Team learning toward enhancing innovative work behaviour in vocational educator teams

The relationship between team learning conditions, team learning behaviours and team learning products over time

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1. Relevance of team learning in organisations

In organisations teams serve as a key resource for accomplishing tasks, developing innovative solutions and becoming a learning organisation (Dochy, Gijbels, Raes, & Kyndt, 2014; Kim & Chung, 2017). Because of the changing environment (e.g., changes in the labour market, society or policy), organisations face increasingly complex challenges. To meet these challenges, which often need innovative solutions, employees have to accomplish complex, knowledge-intensive and non-routine tasks (e.g., Segers, Messmann, & Dochy, 2018; Somech & Khalaili, 2014).

Teams can accomplish these tasks in a more effective, efficient, and innovative way than can individuals (Edmondson, 1999; Dochy et al., 2014; Wilson, Goodman, & Cronin, 2007). This advantage of teams over individuals is based on a wider spectrum of task-relevant knowledge and skills that can be used for accomplishing these tasks (Van Knippenberg, De Dreu, & Homan, 2004).

Especially innovative solutions are crucial for organisations because of global competition, market dynamics, and/or societal, economic and technological developments (Fay, Shippton, West, & Patterson, 2015; Segers et al., 2018). Innovation development requires innovative work behaviour from employees (Messmann & Mulder, 2012; Thurlings, Evers, & Vermeulen, 2015). Innovative work behaviour includes all work activities carried out by employees that are required to develop novel and beneficial processes or products (Messmann & Mulder, 2012). Innovations and thus teachers' innovative work behaviour are also crucial in vocational education. Vocational colleges have to respond to changes in the labour market by providing the students with the right skills and knowledge to meet the changing work requirements (Truijen, Sleegers, Meelissen, & Nieuwenhuis, 2013). Further challenges in vocational education that require teachers' innovative work behaviour are caused by new technologies, new insights into teaching or societal and political changes, such as the integration of refugees or quality improvement in educational programmes (Bouwmans, Runhaar, Wesselink, & Mulder, 2017; Thurlings et al., 2015).

Because of the advantage of teams over individuals for meeting those challenges, such as a wider knowledge base, teams were introduced into organisations, such as vocational colleges. Such organisational teams are described as work teams that are more than simply a collection of individuals; rather, they are a cohesive unit (Sessa & London, 2008). Work teams are defined as units, embedded in the organisation, that are composed of two or more employees. These employees interact socially, perform together on organisationally relevant tasks with a common goal, are interdependent to accomplish the task and manage boundaries with other units outside the team (Burke, Salas, & Diaz, 2008; Kozlowski & Bell, 2003).

Only under certain conditions it is possible for teams to learn. Team learning is essential to cope with the changing environment, to achieve goals and to achieve a high level of performance (Senge, 1990; Van Woerkom & Croon, 2009; Zaccaro, Ely, & Schuffler, 2008). In other words, teams have to engage in team learning behaviours but require certain team learning conditions to do so. Teams' high engagement in team learning behaviours means that the aggregated behaviour of the team members is highly pronounced because the team cannot behave, per se, but the team members can (Kozlowski

& Bell, 2003). This high level of engagement in team learning behaviours results in team learning products. Team learning products entail behavioural or cognitive change or improvement.

Based on these considerations team learning can be defined as a process of *team learning behaviours* that can change over time, can occur in different combinations, are under various influences (*team learning conditions*) at different levels (individual, team or organisational level) and lead circularly to change or improvement (*team learning products*) for individuals, the team or the organisation (Decuyper, Dochy, & Van den Bossche, 2010).

Although much research has been conducted in the field of team learning, the complexity and dynamic of team learning were not captured to its full extent (cf. Decuyper et al., 2010). Specifically, the following three shortcomings in research can be identified:

1) Since behaviour changes over time, it is not possible to examine behaviour without considering temporal change (Roe, 2008). However, longitudinal studies that take the dynamic perspective into account and focus on how team learning changes over time are missing (Collins, Gibson, Quigley, & Parker, 2016; Kozlowski, 2015; Lehmann-Willenbrock, 2017).

2) Team learning is a complex construct because team learning consists of various aspects. For instance, different team learning behaviours are influenced by various team learning conditions and can lead to various products (cf. Sessa & London, 2008; Decuyper et al., 2010). Therefore, team learning cannot be examined to its full extent all at once. Rather it is necessary to examine team learning from different perspectives and focus on certain aspects of team learning. However, some team learning conditions, behaviours and products are neglected in research (Decuyper et al., 2010). Particularly team learning products are neglected that are crucial for teams in organisations because of their tasks, such as innovative work behaviour (Messmann & Mulder, 2011). Therefore, it is important to examine the relationship between team learning behaviours and innovative work behaviour to understand how innovative work behaviour in teams can be fostered.

3) Because of the interdisciplinary relevance of team learning for organisations, team learning was examined in different domains (Decuyper et al., 2010). However, knowledge about team learning in work teams in certain domains, such as vocational education, is somewhat limited (Vangrieken, Dochy, Raes, & Kyndt, 2015). Especially, because of teachers' long-standing individualism, team learning in vocational education has a special position in comparison with other domains (Vangrieken et al., 2015). Moreover, the stability of the teams regarding team composition and the teams work on projects that have to be carried out within one school year are specific characteristics for vocational education. Therefore, further research on teachers' team learning and on teachers' innovative work behaviour in the domain of vocational education is crucial (cf. Thurlings et al., 2015; Truijen et al., 2013).

These shortcomings in research are addressed in this thesis. In order to acquire knowledge about team learning in vocational education, the overarching aim of this thesis is to gain insight into the relationship between team learning conditions, team learning behaviours and team learning products (with a focus on innovative work behaviour) over time in vocational education. To achieve this aim, the following two reasearch questions will be answered:

1) *How do team learning conditions, team learning behaviours and innovative work behaviour relate and change over time?*
2) *How is team learning characterised in work teams in vocational education?*

By answering these research questions, team learning in vocational education can be understood in more detail and implications for both practice and research can be derived. Practical implications refer to how teams can be supported to reach a high level of team performance and how team learning as well as innovative work behaviour can be fostered to solve complex challenges facing organisations. Furthermore, implications for fruitful further research can be derived.

