, solve sub-tasks individually and then assemble the partial results into the final output (Sawyer, 2006). In *collaboration*, partners do all their work together. Collaborative work can be seen as sharing ideas, knowledge, competences and information to accomplish a task or goal (Nunamaker, Dennis, Valacich, Vogel, & George, 1991). Both terms have a lot in common. Still we prefer to term 'collaborative' since it stresses not the division of work in a small group but rather the interaction in the group in all activities.

As Dillenbourg argues in his famous chapter in 1999 (p.5): "Collaborative learning is not one single mechanism: if one talks about "learning from collaboration", one should also talk about "learning from being alone". Individual cognitive systems do not learn because they are individual, but because they perform some activities (reading, building, predicting, ...) which trigger some learning mechanisms (induction, deduction, compilation,...). Similarly, peers do not learn because they are two, but because they perform some activities that trigger specific learning mechanisms. This includes the activities/mechanisms performed individually, since individual cognition is not suppressed in peer interaction. But, in addition, the interaction among subjects generates extra activities (explanation, disagreement, mutual regulation, ...) which trigger extra cognitive mechanisms (knowledge elicitation, internalisation, reduced cognitive load, ...). The field of collaborative learning is precisely about these activities and mechanisms. These may occur more frequently in collaborative learning than in individual condition. However, on one hand, there is no guarantee that those mechanisms occur in any collaborative interactions. On the other hand, they do not occur *only* during collaboration. At some level of description - at least the neuron level-, the mechanisms potentially involved in collaborative learning are the same as those potentially involved in individual cognition.

Collaborative learning is not a method because of the low predictability of specific types of interaction. Basically, collaborative learning takes the form of *instructions* to subjects (e.g., "You have to work together"), a physical *setting* (e.g., "Team mates work on the same table") and other institutional *constraints* (e.g., "Each group member will receive the mark given to the group project"). Hence, the 'collaborative' situation is a kind of *social contract*, either between peers, or between peers and the teacher (then it is a didactic contract). This contract specifies conditions under which some types of interactions *may* occur, there is no guarantee they will occur. For instance, the 'collaboration' contract implicitly implies that both learners contribute to the solution, but this is often not the case. The efficacy of collaborative learning depends on the complex interaction between three components: the individual students, the

group they are participating in, and the assignment they are collaborating on (Schellens, Van Keer, De Wever, & Valcke, 2007).

3.1. Empirical evidence for collaborative learning

There exists a lot of research on collaborative learning. Research has already proven that cooperative learning can improve knowledge acquisition (Lou, Abrami, & d'Apollonia, 2001), elaboration of subject matter (Krol, Janssen, Veerman, & Van der Linden, 2004), and mindfulness (Lambiotte et al., 1988). Collaborative learning can also lead to a deeper level of learning, critical thinking, shared understanding, and long-term retention of the learned material (Garrison, Anderson, & Archer, 2001; Johnson & Johnson, 1999). From a social point of view collaborative learning leads to a better development of social and communication skills, more positive perceptions towards group members, better social relationships and higher levels of group cohesion (Gupta, 2004; Johnson & Johnson, 1989; Johnson, Johnson, & Smith, 2007). Johnson and Johnson (2003) did a large review about the value of cooperative learning against individual learning and competitively learning. They found that groups perform better, take better decisions and are better in solving problems than individuals or competitively oriented groups. They also discovered that in a collaborative group, there is a bigger interrelation attraction than in competitive oriented groups. Their findings also showed that group efforts promoted greater social support than the other two forms of learning. Finally, collaborative learning results in a higher level of psychological health and in a higher level of self-esteem. As a consequence, collaborative learning gained more and more interest. Research on the effectiveness of these forms of collaborative learning has been done primarily in the area of problem-based learning (PBL) and to a lesser extent in project-based learning (PjBL). Although there are many forms of collaborative learning, problem-based learning and project-based learning are probably two of the most well spread, particularly in higher and academic educational programmes (Tynjälä & Gijbels, 2012).

3.1.1. Problem-based learning

Although originally developed for medical training in Canada at McMaster University, the orthodox version of problem-based learning (PBL) has been modified and applied globally in many disciplines (Gijselaers, 1995). Within the literature, PBL has been defined and described in different ways. On the basis of the original method as developed at McMaster University, Barrows (1996) described six core characteristics of PBL. The first characteristic is that learning needs to be student-centred. Secondly, learning has to occur in small student

groups under the guidance of a tutor. The third characteristic refers to the tutor as a facilitator or guide. Fourthly, authentic problems are primarily encountered in the learning sequence, before any preparation or study has occurred. Fifthly, the problems encountered are used as a tool to achieve the required knowledge and the problem-solving skills necessary to eventually solve the problem. Finally, new information needs to be acquired through self-directed learning.

The aim of schools and colleges implementing PBL is to educate students that are able to understand and solve complex problems in a changing world (Gijbels et al., 2005). The interest in the question towards the effects of PBL has produced, until now at least, eight systematic reviews on the effects of problem-based learning (see also Gijbels, Van den Bossche, & Loyens, 2013). The review by Albanese and Mitchell (1993) is probably the most well known. The main results from this review are that PBL is more nurturing and enjoyable and that PBL-graduates perform as well, and sometimes better, on clinical examinations and faculty evaluations than students in more conventional instruction. However, PBL students score occasionally lower on basic science examinations and view themselves as less well prepared in the basic sciences in comparison to their conventionally trained counterparts. Further, PBL-graduates tend to engage in backward reasoning rather than the forward reasoning experts engage in. Finally, the costs of PBL are high when class sizes are larger than 100.

At the same time, Vernon and Blake (1993) synthesised all available research from 1970 through 1992 comparing PBL with more conventional methods of medical education. Five separate statistical meta-analyses resulted in the following main results: PBL is found to be significantly superior with respect to students' attitudes and opinions about their programs and measures of students' clinical performance. Contrary to the previous reviews findings, the results of PBL students do not significantly differ from conventionally taught students on miscellaneous tests of factual knowledge and tests of clinical knowledge. However, students from conventional education perform significantly better than their PBL counterparts on the National Board of Medical Examiners (NBME), a standardized test administered to medical students in the US.

Berkson (1993) also searched for evidence of the effectiveness of PBL in the medical PBL-literature till 1992. Six topics on the effectiveness of PBL compared to conventional curricula underlie this narrative meta-analysis in the medical domain: problem-solving, the impart knowledge, students' motivation to learn medical science, the promotion of self-directed learning skills, student and faculty satisfaction, and the financial costs. The results

showed no distinction between graduates from PBL and conventional instruction, but PBL can be stressful for both students and faculty and a PBL curriculum may be unreasonably expensive.

Subsequently, Colliver (2000) questioned the educational superiority of PBL relative to standard approaches. Colliver focused on the credibility of the claims about the ties between PBL and educational outcomes and the magnitude of the effects. He conducted a review of medical education literature, starting with the three reviews published in 1993 and moving on to research published from 1992 through 1998 in the primary sources for research in medical education. Colliver concluded that their is no convincing evidence that PBL improves the student's knowledge base and clinical performance, at least not of the magnitude that would be expected given the resources required for a PBL curriculum. Nevertheless, PBL may provide a more challenging, motivating and enjoyable approach to medical education.

One of the more recent reviews by Smits et al. (2002) is limited to the effectiveness of PBL in continuing medical education. This review only included controlled evaluation studies in continuing medical education from 1974-2000. In short, Smits and colleagues concluded that there is limited evidence for PBL to increase participants' knowledge, performance, and patients' health. However, there was only moderate evidence that doctors were more satisfied with PBL.

The review by Dochy, Segers, Van den Bossche, and Gijbels (2003) was the first review searching for studies beyond the domain of medical education. The main question was similar but much more itemised than the other reviews: What are the main effects of PBL on students' knowledge and knowledge application and what are the potential moderators of the effect of PBL? The results of this meta-analysis suggested that PBL has statistically and practically significant positive effects on students' knowledge application. The effects of PBL on students' knowledge base tended to be negative. However, this effect was found to be strongly influenced by outliers (i.e. studies with high effect sizes possibly overestimating the overall effect). In addition, the moderator analysis on the retention period of students' knowledge suggested that students in a PBL environment have slightly less knowledge but remember more of the acquired knowledge, because they can rely on a more structured knowledge-base (Dochy et al., 2003).

In order to further investigate the moderating effect of the method of assessment on the effects of PBL, a second meta-analysis was set up (Gijbels, Dochy, Van den Bossche, & Segers, 2005). In this meta-analysis, the influence of assessment was the main independent variable. The goal of this study was to describe the effects of PBL from the angle of the

underlying focal constructs being measured with the assessment. Using Sugrue's model (1995) as a frame of reference, the research questions were: What are the effects of PBL when the assessment of its main goals focuses on respectively (1) the understanding of concepts, (2) the understanding of the principles that link concepts, and (3) the linking of concepts and principles to conditions and procedures for application? In order to be congruent with its educational goals and resulting instructional principles and practices, the assessment of the application of knowledge when working with authentic problems is at the heart of the matter in PBL. Therefore, it was expected that students in PBL perform better at the third level when compared to students in more traditional learning environments. The results of the meta-analysis showed a difference in the reported effects of PBL between each of the three levels. However, different from expectations that the effects of PBL are larger when the method of assessment is more capable of evaluating complex levels, the effect size for the third level of the knowledge structure was smaller compared to the effect size of the second level and not statistically significant. Moreover, in only 8 of the 40 studies included in the meta-analysis the assessment focused at the third level. Most studies (N= 31) assessed at the level of understanding of concepts. PBL had the most positive effects when focal constructs being assessed were at the second level, understanding the principles that link concepts. These results imply an implicit challenge for PBL to pay more attention to the third level of the knowledge structure, both during the learning activities that take place and students' assessment.

Finally, the meta-analysis by Walker and Leary (2009) builds upon the studies by Dochy et al. (2003) and Gijbels et al. (2005). They performed a meta-analysis that crossed disciplines as well as categorised the types of problems used, the PBL approach employed, and the level of assessment. Across 82 studies and 201 outcomes their findings favour PBL. In addition, the homogeneity analysis indicated that a closer examination of potential moderators was needed.

3.1.2. Work-based project learning

Project-based learning can be seen as a pedagogical innovation that integrates theory and practice by means of problem solving related to working life issues (e.g., Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Van den Bergh et al., 2006). The main difference from problem-based learning is that the problems are more complex: they are not just authentic but real in the sense of requiring a real solution from the students. On the other hand, just as with problem-based learning, project-based learning can in practice assume a variety of forms. Blumenfeld et al. (1991) provide a useful basic definition. According to

them, the essence of project-based learning is that a question or problem serves to organise and drive activities; also that these activities culminate in a final product that addresses the driving question (Blumenfeld et al., 1991; see also Helle, Tynjälä, & Olkinuora, 2006). Naturally, this basic definition can be specified further. Characteristics linked with project work include student-centeredness (i.e., involving the student in aspects such as setting learning objectives, deciding upon work procedures, etc.) together with the fact that it goes on for a long period of time and that the work is organised in a systematic fashion (see also Helle, Tynjälä, & Vesterinen, 2006; Tynjälä, Pirhonen, Vartiainen, & Helle, 2009).

Within the current section, the focus is on work-based project learning. Within this form of project-based learning the project or problem the students are working on is derived from working life practice. The project is based on a collaboration between a professional organisations and the student group and its teachers. The professional organisation presents an authentic, real life problem that they are facing and in collaboration with the students a solution is sought. Unfortunately, a particular difficulty of this form of learning lies in the – often lacking – readiness of both parties to collaborate.

In a their review of the literature on work-based project learning and its impact on learning in post-secondary education, Helle, Tynjälä, and Olkinuora (2006) concluded that the research was so limited as to be virtually non-existent. Since then, however, some researchers have collected empirical evidence which tends to support the learning resulting from project-based learning, and which also illustrates the model of Integrative Pedagogy. Verpoorten, Gijbels, and Donche (2010) investigated the learning outcomes of a project-based learning course "Interdisciplinary Project (IP)" within a masters program. During the IP students work in groups of six students, spending nine months on a specific but complex task formulated by an external bidder. The authors administered the Inventory of Learning Styles (Vermunt, 1992) to assess students' self-regulated learning and conducted semi-structured interviews with students one year after they finished the course. They asked about the kinds of learning outcomes that students recognised during the project, and how the students evaluated the learning in project-based learning as compared to the other courses in the program. The results indicated that for all students the "real assignment" work was found motivating. Students reported that they had learnt more or different issues compared to other courses, but also that the workload was high, partly because they did not have all the information they needed to solve the task right from the start of the course. Students reported that they learnt much from the discussions within the project group and from the peer assessment within the

group. They improved their skills in analysing problems and in developing, carrying out and monitoring plans. At the same time they learnt to function in a team and to give guidance to a team. They reported that by writing minutes and reports and by communicating with external organisations their communication skills had improved. Another reported learning outcome involved the realisation that theory can work differently in practice. Working and learning in projects draws heavily on the independence of the students and on the ways in which independent students can monitor their own learning activities. This seems to make all the difference between working and learning in the project team as, on the one hand, an exciting opportunity, or on the other, an intolerable burden.

Helle and Tynjälä (2007; Tynjälä, Pirhonen, Vartiainen & Helle, 2009) reported similar findings on the learning outcomes of project-based learning in a course on information systems design. They divided different forms of learning results into three basic categories: 1) domain-specific knowledge and skills, 2) generic working-life competences (such as communication and teamwork skills), and 3) the development of professional identity (involving the strengthening of the self concept and clarifying career prospects). Of these outcomes the second and the third group are less easy to gain through traditional classroom study. Helle, Tynjälä, Olkinuora and Lonka (2007) also found motivational effects in their studies, as did Verpoorten et al. (described above). The results indicated that the intrinsic study motivation of students increased substantially during the project-based course, while motivation remained stable among the control group students who lacked any project-based learning component in their studies. Furthermore, and even more interestingly, the results indicated that students who were originally ranked lowest in self-regulation profited most in terms of intrinsic study motivation. The authors concluded that project-based learning seems to provide students with a learning environment that prepares them well for their future work.

The literature on collaborative learning within education has shown the potential benefits that team learning within organisations can have. In general results show that students learn better cooperatively than they do individually. The research on problem based on project-based learning however also shows that several factors influence these potential benefits of learning and working together. However, it is also important to notice that considerable differences exist between educational and professional contexts. On the one hand, one of the most important differences is that learning ‘an sich’ is not a goal within professional organisations in contrast to educational settings. On the other hand, project-based learning, which is oriented towards working life and requires authentic solutions that will be applied within the

professional organisation, already forms a bridge between both contexts. However, due to the differences between both contexts specific models on team learning in professional organisations have been developed.

4. Team learning in professional organisations

Also recently, several researchers have tried to model team learning in professional contexts. At least five models that do try to understand the processes behind team learning can be found: (1) the model of work-team learning (Edmondson, 1999), (2) the model of team learning process (Edmondson, 2002), (3) the model of group continuous learning (Sessa and London, 2006), (4) the model of team learning beliefs and behaviours (Van den Bossche, Gijselaers, Segers, and Kirschner (2006)) and (5) the integrative systemic model for team learning (Decuyper, Dochy & Van den Bossche (2010)).