In the next chapter, Chapter 2, the theoretical foundation and conceptualisation of team learning is described. A framework for team learning is built; the different perspectives on team learning are described; and the theoretical link between team learning conditions, team learning behaviours and team learning products is visualised. In Chapter 3, the aim of this thesis is explained in more detail, and an overview of the four studies included in this thesis will be given. In Chapters 4, 5, 6 and 7, studies published in peer-reviewed journals are presented. In Chapter 8, the results of these different studies will be summarised and discussed before the two overall research questions are answered. After that, limitations and implications for both future research and practice are described.

2. Theoretical foundation and conceptualisation of team learning at work

In this chapter the conceptualisation of team learning and the theoretical foundation will be described. First, to conceptualise team learning at work it is necessary to define learning at work. After that, different perspectives on team learning at work will be discussed before the conceptualisation of team learning of this thesis is presented. Finally, various team learning behaviours, team learning products and team learning conditions are described.

2.1 Learning at work

Learning is defined 'as implicit or explicit mental / or overt activities and processes leading to changes in knowledge, skills or attitudes or the ability to learn from individuals, groups or organisations. These can under certain conditions lead to changes in work processes, work outcomes of individuals, groups or organisations' (Simons & Ruijters, 2004, p. 210).

Learning is a process that is visible in learning behaviours (Kolb, 1984; Kolb & Kolb, 2009) that lead to learning products in the form of cognitive or behavioural change.

Regarding learning at work, the work environment is the learning context (Mulder, Messmann, & König, 2015). Individuals learn at work by doing the work itself, by interacting with colleagues, by coping with challenges or by reflecting on experiences. Learning at the workplace 1) occurs during daily work in which learning and work processes are interwoven, 2) results from experience, 3) has a low degree of structure, 4) is initiated by the learner him/herself (internal stimulus) and 5) is independent of time and place (Kyndt, Govaerts, Smet, & Dochy, 2018; Watkins & Marsick, 1992; Mulder, 2013). Learning behaviours at work can be cognitive or physical and are executed by employees

while accomplishing their work tasks. These learning behaviours can be planned (deliberate) or spontaneous (reactive).

Learning at work can take place individually or in a social context, characterised by interaction. Considering the context in which learning at work takes place is important (Marsick, Volpe, & Watkins, 1999). The context offers different opportunities for learning and participation (Billett, 2004). On the one hand, the context is important because it provides a framework for the learner to interpret the challenges, choose information and evaluate the results of his/her behaviours. On the other hand, the context can stimulate the learning process by the interpretation of events as critical incidents (Segers et al., 2018). In this thesis the focus is on learning at work in a social context that takes place in interaction with other persons. Work teams provide the social context for learning at work in this thesis. Thus social learning behaviours at work within the team are described as team learning behaviours.

In accordance with learning at work, team learning occurs during teamwork in which the team executes tasks and in which the work and learning process intertwine (Segers et al., 2018). Before the conceptualisation of team learning is described in detail, different perspectives on team learning in the literature are discussed.

2.2 Team learning at work from different perspectives

As a consequence of the great interest in team learning across different disciplines and the difficulty in capturing the full extent of team learning, there are different perspectives on team learning. These different perspectives result in different conceptualisations and definitions of team learning. Team learning is conceptualised 1) as a process (e.g., Dechant, Marsick, & Kasl, 1993; Edmondson, 1999, 2002), 2) as product of a process (e.g., Ellis, Hollenbeck, Ilgen, Porter, West, & Moon, 2003; Sessa & London, 2008; Van den Bossche et al., 2006) 3) and as a combination of both perspectives (e.g., Argote, Gruenfeld, & Naquin 2001; Arrow & Cook, 2008).

1) Team learning is conceptualised as a process of different team members' behaviours, such as reflection, asking questions or seeking feedback. From this perspective, Edmondson (1999, 2002) developed the two following models of team learning: the model of work-team learning (Edmondson, 1999) and the model of the team learning process (Edmondson, 2002). In the first model, she focuses on the extent of team beliefs to which the team members engage in team learning behaviours that are associated with satisfying customer needs and expectations as an indicator for team performance. She defines team learning as '…an ongoing process of reflection and action…' (Edmondson, 1999, p.353). In the second model, she develops a social-psychological model of team learning. She defines team learning as '…a process in which a team takes actions, obtains, and reflects upon feedback….' (Edmondson, 2002, p. 2002). In this conceptualisation she focuses on the relationship between interpersonal risks and team learning as a process without a differentiation of concrete team learning behaviours. This model can be seen as a supportive framework for team leaders to manage and cope with the risks of learning (Dochy et al., 2014).

2) Other researchers describe team learning as a product of different team learning behaviours, such as sharing, creating or acquiring unique knowledge. For instance, Ellis and colleagues (2003) define team learning '…as a relatively permanent change in the

team's collective level of knowledge and skills…' (pp. 821–822). Examples of conceptualisations that put emphasis on the realisation of a product are the model of continuous group learning (Sessa & London, 2006) and the team learning model of Van den Bossche, Gijselaers, Segers and Kirschner (2006).

Sessa and London (2006) define team 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 …' (p. 652). They describe the team as a system in which team learning conditions and behaviours change as the team learns. As a learning product, they describe the change as learned patterns of interaction that can be used in the future when they are needed. Van den Bossche and colleagues (2006) conceptualise team learning as the creation of mutually shared cognition. They developed a model in which they combine aspects of team learning conditions (e.g., task cohesion or psychological safety) and different team learning behaviours (constructive, constructive conflict and co-construction) that are important for creating a shared cognition within the team and team effectiveness.

3) The third perspective on team learning is a combination of team learning as a process and team learning as a product. For instance, Argote and colleagues (2001) emphasise in their definition of team learning '….both the processes and outcomes of group interaction…' (p. 370). They focus, on the one hand, on the process of team interactions as team learning behaviours through which knowledge is acquired, shared and combined and, on the other hand, on changes in knowledge as a team learning product.