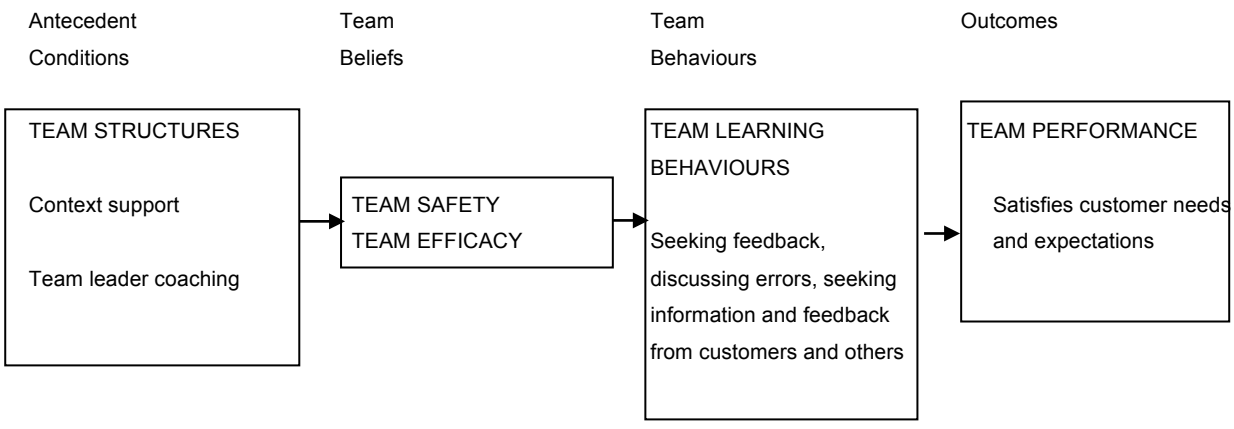
4.1. Model of work-team learning (Edmondson, 1999)

Edmondson (1999) studied real organisational work teams from different types, using both qualitative and quantitative methods to examine the model constructs. She observed a variable extent to which teams engaged in team learning behaviour, providing the perfect environment to examine team learning factors. She stated that team learning behaviour is significantly positively associated with team performance and that psychological safety significantly predicted team learning behaviour, as can be seen in Figure 1 below.

Figure 1 shows the variables in the team learning model, such as team structures, team safety and efficacy, team learning behaviour and team performance.

Figure 1

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



Results from Edmondson's research revealed that team psychological safety is associated with team learning behaviour, that team efficacy is associated with team learning behaviour and that team efficacy predicts team learning behaviour when controlling for team psychological safety. The different concepts of her model will be discussed into more depth.

4.1.1. Team efficacy

Previous research has examined group efficacy as a group-level phenomenon (e.g., Guzzo, Campell, Shea,& Yost, 1993) or linked team efficacy with performance (Gibson, 1996; Lindsley, Brass, and Thomas, 1995). However, research has not defined methods through which joint ideas of efficacy result in higher levels of performance. Edmondson (1999) suggests that efficacy stimulates the confidence among team members, promoting team learning behaviour and working towards an accomplishment of the shared team goal. When team members doubt about speaking up about previous errors, a positive result may be achieved when two conditions are satisfied: (1) team psychological safety; they feel safe and feel they will not be rejected (relating to interpersonal threat) and (2) team efficacy; they feel capable as a team to use this new information to create positive results (relating to team performance). In sum, these are two complementary concepts; team efficacy adds to the positive effect of psychological safety on team learning.

4.1.2. Team Leader Behaviour and Context Support

Team effectiveness can be increased by enhancing structural features such as a clearly defined team goal, an enabling design (with context support such as access to proper resources, information, etc.) and team leader behaviours (such as coaching, giving direction) (Hackman, 1987; Wageman, 1998). Edmondson (1999) uses these structural features to explain antecedents of team psychological safety. Context support, for instance, stimulates team psychological safety as it reduces insecurity and defensiveness in a team. Next, team leader behaviour also has a positive effect on team psychological safety, as salient, supportive and coaching-oriented behaviour may result in an environment which is believed to be safe by team members, and, in contrast, authoritarian or punitive behaviour may obstruct members to engage in interpersonal risk-taking involved in team learning behaviour (Edmondson, 1996).

In sum, team psychological safety can be considered as a state including structural features to achieve behavioural results, or as a 'mediator between the antecedents of team leader coaching and context support and the outcome of team learning behaviour' (Edmondson,

1999). Furthermore, Edmondson (1999) states that 'team efficacy mediates between the antecedents of team leader coaching and context support and the outcome of team learning behaviour', meaning that team members will feel more confident about their chances of success in a supportive and safe environment, therefore resulting in team efficacy and consequently promoting team learning.

4.1.3. Team type

Various types of teams can be distinguished in various dimensions, ranging from cross-functional vs. single-functional, to time-limited vs. enduring and manager-led vs. self-led teams (Edmondson, 1999). Although team learning behaviour may differ in various team types (e.g., a time-limited new product development team vs. an on-going self-directed production team), the relation of team psychological safety with team learning behaviour applies across different types of teams. Therefore, team type does not significantly influence team learning behaviour when assessed with other variables as discussed in the model below, whereas team psychological safety and team efficacy do have an important effect.

4.2. Model of Team Learning Process (Edmondson, 2002)

Later on, Edmondson developed a social psychological model that explores the concept of trust and collective learning in teams. In order to do so, she conducted several field studies in organisational settings. The model states that interpersonal risks can reduce collective learning and distinguishes psychological safety from trust, by defining three elements of psychological safety that differ from trust; the timeframe, the object of focus and level of analysis. Furthermore, it explains the reasons of the improvement of interpersonal risks and structured learning processes in teams by psychological safety. Practically, this model can be used by team leaders to help the participants in managing and overcoming the risks of learning, e.g. losing face or other risks that can threaten or damage the image others hold of them.

The model has been based on the idea that people are consciously and unconsciously hesitant towards certain behaviour that could change or damage the image others have of them. The immediate social context can influence this behaviour. The complex organisational culture cannot fully improve uncertainty and anxiety, as many individual interpersonal risks remain hidden and tend to be set to the background.

Many people tend to minimise the risk to their image, especially in a work-related setting and in front of those people that formally evaluate them, as instrumental (promotions, other

beneficial advantages) and socio-emotional (preference of approval above disapproval) factors are involved. The model discusses how the creation of conditions with a low interpersonal risk can help in minimising this risk. Four specific risks can be distinguished: (1) being seen as ignorant, (2) incompetent, (3) negative or (4) disruptive. Each risk can be activated by different team learning behaviours. Overall, the model describes the collective learning process, explaining concepts of psychological safety, the process of team learning, the role of the team leader and how these concepts are related.

Edmondson uses the term 'psychological safety' to describe the extent to which people consider the work environment to be safe to take interpersonal risks or 'putting themselves on the line' (making mistakes, asking questions, proposing new ideas etc.), thereby benefitting from learning. However, team psychological safety does not imply group cohesiveness, which can undermine individual thinking and can result in the absence of interpersonal risks. It does create an environment for productive group discussion and shared goals. According to Edmondson, it is essential to firstly create conditions of this psychological safety and secondly develop a collective learning process with a compelling goal in order to achieve effective learning in organisations, as psychological safety creates engagement and a goal provides direction and motivation.

One of those conditions is trust, summarised as the expectation that others' future actions will benefit someone else, making one willing to be vulnerable to those actions (Mayer et al. 1995; Robinson, 1996). Trust and psychological safety both include complementary perceptions of risk or vulnerability, as well as choices that minimise negative consequences and potential positive consequences for the organisation. Edmondson's analysed data from a manufacturing company study to show that psychological safety stimulates team learning, which then promotes team performance throughout the hierarchical roles of the organisation (e.g., doctors and nurses sharing experiences can stimulate team performance as a whole). It can also facilitate innovation, e.g., a nurse loses her fear of speaking up stimulates people to share ideas, which results in introducing medical innovations. In order for collective learning to take place, psychological safety needs to be created, for instance by reducing the risks of speaking up, and some type of structure needs to be created for exchanging ideas and initiating action. According to Argyris and Schön (1978) structure can be created (and consequently collective learning can be achieved) through reflection-action, or 'double-loop-learning', repetitive cycles of action, reflection, and adjustment or implementation. In order for subsequent action to take place, a compelling shared goal needs to be established first

(creating shared understanding) which is also well defined for all team members in order to create reflection-in-action (Hackman, 1987).

Edmondson states that psychological safety acts as a moderator in the positive relationship between a compelling goal and team learning. A high level of psychological safety results in a stronger relationship and therefore increases motivation to learn, while a low level causes a weaker relationship and reduction in motivation.

Figure 2

Model of Team Learning Process (Edmondson, 2002)

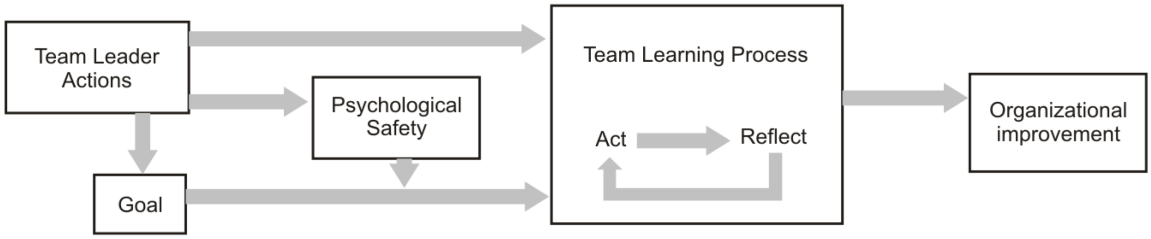


Figure 2 illustrates the team learning process, depicting the actions of the team leader that influence the goal, the psychological safety and the team learning process. Psychological safety, however, acts as a moderator between a compelling shared goal and the team learning process, stimulating the effect of this goal on team learning, concluding in organisational improvement.

As a paradox, team learning is achieved by both freedom in behaviour, which is promoted by psychological safety and guidance or structure through deliberate action (West, 2000). Managing this paradox and helping to define a shared goal for the team are the main tasks of the team leader. His actions and attitudes define the team learning process (as they influence psychological safety), structure it and communicate the team goal. The leader must also establish structure for the team to ensure reflection-action and corresponding adjustments (Edmondson 2002). Edmondson states that empirical research is needed to test and extend the model illustrated in Figure 2. This model tries to be a supportive framework for team leaders in order to achieve space for innovation while providing structure for learning without rigidity and creating a climate of psychological safety.

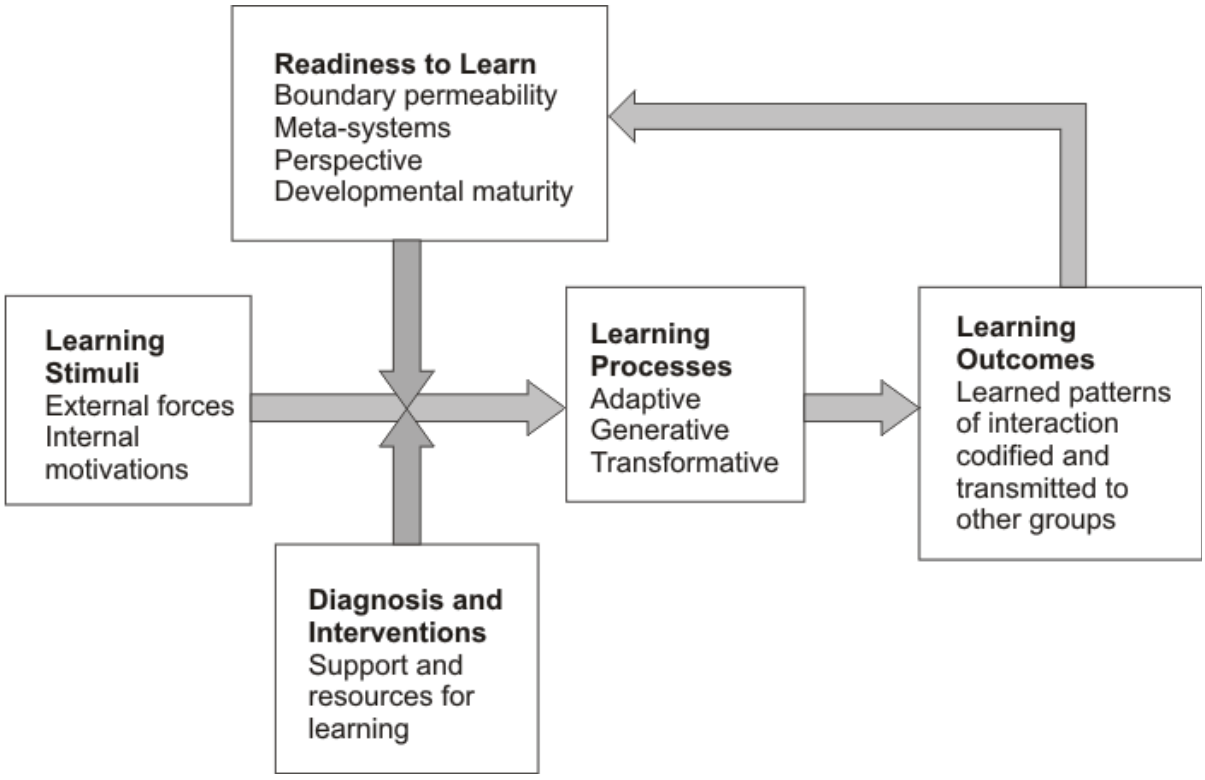
4.3. Model of group continuous learning (Sessa & London, 2006)

In 2006, Sessa and London designed a model for group learning from a different perspective. Senge states in 'The fifth discipline' that "team learning is vital because teams, not

individuals, are the fundamental learning unit in modern organisation. This is where the rubber meets the road; unless teams can learn, the organisation cannot learn." (1990a, p. 10). Team learning appears to be a key driver for individual learning (Slavin, 1996; Sweet & Michaelsen, 2007), team effectiveness (Crossan, Lane, White, & Djurfeldt, 1995; Van den Bossche, Gijselaers, Segers, & Kirschner, 2006) and organisational learning and innovation (Crossan, Lane & White, 1999). Sessa and London (2006) define group learning as "a deepening and broadening of the group's capabilities in (re)structuring to meet changing conditions, adding and using new skills, knowledge, and attitudes, and becoming an increasingly high performing group through feedback and reflection about its own actions and consequences (p. 652)". They see the group as a system. From this systemic point of view, group learning is a dynamic system in which learning processes, the conditions that support them, the individuals in the group, and the "behaviour" of the group change as the team learns (Argote, Gruenfeld, & Naquin, 2001; Kazl, Marsick, & Dechant, 1997; Sessa & London, 2006).

Figure 3

A Model of Group Continuous Learning (Sessa & London, 2006, p. 653)



The model of group continuous learning (Figure 3) described the elements of group learning and their relationships. Learning stimuli and readiness to learn are the two antecedents.

Learning stimuli (or triggers) are pressures, demands, challenges, opportunities that arise internally from group leaders or members, or externally from the environment. The stimuli affect the group's work so that the group cannot continue to work in the same way and be successful (Sessa & London, 2006). Readiness to learn determines the stimuli detected by the team and its members, and the responses in which stimuli occur.

Sessa and London (2006) studied the conditions that trigger group learning and variables that contribute to a group's readiness to learn. Readiness to learn is the degree to which the group recognises that it needs to change to accomplish its work and has made a decision to take some sort of action. Readiness is a function of three factors: a group's maturity, its boundary permeability and its learning orientation.

Group maturity is the process of moving from a simple collection of individuals towards a complex and integrated system. In a fully integrated and mature group, the group works, learns, and makes decisions as a single unit. To become a holistic system, group members need to develop mutual trust, a shared mental model, a group identity, cohesiveness, and potency.