Arrow and Cook (2008) define team learning as '…a directed or undirected process of shared attention to information that results in a product of increased collective access to knowledge, development of shared mental models, and expanded ability to satisfy the implicit and explicit goals of the group' (p. 50). While Argote et al. (2001) focus on the individual level, Arrow and Cook (2008) take the individual level, the organisational level and the team level into account, which are important for understanding team learning in-depth. Moreover, they focus on change in team learning behaviours and team learning products.

These conceptualisations show that within the same perspective on team learning the focus is on different team learning conditions, behaviours and products. Also, different levels (individual, team and organisational) are taken into account by conceptualising team learning. By considering team learning only from the process or the product perspective, the complexity of team learning with all its aspects cannot be captured. Furthermore, only a part of that what happens when team members work and learn together is captured. To capture team learning in its complexity, integrative cross-disciplinary conceptualisations are necessary that take various team learning conditions, behaviours and products, the different levels and both the process and product perspective into account (Dochy et al., 2014), such as the integrative model of team learning from Decuyper et al. (2010). They describe team learning as a combination of team learning behaviours that lead to team learning products at the individual, team or organisational level. They cluster various team learning conditions, team learning behaviours and team learning products found in literature in their model. By taking this model into account in this thesis, team learning is considered from the process and product perspective as a systemic, complex and multidimensional construct.

2.3 Team learning at work

Based on the conceptualisation of learning at work, the general system theory (GST) (Bertalanffy, 1968) and the complexity theory (Jörg, 2004), team learning at work in this thesis is defined as a product and a process of team learning behaviours that can change over time, can occur in different combinations and is influenced by various team learning conditions at the individual, the team or the organisational level (Argote et al., 2001; Decuyper et al., 2010).

This definition shows that team learning is conceptualised as the process of team learning behaviours as well as a product of team learning behaviours (cf. Argote et al., 2001). In addition, team learning conditions that can influence team learning behaviours are taken into account. Moreover it shows that team learning is systemic, complex and multidimensional.

The GST emphasises that an organisation, as well as human life, is composed of systems. A system is a set of elements as sub-systems (e.g., individuals) that interrelate (Bertalanffy, 1968). These systems are open systems consisting of elements (sub-systems), standing in interrelation among themselves and with their environment (supra-system), and change over time (Bertalanffy, 1968). This interrelation is characterised by interaction. To grasp the reality of a system it is necessary to understand the elements as sub-systems and the environment as the supra-system. In particular it is important to understand the reciprocal relationships between the sub-systems, the system and the supra-system as they influence each other (Bertalanffy 1968). Consequently, a team is an open system that is embedded in the organisation and interconnects team members with each other. Taking into account the individual, team and organisational level by conceptualising team learning is crucial to understand the reality of team learning. In this sense team learning is a systemic, multilevel phenomenon.

According to the complexity theory, complex constructs are those whose components do not have simple and linear relationships. Rather, they have dynamic, non-linear relationships that evolve and change over time (Jörg, 2004). To grasp the reality of complex constructs, these non-linear, dynamic realtionships have to be understood. In addition, the temporal component must be taken into account since relationships emerge and change over time (Jörg, 2009).

When thinking in terms of the complexity theory about learning, interaction is seen as a key concept for learning (Jörg, 2009). Learning in interaction is (cf. learning at work) 'viewed as a dynamic process of change within and between dynamically interconnected networks of human beings' (Jörg, 2009, p. 16). Both theories, the complexity theory and the GST, emphasise that interaction takes place between open systems and is seen as a complex and dynamic process and not as a linear and static one (Bertalanffy, 1968; Jörg, 2004).

Accordingly, the team learning process is a complex process and can be described as chaotic, cyclical and non-linear. Chaotic means that team learning behaviours evolve and change over time, are interrelated and take place in different combinations. Non-linear means, that there are no simple and unidirectional relationships between various team learning behaviours but rather reciprocal and complex ones. Cyclical means that team

learning products, resulting from team learning behaviours, can in turn be team learning conditions for future team learning (Decuyper et al., 2010).

Finally, team learning is a multidimensional construct as it consists of various team learning behaviours that are influenced by various team learning conditions at different levels and lead to various team learning products (cf. Arrow & Cook, 2008; Kozlowski & Bell, 2003). By regarding these various dimensions, it is possible to understand 1) what teams do when they learn, 2) what teams need to do in order to learn and 3) what teams learn (cf. Decuyper et al., 2010). Thus, to capture team learning to its full extent, various team learning conditions from different levels, behaviours and products have to be considered. This is how team learning can be understood in more depth.

In the next sections, team learning behaviours, team learning products and team learning conditions are described in detail.

2.3.1 Team learning behaviours

In accordance with the conceptualisation of learning at work, all team learning behaviours are carried out by team members while accomplishing team tasks and are characterised by social interaction among team members. Consequently, these behaviours are shared by at least of two team members (not all team members have to be involved). The extent of team learning behaviours within a team depends on how often the team members engage in team learning behaviours. Team learning behaviours describe what happens when teams work and learn. They can be differentiated, on one hand, according to whether they are planned (deliberative) or spontaneous (reactive) learning behaviours and, on the other hand, according to whether they are cognitive or physical and consequently observable or not (Mulder, 2013). As previously mentioned, various team learning behaviours are considered in the different definitions and conceptualisations of team learning. These team learning behaviours found in the literature can be clustered into the following seven core team learning behaviours divided into three categories according their function (Decuyper et al., 2010): 1) Basic behaviours (sharing, co-construction and constructive conflict) describe what happens when teams learn and result in change but not necessarily in improvement. 2) Facilitating behaviours (boundary spanning, team activity and team reflexivity) are responsible for the context and focus of team learning and result in efficiency and effectiveness. 3) Finally, storage and retrieval cover the dynamic, temporal perspective as they lead to the persistence of team learning over time. This is because team learning products, such as shared knowledge or developed procedures, that are stored can be used for further team tasks and serve for further team learning as a team learning condition. In this sense, storage and retrieval link past team learning with present and/or future team learning (Decuyper et al., 2010).