Teams will be more likely to learn when they are more sensitive to the demands and concerns of others persons, other groups, and the organisation as a whole and when they have appropriate 'boundary permeability', i.e. the ease with which people and resources move in and out of the group (Arrow, McGrath, & Berdahl, 2000). Consequently these boundaries need to be sufficiently permeable so that groups can access the resources they need, but not that permeable external input overwhelms the group or causes group resources to be drained from the group (Alderfer, 1980). Teams differ in their proactive learning orientation or overall learning propensity (Bunderson & Sutcliff, 2002, 2003). Teams that are high in 'learning orientation' are more ready to learn, they seek opportunities to develop new skills and knowledge and devote time to learning, enjoy and take on challenging assignments from which they can learn, and are willing to test new ideas.

The outcomes of this group learning process are the learned patterns of adaptive, generative, and transformative learning (patterns that become part of the group's mental model). (1) 'Adaptive learning' occurs when the group spontaneously makes changes in the way members interact and the work they do to accommodate environmental demands, pressures, or requests. This often happens without the members knowing that any real changes have been made. (2) 'Generative learning' is proactive learning and applying new skills, knowledge, and information, sharing this with the other members of the group, and as a group, using these skills, knowledge, and information to change the group's goals, tasks, or

work methods. It is motivated and regulated by the group itself. Generative learning implies creating and continuously exploring new opportunities that create potential for new sources of growth (Senge, 1990). (3) 'Transformative learning' occurs when team structure, tasks or goals are significantly changed to deal with external pressure, respond to opportunities, or find new team directions. Team members critically reflect on personal experience to modify their own beliefs, attitudes and emotional reactions. Consequently it modifies team role perceptions, responsibilities and relationships (Wenger, 1999) and results in a deeper sense of understanding (Kegan, 2000). Transformative learning can be seen as recreating the group in more fundamental ways.

Group continuous learning is a function of stimuli and readiness to learn (Sessa & London, 2006). In the process, the group learns adaptive, generative, and/or transformative patterns of interaction. If the group is successful, it will continue to use adaptive, generative, and transformative interaction patterns when they are needed in the future.

4.4. The model of team learning beliefs and behaviours of Van den Bossche et al. (2006)

Van den Bossche et al. (2006) developed a model based on collaborative learning (as a social process of knowledge building) combined with aspects of the social climate in which learning takes place and by which this learning is influenced. Team learning beliefs and behaviours influencing team effectiveness are stressed in the model.

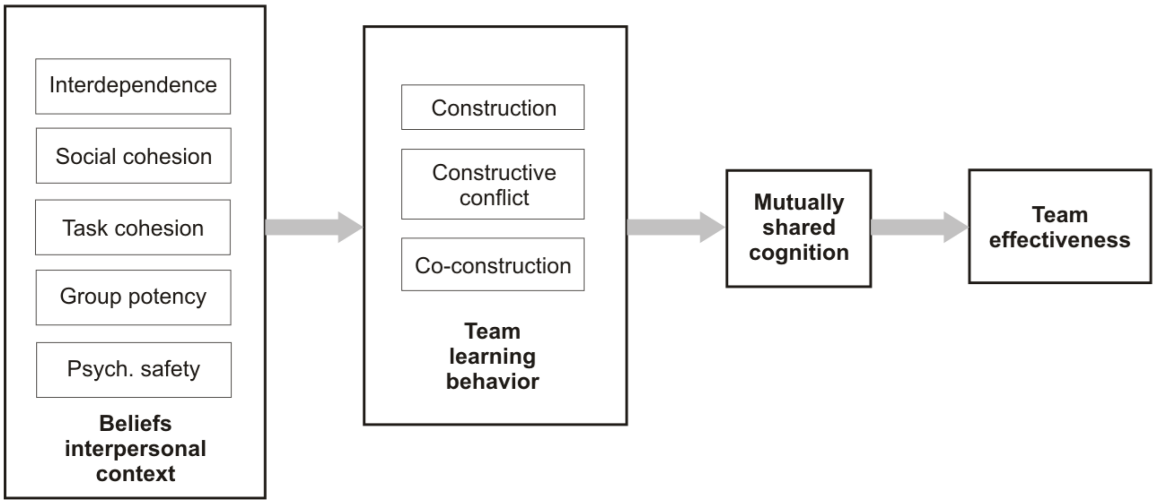
Collaboration is defined as "the process of building and maintaining a shared conception of a problem or task, distributing responsibility across members of the group, sharing expertise, and mutually constructing and negotiating cognition (Roschelle, 1992, in Van den Bossche et al., 2006, p. 495)." Van den Bossche stated that team members share knowledge, achieving mutually shared cognition, which is called "team learning behaviour". He also considered negotiation to be the key element to determine which interaction and discourse patterns are forms of team learning behaviour. Two team learning processes are further discussed which enables a group perspective: (1) construction and co-construction of meaning, and (2) constructive conflict towards agreement.

Construction of meaning is the process of articulating personal meaning incorporated in the social setting (Stahl, 2000), starting when a team member identifies a problem, suggest possible solutions, sharing ideas with fellow team members and therefore inserting meaning. Team members then respond and try to solve the matter, matching ideas and giving feedback. This process can result in co-construction (or collaborative construction), modifying original suggestions by mutual discussion and cooperation (Webb & Palincsar, 1996).

Constructive conflict refers to the fact that team members may not always come to a agreement on solving issues, having their own interpretation on the situation with obviously their own solutions they see best. This can result in further elaboration through negotiation of these different opinions. However, these differences may not always guarantee a positive outcome, as elements may be ignored to resolve the matter (De Dreu & Weingart, 2003), or these differences may be seen as personal, emotional rejection instead of mere differences in understanding the problem, therefore obstructing productive team behaviour (De Dreu & Weingart, 2003). Team benefits will only be achieved if difference in opinions (or meanings) result in further negotiation. Van den Bossche (2006) summarises constructive conflict as "negotiation of the differences in interpretation among team members by arguments and clarifications " (Van den Bossche, 2006, p. 496).

Figure 4

Team Learning Beliefs and Behaviours – Model (Van Den Bossche, 2006, p. 503)



Van den Bossche (2006) used quantitative and qualitative methods to come to a joint model of team learning beliefs and behaviours (see Figure 4). Team learning behaviour includes construction, constructive conflict and co-construction, concepts that have been discussed earlier. Beliefs about the interpersonal context include psychological safety (the safety to take interpersonal risks), interdependence (perceived task interdependence in the team), cohesion (social cohesion and task cohesion) and group potency. These beliefs lay on the basis of team learning behaviour and may lead to mutually shared cognition, resulting in increasing team effectiveness.

Results show that perceived team effectiveness is significantly predicted by team learning behaviour, and that mutually shared cognition acts as a mediator between team learning behaviour and team effectiveness. Mutually shared cognition can therefore be identified as a profound learning outcome. Next, it is stated that team members will engage in social (cognitive) processes of team learning behaviour in a specific climate or under specific circumstances, i.e. interdependence, task cohesion, psychological safety and group potency stimulate team members to engage in learning behaviour. Several empirical studies (e.g., Boon, Raes, Kyndt, & Dochy, submitted; Van den Bossche, Gijselaers, Segers, and Kirschner, 2006) have recently replicated and confirmed this model in different contexts using sports teams, police teams, military teams, etc. (see section 5.)

4.5. Integrative systemic model for team learning (Decuyper, Dochy, & Van den Bossche, 2010)

Compared to research on teamwork, research on team learning progressively lacked integration to a greater extent (Kozlowski & Bell, 2008). Therefore Decuyper, Dochy, and Van den Bossche (2010) co-constructed an integrative systemic, cyclical, and theoretical model that reflects the complexity of team learning and at the same time identifies and structures the complex body of team learning variables. They proposed a framework that consists of three categories: supra-system (environment & organisation), system (team), and subsystems (individuals). The 'supra-system' category contains all variables found in literature on team learning that stem from the organisation or the environment of the team, such as the organisational culture, structure, goals and strategies. The 'system' category contains variables on the team level, such as task cohesion, psychological safety, interdependence, team culture, and a shared mental model. The 'subsystems category' contains variables that are situated at the level of the individual, such as prior knowledge, individual learning, and motivation.

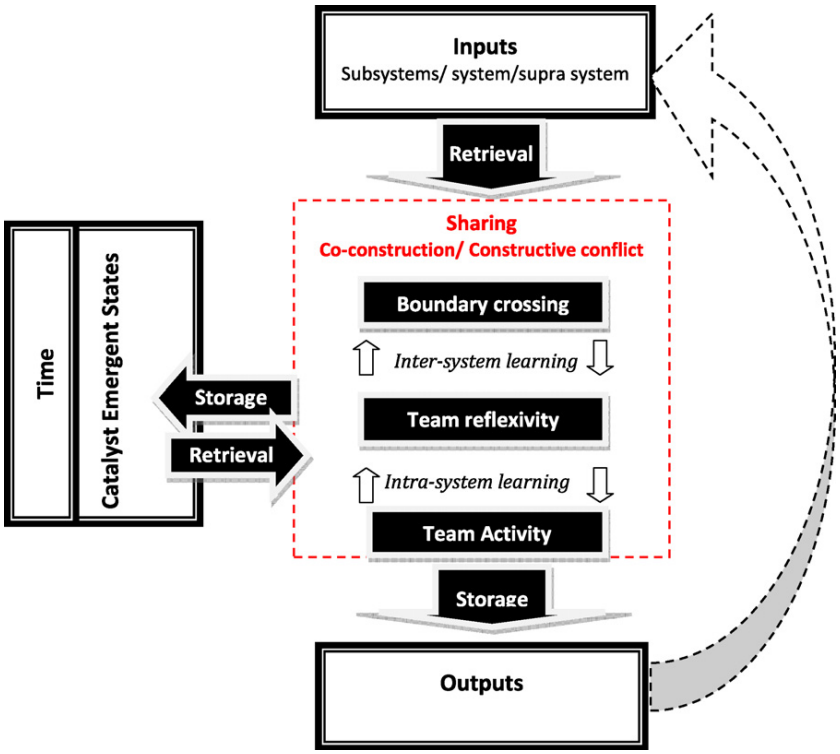
The model organises and combines team learning processes, outputs, inputs, catalyst emergent states and time-related variables. Figure 5 illustrates the integrative systemic model for team learning, clustering the different variables used in research on team learning.

Decuyper, Dochy, and Van den Bossche (2010) state that input variables from various systems or levels (team members, team, organisation and environment) influence and stimulate the activation of team-level learning processes. Based on literature, eight core categories of team learning processes are derived: sharing, co-construction and constructive conflict; team reflexivity, team activity and boundary crossing; storage and retrieval. These

team learning processes can result in adaptive, generative or transformative learning outputs in the team at various dimensions and levels, which can sometimes result in instantaneously noticeable enhanced team performance.

Figure 5

Integrative Systematic Model for Team Learning (Decuyper et al., 2010, p. 115)



Team learning processes are continuously accompanied and influenced by co-evolving catalyst emergent and time-related variables, as indicated by the intermediate categories in the model. This catalyst emergent states-category contains specific variables that do not embody the trajectory or movement itself, but are closely connected to the team learning process, since they grow from team learning processes and directly catalyse or reinforce them. This is the reason why changes in the team's capability to act differently often remain unnoticed.

The construction of a joint space for high quality interaction is essential for team learning (Barron, 2000a; Bouwen, 1998; Rowe, 2008; Steyaert, Bouwen, & Van Looy, 1996). Dechant, Marsick, & Kazl (1993) and Edmondson (1999) mention that team learning consists of several crucial communicative actions: dialogue, feedback, sharing of information, framing, reframing, confrontation, negotiation, etc.

Decuyper et al. (2010) distinguish two levels of team learning. The first and most fundamental level consists of three basic process variables: 'Sharing', 'Co-construction' and

'Constructive conflict'. In order to learn, teams need to engage these three central team learning processes. The second level of team learning process variables consists of the facilitating variables 'team activity', 'team reflexivity', and 'boundary crossing communication'.

Without constructive conflict, co-construction or sharing, there is no team learning. These basic team learning processes describe what happens when teams learn. Although these processes result in change, they do not necessarily lead to improvement (Sessa & London, 2008b). The balance between co-construction and constructive conflict empowers a team to learn in any direction within its organisational context. After all, a team can also learn to be unproductive, ineffective, inefficient, etc. Therefore, the second level of team process variables consists of variables that are responsible for its locus and focus: team reflexivity, boundary crossing communication and team activity. These are processes that help teams to learn in the 'right' direction and therefore influence the efficiency and effectiveness of the team learning process. The relationships between the basic variables should be seen as relationships of 'circular causality', rather than relationships of 'linear causality' (Decuyper, Dochy, & Van den Bossche, 2010). Indeed, while the facilitating process variables are directing, the basic process are simultaneously empowering the facilitating processes.

4.5.1. Basic process variables

Sharing is the process of exchanging opinions, communicating knowledge, creative thoughts or competences between team members, who were previously unaware that these were present in the team (Burke, Salas & Diaz, 2008; West, 2002). As team members try to listen and use their team member's information to give meaning to the situation, sharing can evolve into co-construction of meaning (Webb & Palincsar, 1996). They can also complement, confront and integrate each other's knowledge, competences, opinions and creative thoughts, which facilitates the development of shared mental models, and therefore enriches current personal visions (Senge, 1990b).

Co-construction is the mutual process of building meaning by refining, building on, or modifying an original offer in some way (Baker, 1994). London, Polzer, and Omoregie (2005) see it as the common quest for and confirmation of interpersonal congruence. Van den Bossche, Gijselaers, Segers, and Kirschner (2006) mention that sharing is an important precondition for co-construction. The open communication of creative thoughts and articulation of personal meaning is the first step for co-construction to take place. Fellow team members will then actively listen, as they engage in repeated cycles of acknowledging,

repeating, paraphrasing, enunciating, questioning, concretising, and completing their shared knowledge, competences, opinions or creative thoughts. In search for interpersonal congruence, team members express, refine and extend (implicitly shared) patterns of thought, language and action (London, Polzer, & Omergie, 2005). This leads to shared knowledge or new meaning that was previously not available to the team (Van den Bossche et al., 2006). For co-construction to actually take place, a similar perspective or a similar reference framework is required from the team members. When teams engage in co-construction, pleasant learning occurs, since the load of the learning energy will be positive.

Constructive conflict is a process of negotiation or dialogue that uncovers diversity in identity, opinion, etc. within a team. It is a conflict or an elaborated discussion that stems from diversity and open communication, and leads to further communication and some kind of temporary agreement (Van den Bossche, 2006). Constructive conflict is necessary to come to fundamental changes in thought and behaviour. When teams engage in constructive conflict, unpleasant learning occurs since the load of the learning energy will be mostly negative. After all, general constructive conflicts lead the team members out of their 'comfort-zone'. It activates a certain affective state that liquefies our primitive and more fundamental cognitions and beliefs (Topping & Ehly, 2001).

De Dreu and Weingart (2003) show how constructive conflicts are more likely to lead to learning and conceptual advancement, whereas a regular conflict will not. In a regular conflict, team members may, on the one hand, take their differences as a paradox. The paradox might then be resolved by ignoring one of the conflicting elements. A regular conflict, on the other hand, might be experienced as a personal or emotional rejection instead of a difference in the interpretation of the problem. In these cases, the conflict will freeze the mental model instead of facilitating it, due to the lack of constructive conflict. De Dreu & Weingart (2003) argue that the constructiveness of a conflict depends on its nature: affective relationships conflicts versus cognitive/task conflicts.