This thesis focuses on team learning behaviours for the following reasons: First, team learning occurs if teams engage in learning behaviours. Engagement in team learning behaviours leads to change or improvement, as a team learning product. Second, in accordance with the definition of learning at work, the learning process becomes visible in concrete behaviours (Kolb, 1984; Kolb & Kolb, 2009). Third, focusing on team learning behaviours is important for examining change over time within the team. Team learning conditions are often stable and difficult to change, for instance, if someone changes jobs and therefore there is a change of team members within the team. In contrast, team

learning behaviours can be fostered actively by the organisation as well as by the team or the team members themselves, and in that way the team learning products can be influenced. Fourth, as team learning behaviours lead to change or improvement, they are essential for different team learning products and team performance. This will be discussed in detail in the next section.

2.3.2 Team learning products

Team learning products are the result of the engagement in team learning behaviours and can be of different types. In this thesis the focus is on secondary team learning products, which are not pursued by the team but are necessary for achieving its goals with a high level of performance (Decuyper et al., 2010). These team learning products can be distinguished in the following three types: behavioural, cognitive and affective products (Stagl, Salas, & Day, 2008). This thesis focuses on innovative work behaviour as a behavioural product and team mental models as a cognitive product (see Figure 1). Just as with work teams in organisations, as discussed in the introduction, work teams in vocational education also need to develop innovative solutions to solve challenges, and innovative work behaviour is crucial. Research on team learning focuses mainly on innovation as a product and shows that teams are a key driver for developing innovations (Crossan, Lane, & White, 1999). However, examining the process of innovation development has been largely neglected (Crossan & Apaydin, 2010). Therefore little is known about how teams contribute to the process of innovation development. The process is characterised by a set of requirements that have to be met to successfully develop innovations. These requirements range from the explanation of opportunities and the generation of ideas (creative behaviour) to the promotion of ideas and the realisation of the ideas (implementation behaviour) (Messmann & Mulder, 2012). Therefore it is crucial to take into account innovative work behaviour and examine the relationship between team learning behaviours and innovative work behaviour. Innovative work behaviour includes any work activities required for the conscious development, implementation and application of new and beneficial ideas, processes and products which can lead to an increased performance of the team or the organisation (Messmann & Mulder, 2012; West & Farr, 1990). To capture innovative work behaviour adequately, it should be measured as a holistic construct. This means that the multidimensional (including the various activities of opportunity exploration, idea generation, idea promotion and idea realisation) dynamic and context-bound nature of innovative work behaviour should be taken into account (Messmann & Mulder, 2012).

The focus on team mental models relates to its importance for team performance (Van den Bossche et al., 2006). Moreover, developing team mental models about the key elements of teamwork is the essence of collaboration (Dillenbourg & Traum, 2006). Team mental models can be described as the shared understanding of the team members regarding their commonly used equipment, their tasks, team members' characteristics or their roles and the interaction processes that take place during teamwork (Cannon-Bowers, Salas, & Converse, 1993). Team mental models are important for accomplishing complex tasks when knowledge or support from several team members is needed (Dao, Strobl, Bauer, & Tarba, 2017). As the work teams in vocational education work on knowledge-

intensive and complex tasks, it is necessary to focus beside innovative work behaviour also on team mental models as a team learning product.

Moreover, little is known about the development of team mental models in work teams in vocational education. Therefore longitudinal studies examining the relationship between team learning behaviours and team mental models are needed to understand the development of team mental models over time.

Both team learning products, innovative work behaviour and team mental models are not pursued by the teams specifically but are needed to accomplish their tasks in an efficient, effective, high-quality and innovative way (e.g., Van den Bossche, Gijselaers, Segers, Woltjer, & Kirschner, 2011). Consequently, both team learning products represent a direct indicator of team performance. Moreover, the relevance of indicators for team performance depends on the goal of the work teams and the characteristics of the work tasks on which the teams work (cf. Anselmann, 2018). As mentioned, work teams in vocational education work on complex, knowledge-intensive and non-routine tasks that require innovative solutions. They have to develop shared knowledge and innovations to accomplish those tasks. Therefore both team mental models and innovative work behaviour are good indicators for team performance.

Aside from these team learning products as specific indicators for team performance, there are general indicators for team performance (Van Woerkom & Croon, 2009). These indicators, namely efficiency, effectiveness and innovativeness, are important for various types of teams from various domains (e.g., Anselmann, 2018; Van den Bossche et al., 2011).

Efficiency refers to the extent of the attainment of goals and the satisfaction of internal and external expectations. This also includes that the product or process be free from errors (Hoegl & Gmuenden, 2001; Van Woerkom & Croon, 2009). Effectiveness refers to the input-output comparison. This means the extent of the team's adherence to schedules and resources (Hoegl & Gmuenden, 2001). Innovativeness refers to the extent of beneficial, newly implemented strategies, processes or products (cf. Van Woerkom & Croon, 2009).

2.3.3 Team learning conditions

Due to various conditions that influence team learning, teams often fail to reach a high level of team performance or to generate change or improvement because of a lack of engagement in team learning behaviours (e.g., Van den Bossche et al., 2006). Thus, they fail to achieve effective learning. Therefore it is crucial to consider team learning conditions at different levels to understand team learning to its full extent because team learning conditions can hinder or enhance effective team learning by influencing the team learning behaviours. In the literature, a large number of team learning conditions at the individual level, the team level and the organisational level can be identified (cf. Decuyper et al., 2010).

First, team learning conditions at the individual level can be the characteristics of team members, such as motivation (e.g., Argote, McEvily, & Reagans, 2003) or prior knowledge (e.g., Sweet & Michaelsen, 2007). Also, the behaviours of team members, such as systems thinking (e.g., Salas, Burke, Cannon-Bowers, 2000) or individual learning (e.g., Roth & Lee, 2006), can influence team learning.