Van de Vliert and Euwema (2004) focus on the different modes of styles of conflict resolution, which can be subsumed under two dimensions, agreeableness and activeness. The authors conclude that the two dimensions that account for the most variance in social interaction are positive-negative. Avoiding and fighting are generally considered to be negative methods, as they tend to intensify conflicts and they are viewed as more disagreeable. The more positive, prosocial methods, yielding and cooperation, mitigate conflict and are viewed as more agreeable. Also Jehn (1995) finds affective or relational conflicts to be dysfunctional and cognitive or task conflicts to be beneficial for team

performance. Van den Bossche, Gijselaers, Segers, and Woltjer (2005) add that it is not the occurrence of task conflicts that facilitates team performance or team learning, but the effort of integrating differences in points of view through constructive conflict. Although the processes construction and constructive conflict are conceptually split in this model, they will often co-exist and reinforce each other in practice (Van den Bossche et al., 2006). As a conclusion, the primary task of any team that wants to learn is the creation of dialogical space.

4.5.2. Facilitating process variables

Team reflexivity is the process of co-constructing, de-constructing and reconstructing a clear and relatively stable vision or mental model of the ultimate (authentic) and instrumental team goals and methods. Teams only learn effectively when their learning helps them to reach their goals over and over again (Covey, 1989). Both situated on the task and the social level, these team objectives and methods steer the other four core processes of team learning in the right direction of authentic goal attainment.

In order to attain the team goals, they need to develop a clear vision on where they stand (current reality), what they want to reach (ultimate team goals), and how they want to reach it (team methods and instrumental team goals). The process of co-constructing, deconstructing and reconstructing a clear and stable vision or mental model of the ultimate and instrumental goals and methods is called team reflexivity. West (2000) defines it as the extent to which group members overtly reflect upon, and communicate about the groups' objectives, strategies and processes and adapt them to current or anticipated circumstances. Arrow et al. (2000), Argyris and Schön (1978), and Sterman (1994) all conceptualise reflexivity within systems in terms of double loop learning. Whereas non-reflective teams only succeed in questioning the extent to which they have achieved the planned goals (single loop learning), reflexive teams also succeed in questioning the actual goals, thereby questioning the rules of the game and the underlying steering variables (double loop learning).

Team activity is the process of team members working together, activating physical and psychological means required for reaching their goals. It is both a process of gradual adaptation of team behaviour in the execution of planned actions as well as a process of making mistakes and having unplanned experiences that disrupt the team functioning. Team activity is about 'learning by doing': teams generally do not only learn explicitly through knowledge transfer or evaluation, but also implicitly throughout team activity. Tacit knowledge, for example, can only be transferred in authentic team activities (Argote, 1993). Moreover, team learning may sometimes improve performance without improving the

subject's ability to articulate what exactly causes the improvement. Experiment is seen as a special and necessary mode of system activity for effective learning, by testing the groups cognitive hypothesises shared mental models and decisions in practices, or discovering and assessing their impact. Arrow and Cook (2008) state that both planned team activity as chaotic team activity serve the cause of team learning in a different way. Whereas planned team activity cause team members to learn how to execute their planned activities better and faster, a sudden lack of coordination can lead to mistakes and unplanned experience can often trigger constructive conflicts, co-construction and therefore team learning.

Boundary Crossing is a process of communication across borders: between the team and its environment or between team members that represent different groups. Kazl, Marsick, and Dechant (1993, p. 8) elaborate on team learning and define boundary crossing as: "(...) to seek or give information, views, and ideas through interaction with other individuals or units. Boundaries can be physical, mental or organisational."

From this point of view boundary crossing is a special type of sharing. Without sharing knowledge, competences, opinions or creative ideas across boundaries, teams can neither learn nor work. The effectiveness of a team is not only determined by the team itself but it is also negotiated on the boundaries between the team and its environment.

Research has shown that boundary crossing is related to successful team learning and perceived effectiveness across time (Edmondson, 2002b; Hirst & Mann, 2004). Brooks (1994) shows that it affects both the ability to bring information into the team and the effective dissemination of learning.

4.5.3. Inter-system and intra-system learning

Team reflexivity is the central process in effective team learning. When a team engages in team reflexivity, it can lead to two different types of learning. First of all, intra-system team learning refers to a team reflecting on their own past activities, successes and failures and consequently plan modification for future action. Secondly, inter-system learning occurs when a bridge is formed between team learning, individual learning, learning in other teams, organisational learning and learning in an organisational context. This type of learning is bi-directional and happens through boundary crossing: on the one hand a team may reflect on and integrate knowledge, ideas, expertise etc. coming from outside of the team, but on the other hand a team may also plan to disperse what is learned in the team via boundary crossing.

4.5.4. Storage and retrieval

The team learning processes of storage and retrieval lead to the persistence of team learning over time. The results from basic and facilitative team learning processes, such as shared knowledge, ideas, plans, developed procedures, are saved by means of storage and and can be retrieved. Wilson, Goodman and Cronin (2007 in Decuyper 2007 et al., 2010) use the term 'software', which means the immaterial repositories of storage such as the memory of an individual in a team, shared mental models, and the transactive memory system. The hardware of a team is of material nature, such as notes, computer databases, bulletin boards, expert systems, and artefacts.

5. Empirical evidence for the antecedents and outcomes of team learning

Different researchers empirically investigated different types of teams within organisational settings. In order to make a distinction between the different types of teams and their characteristics different researchers, like Sundström, deMeuse, and Futrell (1990) or Cohen and Bailey (1996) created a team type typology. Most existing typologies are slightly different but the categories they use are mostly overlapping. The differences and parallels between the typologies of Cohen and Bailey (1996) and Sundström et al. (1990) can be considered as a good example of the connections between the different typologies. Cohen and Bailey (1996) made a distinction between four different types of teams, namely work teams, parallel teams, management teams and project teams. Sundström et al. (1990) made a comparable distinction between advice and involvement teams (e.g. Cohen and Bailey's parallel teams), production and service teams (e.g. Cohen and Bailey's work teams), project and development teams (e.g. Cohen and Bailey's project teams), and as a last category they added a category different from management teams, namely action and negotiation teams (Cohen & Bailey, 1996). A few years later, Devine (2002) created a typology that can be seen as an integrative typology that consists out of 14 different types of organisational workgroups based on seven underlying dimensions, namely fundamental work cycle, physical ability requirements needed from team members to fulfil the task, temporal duration of group existence, task structure, active resistance against accomplishing teams goal, hardware dependence, and health risk. Although all the teams that are classified in the typology can be described using the general definition of a team described earlier in this chapter, these 14 types of teams differ in a number of ways. When creating a general model of team learning one could suspect that this general model is not a perfect fit for all the different types of teams that exist. A lot of the 'noise' found in small group research can be attributed to sampling

error but most of this noise can be attributed to the differences between the different types of teams (Devine, 2002). When we look at studies that focus on different types of teams, we can see that due to the team characteristics, that are specific to the different types of teams, the variables that shape the interpersonal context has a slightly different influence on the team learning behaviours depending on the type of team that is studied.

Van den Bossche et al. (2006) tested their Team Learning Beliefs and Behaviours model on 75 student teams. These student teams had the mission to advise an organisation on its strategy, as a consequence they can be classified under advisory workgroups. Advisory workgroups are short-term, cross-functional teams that operate outside of the formal structure of an organisation. They have a specific goal in terms of e.g. formulating advise concerning the sociotechnical systems of the organisations or to improve organisational effectiveness (Devine, 2002). Van den Bossche et al. (2006) found, in line with Roschelle and Teasly (1995), that merely gathering a number of people is not sufficient to create team learning behaviours, but that an interpersonal context is needed for these people to share their understanding. Van den Bossche et al. (2006) also found that certain aspects of the interpersonal context are more important then others to stimulate team learning behaviour. Psychological safety was found to have a strong relationship with team learning behaviour. It seems important for team members to be able to feel as if they can discuss and elaborate unrestrained on their opinion, for learning to take place within the context of a team (Edmondson, 1999). The other variables included in the model, group potency, task cohesion, and interdependence also play an important role.