Second, at the organisational level, for instance, organisational strategy (e.g., Zellmer-Bruhn & Gibson, 2006) or organisational culture (e.g., Bain, 1998) can hinder or foster team learning.

Third, at the team level, Decuyper et al. (2010) distinguished catalyst emergent states, time-related team learning conditions and team learning conditions. Catalyst emergent states include variables such as psychological safety (e.g., Van den Bossche et al., 2006) or group potency (e.g., Gibson, Randel, & Early, 2000). Time-related team learning conditions are, for example, team experience (e.g., Huckman, Staats, & Upton, 2009). And the third category refers to further team learning conditions at the team level, such as task interdependence (e.g., Van den Bossche, 2006) or team structure (e.g., Bresman & Zellmer-Bruhn, 2013).

In this thesis the focus is on team learning conditions at the team and the individual level for the following reasons: Team learning conditions at the team level are more stable over different domains than team learning conditions at the organisational level and depend more on the type of the team regarding goals, tasks and team composition (cf. Cohen & Bailey, 1997). Moreover, the teams in vocational education have similar organisational structures because all the participated colleges are mangaged by the government. Because of the resulting little variance between the teams with regard to their organisational conditions, we focus on learning conditions at the individual and team level.

In this thesis four team learning conditions were selected (see Figure 1) that seem to be the most important for a high level of engagement in team learning behaviours across different domains (cf. Decuyper et al., 2010). Because the selected team learning conditions influence the interaction between the team members, a large extent of them can enhance engagement in team learning behaviours (Van den Bossche et al., 2006).

Task interdependence describes the extent to which team members depend on each other to accomplish their tasks. The more the team members need each other to accomplish their tasks, the more interaction is necessary (Rupprecht, Strasser, Mulder, & Gruber, 2011). Thus, the team members can engage more in team learning behaviours.

Team structure describes the extent of the division of responsibilities and roles within the teams (Bresman & Zellmer-Bruhn, 2013). A clear structure within the team facilitates communication among team members in regard to sharing knwoledge, gathering imformation and reflecting on the task because everyone knows who has the relevant knowledge and can help to accomplish tasks (Bunderson & Boumgarden, 2010).

Group potency describes the extent of the team members' collective belief that it can work effectively regardless of the nature and the content of the task (Guzzo, Yost, Campbell, & Shea, 1993). Teams that believe in working effectively can handle challenges better (Van den Bossche et al., 2006). Thus, the team is able to regulate team learning behaviours and share and process information effectively (Gully, Incalcaterra, Johi, & Beaubien, 2002).

Intrinsic motivation refers to the enjoyment of activities that are necessary to accomplish the team tasks, such as finding innovative solutions (cf. Tierney, Farmer, & Graen, 1999). The enjoyment of team members can be seen as a basic condition. Team members, who are not enthusiastic about working in and for the team, avoid engaging in team learning behaviours (Tierney et al., 1999; Hirst, Van Knippenberg, & Zhou, 2009).
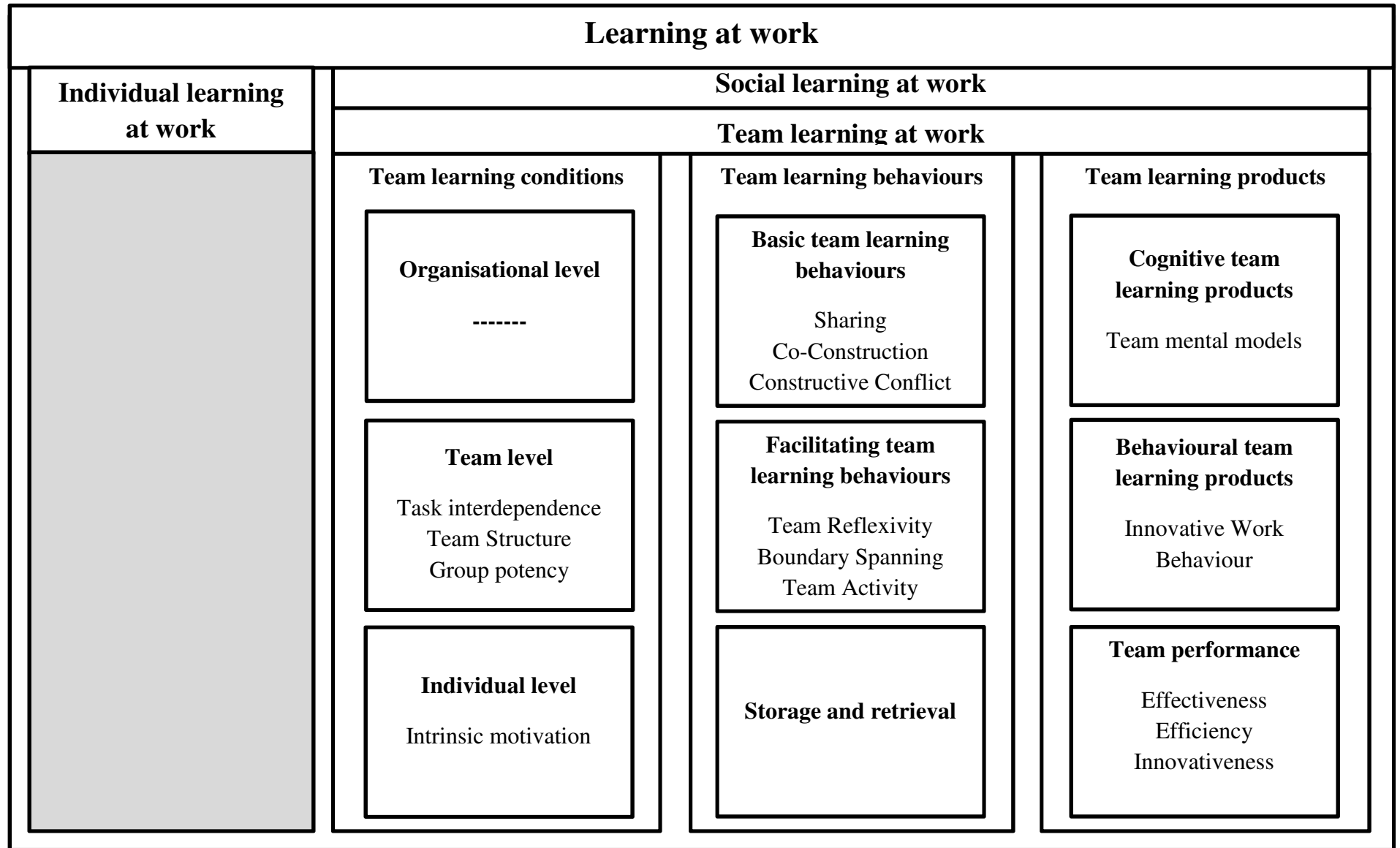
Figure 1. Overview of team lerning at work and the considered team learning conditions, team learning behaviours and team learning products.

3. Aim of the thesis and overview of the studies

3.1 Aim of the thesis

Based on the overarching research questions of how team learning conditions, team learning behaviours and team learning products relate and change over time and how team learning is characterised in vocational education, the following three aims are pursued.

Aim 1 – Identification of relationships between team learning behaviours and innovative work behaviour in work teams

As innovative work behaviour is essential for teams to meet the challenges faced by organisations, it is important to understand how innovative work behaviour in teams can be fostered. Therefore the aim was to identify relationships between team learning behaviours and innovative work behaviour in order to derive practical implications to foster innovative work behaviour in organisations. Because of the interdisciplinary relevance, the relationship between team learning behaviours and innovative work behaviour was investigated over various domains. Thus, it was important to analyse the relationship across different domains in detail to find similarities and differences. To achieve this aim, a systematic literature review (Study 1) and a cross-sectional study (Study 2) were conducted.

Aim 2 – Insight into the temporal change of team learning behaviours, innovative work behaviour and their relationships

As behaviour changes over time, it is crucial to consider time when examining team learning behaviour and innovative work behaviour. Moreover, an examination over time is crucial to understand team learning and the relationships between team learning behaviours and innovative work behaviour to its full extent because team learning evolves and changes over time. Therefore the second aim was to take the dynamic perspective of team learning into account and gain insight into the temporal changes of both team learning behaviour and innovative work behaviour and their relationships. Via a deep understanding of how team learning behaviours and innovative behaviour change over time, it is possible to identify starting points to foster innovative work behaviour. 'How' summarise the questions of whether and which team learning behaviours are related to which dimensions of innovative work behaviour at different time points. Based on the cross-sectional study (Study 2) of this thesis, the most important team learning behaviours for innovative work behaviour were selected. Study 3 was conducted to achieve this aim.

Aim 3 – Description of team learning in work teams in vocational education

Because of certain special characteristics of work teams in vocational education, such as the long-standing individualism of teachers or the isolated position of teachers in everyday work, the examination of team learning in the context of vocational education is important. To capture team learning of teachers in vocational education to its full extent, the relationships between different team learning conditions, team learning behaviours and team learning products (innovative work behaviour and team mental models) and team performance were examined, both cross-sectionally and longitudinally. Moreover by comparing the results with results from other domains, possible domain specificities can be identified. Studies 2, 3 and 4 were conducted to achieve this aim.

3.2 Overview of the studies

To achieve the aims of this thesis, four strongly related studies were conducted. These studies are described in articles published in different peer-reviewed journals and are presented in the following chapters.

Study 1 – The impact of team learning behaviours on team innovative work behaviour: A systematic review.

In this review study the existing literature was analysed according to which team learning behaviours relate to innovative work behaviour. The aim of this study was to gain insight into the relationship between team learning behaviours and various dimensions of innovative work behaviour to derive practical implications as to how innovative work behaviour can be fostered. Further, research gaps were identified that were addressed in the following studies. The research question answered by this study was: *What is the impact of team learning behaviours on team innovative work behaviour?* Both qualitative and quantitative studies from various domains were considered that investigated work teams and focused on learning behaviour at the team level. Based on content-related and technical selection criteria, N = 31 studies could be identified.

Study 2 – Team learning behaviours and innovative work behaviour in work teams.

The aim of this cross-sectional questionnaire study (N = 593 team members of 117 teams) was to gain deep insight into the complex nature of team learning in vocational education. The relationships between team learning conditions, team learning behaviours and innovative work behaviour as a team learning product were analysed by considering and combining different gaps in research. In this way the study is a contribution to understanding the complex relationship between team learning behaviours and innovative work behaviour more accurately. By considering vocational education as a neglected domain, the results provide the opportunity to describe team learning in vocational education. Further, by considering team learning behaviours, including neglected ones, simultaneously as separate variables, the most important ones for fostering innovative work behaviour could be identified. The research questions that were answered by this study were: 1) *Which team learning behaviours relate to innovative work behaviour?* 2) *What team learning conditions foster the team learning behaviours that are relevant for innovative work behaviour in interdisciplinary work teams?* Finally, the results of this study were used to select team learning behaviours and team learning conditions for Study 3.

Study 3 – Team learning behaviours as predictors for innovative work behaviour – A longitudinal study.

The aim of this longitudinal questionnaire study (N = 275 team members of 66 work teams) was to gain insight into the changes in team learning behaviours and innovative work behaviour as well as the relationship between both constructs over time. The research question answered by this study was: *How do team learning behaviours predict innovative work behaviour over time?* Gaining insight into how engagement in team learning behaviours can foster innovative work behaviour – this means finding out whether, when and which team learning behaviours are related to which dimensions of innovative work behaviour. Moreover, the results of this study show how team learning behaviours and

innovative work behaviour change over time as to whether they are stable, increase or decrease over the course of one year. By considering various team learning behaviours separately and longitudinally, the present study provides insight into how innovative work behaviour can be fostered through team learning behaviours by providing indications as to which dimensions of innovative work behaviour can be fostered through which team learning behaviours at different time points.