These findings are confirmed by a study in police- and fire teams (Boon, Raes, Kyndt, & Dochy, submitted). Police- and fireman teams can be classified under response workgroup. The collective team task of these teams is to rescue and protect. It is behavioural in nature and requires team members to scan a situation, decide upon an appropriate action and then perform the action coordinated and quickly (Devine, 2002). In addition, the environment in which they operated differs considerably from the student environment in the research of Van den Bossche et al. (2006). Police- and firemen teams often have to act in high-risk environments and team members have to be sure that they can trust each other (Devine, 2002). We found that the Team Learning Beliefs and Behaviours model (Van den Bossche et al., 2006) generally applies to the police- and firemen teams in the study. We also found that, although social cohesion does not predict team learning behaviours, it is significantly related to team effectiveness (Boon et al., submitted). These findings can be explained by the specific

context in which these teams operate: for example, it is important that team members feel like the team 'has their back' and supports them during dangerous interventions. Another important conclusion of this research is the finding that firemen teams score higher on group potency, self-efficacy and team effectiveness than police teams. This finding confirms that difference in processes or constructs depend on the team type that is investigated.

Veestraeten, Kyndt, and Dochy (submitted) tested the Team Learning Beliefs and Behaviours model on military teams. According to Devine (2002) military workgroups are "*small, formal units that use lethal force (or the threat of it) to accomplish a variety of tasks associated with maintaining domestic order and ensuring national security (e.g., aircraft crews and infantry squads)*" (p. 303). They act in physically demanding and hostile situations. Typically for a military environment is a hierarchal organisational structure within which orders have to be followed and executed. Nevertheless, battles can be very ambiguous, ill structured and chaotic, in addition the given orders do not tend to last very long. As a consequence, there is a high need for communication and collaboration among team members (Devine, 2002). This study also confirmed the Team Learning Beliefs and Behaviours model of Van den Bossche et al. (2006). Unlike the findings for other team types in previous studies social cohesion does seem to have, next to psychological safety and group potency, a direct significant influence on team learning behaviours in military teams. According to Veestraeten et al. several other researchers drew similar conclusions concerning the group comradeship within military teams. In military teams, social cohesion is a predictor for motivational factors and performance (Millward, Banks, & Riga, 2009), it provides social support and is important to reduce the negative effects of team-level stressors often present in military contexts (Moldjord, Fossum, & Hollen, 2003). However too much social cohesion could do more harm then good for military teams but also for other type of teams (Van den Bossche et al., 2006). For military teams, it could have a pernicious influence on team performance and decision quality due to the phenomenon of passive and uncritical 'groupthink' (Beck & Pierce, 1996).

Lynn, Skov, and Abel (1999) uncovered several factors that could increase the learning ability of new product teams. They studied the learning practices of 95 new product development teams. These teams can be classified under the term design workgroup (Devine, 2002) and they usually have an assignment that requires them to be innovative and creative. Design teams are temporary and are composed cross-functionally. The product they have to deliver is tangible and most of the times these teams have a clear idea about what they have to create but not about how they have to do it. Lynn et al. (1999) defined team learning as a construct compromised of information acquisition and information implementation. They

found that the practice of reviewing knowledge captured by team members is a significant predictor for information acquisition. Reviewing of knowledge is comparable with the team learning behaviour 'sharing' as defined by Decuyper, Dochy, and Van den Bossche (2010). They also found that an NPD process, a framework to help new product development teams reach their goals, is a significant predictor for information implementation. For a new product development team to be able to put information into action a NPD process seems necessary. Lynn et al. (1999) warn against a to rigorous process because this could prevent certain competencies to come to the surface and distract from a successful NPD process. Stated differently, processes like co-construction and constructive conflict should have a chance to manifest and that is not possible if the processes are to strictly delineated. To conclude, Lynn et al. (1999) also found that the presence of these learning constructs (information acquisition and information implementation) the speed with which the product is brought to the market and new product success.

Edmondson (2003) focussed her research on operation room teams. She classifies them under action teams (Sundström, deMeuse, & Futrell, 2003). "Action teams are defined as teams in which members with specialised skills must improvise and coordinate their actions in intense, unpredictable situations" (Sundström et al., 2003, p. 1421). According to the typology of Devine (2002) however, these operation teams can be classified under medical teams. They have the task to diagnose the physical condition of patients and to take appropriate steps to improve their health under severe time constraints and with the health of the patient at risk when choosing a wrong procedure. Their task is usually very structured due to standardised diagnostic protocols and operating procedures. Edmondson (2003) conceptualises team learning as the learning of new tasks and coordination routines. Team learning processes are defined 'the ease of speaking up', 'boundary spanning' and 'practice/reflection'. The ease of speaking up seems to be an important factor to explain learning outcomes (in this case the implementation of a new technique). This concept is very similar to the variable psychological safety: it also stresses the need to be able to reflect on differences in opinion, questions and ideas in the team in order to create experimentation and a shared idea of what works and what does not work in order to be able to learn and innovate as a team (Edmondson, 2003). Boundary spanning, or communication with external parties, leads to implementation success of the new learned technique through communication. The team leader plays an important role in forming a context where ease of speaking up and boundary spanning are high (Edmondson, 2003).

6. Conclusion

The importance of working and learning together in modern organisations and in education has been increasingly stressed the passed decades. Collaborative learning in the broad sense of learning with and from others and its impact has been investigated extensively in (higher) education whereas team-learning, in the sense that learners in a team are also interdependent in their task and share responsibility for outcomes and are seen by others as a social entity embedded in one or more larger social system, has received more attention in professional organisations.

Looking at the team-learning studies it seems that in all the teams, regardless of the type, the variable psychological safety plays an important role in the team learning process. Edmondson (1999) was the first researcher to address the importance of psychological safety for the functioning of teams. The presence of psychological safety in teams indicates that the beliefs that team members are safe to speak up, to admit their mistakes and to express their concerns are present in the team. The elimination of these concerns is necessary, as the studies discussed above show, in order for team learning behaviours such as experimentation, constructive conflict, sharing, trial and error, seeking help, questioning current team practices to occur (Decuyper et al., 2010).

Another notable variable is social cohesion. Muller and Copper (1994) conducted a meta-analytic integration of the relation between cohesion and performance in teams. They found a strong relation that was mainly attributable to the commitment to the task (task cohesion) and not to the interpersonal relationships in teams (social cohesion) (Muller & Copper, 1994). Based on their conclusion Van den Bossche et al. (2006) hypothesised that social cohesion, in contrast to task cohesion, would not be related to team learning behaviour because the relationship between these two constructs is complex. Although they confirmed their hypothesis, this assumption does not appear to apply to all types of teams. In police and firemen teams social cohesion is correlated with team performance and in military teams it is associated with team learning behaviours. As already stated above this could be attributed to the specific characteristics of the team task (Veestraeten et al., submitted). Teams in the latter study have to work in physically dangerous and low structured circumstances where fast reaction and coordination is necessary. To be able to work as a good functioning unit, these team members have to be able to trust each other and apart from the contribution of the presence of psychological safety and task cohesion, the presence of social cohesion is important for these types of teams. It is up to future research to resolve more of the key-elements of successful team learning.

For us, this future research can only advance in breaking ways if we cross boundaries of disciplines and areas. Having ourselves started studying collaborative learning in universities and later on team learning in companies, we experienced how much we did learn from the 'other' world and from other disciplines. We hope this crossing and collaboration between researchers will increase, both in doing collaborative research, in exchange of researchers and in collaborative writing in different disciplinary scientific journals.

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