Study 4 – The effect of team learning behaviours and team mental models on teacher team performance.
The aim of this longitudinal study (N = 276 team members of 66 work teams) was to gain a deep understanding of the meaning of team learning behaviours to develop a shared understanding with regard to team tasks (task-related team mental model) among team members. A further aim was to understand the meaning of a task-related team mental model for team performance. These aims were addressed by analysing the effect of team learning behaviours on the development of task-related team mental models and team performance. The research questions answered by this study were: 1) *What is the effect of team learning behaviours on team mental models in teacher teams?* 2) *What is the effect of team mental models on team performance in teacher teams with regard to team efficiency, team effectiveness and team innovativeness?* The results provide insight into the relationship between team learning behaviours, task-related team mental models and team performance according to efficiency, effectiveness and innovativeness in vocational education. Regarding the task of the teams in detail and the performance of the teams, it is possible to describe team learning in vocational education in depth.

In the following chapters, the described studies are presented in chronological order (Studies 1 – 4) according to the aims of this thesis. All Studies are published in peer-reviewed journals.

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4. Study 1 -

The impact of team learning behaviors on team innovative work behavior: A systematic review

Full text available at

http://journals.sagepub.com/doi/full/10.1177/1534484316673713

5. Study 2 -
Team learning behaviours and innovative work behaviour in work teams

Full text available at

https://www.emerald.com/insight/content/doi/10.1108/EJIM-12-2017-0194/full/html

Widmann, A. & Mulder, R. H. (2018). Team learning behaviours and innovative work behaviour in work teams. *European Journal of Innovation Management, 21(3)*, 501-520. doi:10.1108/EJIM-12-2017-0194

6. Study 3 -
Team learning behaviours as predictors for innovative work behaviour – A longitudinal study

Full text available at

https://www.tandfonline.com/doi/full/10.1080/14479338.2018.1530567

Widmann, A., Mulder, R. H., & König, C. (2019). Team learning behaviours as predictors for innovative work behaviour – A longitudinal study. *Innovation: Organization & Management, 21(2)*, 298-316. doi:10.1080/14479338.2018.1530567

7. Study 4 -
The effect of team learning behaviours and team mental models on teacher team performance

Full text available at

https://link.springer.com/article/10.1007/s11251-019-09500-6

8. General discussion and reflections

The overarching aim of this thesis was to gain insight into how team learning conditions, team learning behaviours and team learning products relate over time in work teams in vocational education. Based on the general research questions – *(1) How do team learning conditions, team learning behaviours and innovative work behaviour relate and change over time? (2) How is team learning characterised in work teams in vocational education?* - three aims were identified.

In this chapter, the key findings for answering the research questions will be discussed according the three aims before limitations and implications for both future research and practice are described.

8.1 Key findings

8.1.1 Identification of relationships between team learning behaviours and innovative work behaviour in work teams

As work teams are implemented to meet challenges that often require innovative solutions, teams' innovative work behaviour is crucial for organisations. Therefore detailed insight into which team learning behaviours relate to innovative work behaviour is necessary to be able to foster the innovative work behaviour of teams in organisations.

This thesis provides insight into which team learning behaviours relate to innovative work behaviour and provides a starting point as to how innovative work behaviour can be fostered.

Teams that engage in team learning behaviours are more strongly engaged in innovative work behaviour. Study 1 (a review) revealed that all team learning behaviours identified by Decuyper, Dochy, and Van den Bossche (2010) relate to innovative work behaviour or at least to a part of innovative work behaviour, such as creative behaviour or implementation behaviour.

The most consistent results are found for the team learning behaviours of sharing and team reflexivity. All included studies indicate a positive relationship between these two team learning behaviours and innovative work behaviour or parts of it. Based on these results it could be assumed that sharing and team reflexivity are the most important team learning behaviours for enhancing innovative work behaviour. Regarding the other team learning behaviours, positive, negative and non-significant correlations were found. These inconsistent results of the identified studies do not diminish the importance of these team learning behaviours for the enhancement of innovative work behaviour. Rather, there are various reasons for these inconsistent results. As the inconsistent results were found between studies that focus on different domains, one reason could be related to the domain-specific characteristics of the teams, such as work structures, or the possibility for team meetings influenced by the domain (Anselmann, 2018). Moreover, differences in time points, as shown in Study 3 (discussed in the next section), the types of teams and the types of the team tasks can be causes for the inconsistent results (cf. Cohen & Bailey, 1997). Furthermore, the team learning behaviours are examined according to innovative work behaviour as a holistic construct as well as to different individual parts of innovative work behaviour, such as creative behaviour or implementation behaviour. Thus, one reason

for the inconsistent results could be that these team learning behaviours are only important for specific parts of innovative work behaviour.

Sharing, team reflexivity, team activity and constructive conflict are examined regarding to their relationship to innovative work behaviour as a holistic construct. However, only four identified studies consider the entire process of innovation development. The other identified studies focus only on a part of innovative work behaviour. While co-construction is examined with regard to its relationship to creative behaviour, team implementation behaviour and innovation as an outcome of innovative work behaviour, storage and retrieval and boundary crossing are examined only regarding their relationship to implementation behaviour and innovation as an outcome.

Study 1 also shows that different terms were used for similar or the same team learning behaviours, as mentioned previously. All team learning behaviours identified in the selected studies could be categorised in the team learning behaviours identified by Decuyper and colleagues (2010). This provides support for the theoretical classification of team learning behaviours in their model.

Conducting this review was crucial to gain insight into the relationship between different team learning behaviours and innovative work behaviour to select team learning behaviours for the further studies of this thesis and to identify research gaps that could be addressed in the further studies suitably. Study 2 fills several research gaps identified in Study 1. The study provides a first insight into a neglected domain (*vocational education*) and insight into the relationship between neglected team learning behaviours (*boundary spanning* and *storage and retrieval*) and takes innovative work behaviour into account as a holistic construct. Furthermore, by considering different team learning behaviours in one study simultaneously as separate variables, the study enables the identification of a starting point to foster innovative work behaviour. A starting point to foster innovative work behaviour could be to foster team reflexivity as the results of both Study 1 and Study 2 indicate the importance of team reflexivity for innovative work behaviour. While a positive relationship was found between the team learning behaviours, team reflexivity and boundary spanning, and innovative work behaviour, no relationship was found between storage and retrieval and innovative work behaviour. Since in this study innovative work behaviour was examined as a holistic construct, the missing relationship could be caused by the importance of storage and retrieval only for parts of innovative work behaviour (cf. Study 1).

In contrast to previous studies, neither relationship was found between knowledge sharing and innovative work behaviour. Reasons for this missing effect can be domain-specific characteristics, such as the stability of work teams regarding their composition in vocational education (domain-specificity is discussed in detail in the section 'Description of team learning in work teams in vocational education'). Furthermore, it could be caused by the positive interrelation of the examined team learning behaviours, thus leading to multicollinearity. However, because all team learning behaviours correlate with innovative work behaviour, it should be noted that knowledge sharing can be important for a high level of engagement in innovative work behaviour in other circumstances (Bednall, Sanders, & Runhaar, 2014). Moreover, it can be assumed that the model of the study shows which team learning behaviours are the most important at the measurement point, namely team reflexivity and boundary spanning.

8.1.2 Insight into temporal change of team learning behaviours, innovative work behaviour and their relationships

Study 1 reveals further research gaps. Thus, longitudinal studies are missing that provide insight into the relationship between team learning behaviours and innovative work behaviour over time. To address this research gap, Study 3 was conducted.

In contrast to previous research on team learning indicating that team learning evolves and changes over time (e.g., Van der Haar, Segers, & Jehn, 2013), in Study 3 no changes in team learning behaviours could be identified. Rather, team learning behaviours were found to be stable over the school year. One reason for this can be that the participating teams were stable regarding team composition and worked together before the first measurement point. Raes, Kyndt, Decuyper, Van den Bossche, and Dochy (2015) indicate that teams develop over time regarding their team learning conditions at team level and more team learning behaviours are shown in later phases of team development. Team development means that a collection of individuals becomes an effective functioning team (Wheelan, 2005). Team development can be described in four different phases that are marked by various team learning conditions that hinder or foster the engagement in team learning behaviours. For instance, while phase 1 is marked by a high level of anxiety and uncertainty among the team members and by rather low engagement in team learning behaviours, phase 4 is marked by trust, and the team members feel comfortable within the team to work together and by high engagement in team learning behaviours (Wheelan, 2005; Raes et al., 2015). These phases do not follow a linear order, and a team that reaches a higher phase of team development can also sink to a lower phase, for instance if team composition changes or the team is confronted with new challenges. Consequently, the participating teams might be in a higher phase of team development before the first measurement point, where the engagement in team learning behaviours is high and stagnant (Whelaan, 2005). The teams show a high level of engagement in team learning behaviours at all measurement points, what indicates that the teams reached a later phase of team development. Moreover, the stability in team composition and the high levels of team learning conditions over time can be causes for the high level of engagement in team learning behaviours over the whole year.

One focus of this thesis is on the temporal perspective of team learning. The results of this thesis indicate that different team learning behaviours are important at different time points. While knowledge sharing and team reflexivity is important for engagement in innovative work behaviour at the beginning of the school year – when the teams start to work on a new task – boundary spanning becomes important later in the year. Therefore knowledge sharing and team reflexivity may provide a good starting point to foster employees' innovative work behaviour, and later especially boundary spanning should be fostered.

However, the importance of all team learning behaviours over the whole year should not be neglected. A high level of engagement in knowledge sharing and team reflexivity is also important during the year, as the correlations between team learning behaviours and innovative work behaviour indicate. Moreover, the consistent results, as shown in Study 1, indicate that knowledge sharing and team reflexivity is important at all time points.

The missing effects between knowledge sharing and team reflexivity at the second measurement point and innovative work behaviour at the third measurement point could be

caused by the fact that a common knowledge base was created at the beginning of the work task. Moreover, as the teams work together for a longer time and are stable in their team composition and the team members have known each other for a longer time, knowledge sharing could be less important in later phases of the work task. Moreover, Study 2 indicates that a high level of engagement in boundary spanning can also be important at the beginning of the year, for instance if task-relevant knowledge is missing within the team. While in Study 2 no relationship was found between knowledge sharing and innovative work behaviour, in Study 3 a positive effect over time was found. This means that knowledge sharing has no immediate effect on innovative work behaviour but a lagged positive impact on innovative work behaviour.

8.1.3 Description of team learning in work teams in vocational education

Examining team learning in vocational education is neglected, as mentioned above. As work teams in vocational education have a special position because of long-standing individualism and other possible domain-specific hindering factors such as the isolated position of teachers (cf. Vangrieken, Dochy, Raes, & Kyndt, 2015), studies on team learning in vocational education are crucial for a deeper understanding on domain specificity (e.g., Truijen, Sleegers, Meelissen, & Nieuwenhuis, 2013). Studies 2, 3 and 4 provide insight into team learning in work teams in vocational education. In detail Studies 2 and 3 provide insight into the relationship between team learning conditions, team learning behaviours and the behavioural team learning product *innovative work behaviour*. Study 4 extends the understanding of team learning in vocational education by providing insight into the relationship between team learning behaviours and the cognitive team learning product *team mental model* and *team performance* regarding *efficiency, effectiveness and innovativeness*. Based on the results of these studies, team learning in work teams in vocational education can be described as follows:

   1) Team learning conditions and team learning behaviours. The results of Study 2 indicate a positive relationship between team learning conditions at the team level (*task interdependence, team structure and group potency*) as well as team learning conditions at the individual level (*intrinsic motivation*) and team learning behaviours. Thus, all examined team learning conditions are important for enhancing team learning behaviours in work teams in vocational education. These results are consistent with those from other domains (e.g., Bresman & Zellmer-Bruhn, 2013; De Dreu, 2002; Somech & Khalaili, 2014; Van den Bossche, Gijselaers, Segers, & Kirschner, 2006). By investigating these team learning conditions in relation to different team learning behaviours, this thesis provides a deeper insight into the relationship. While task interdependence and team structure relate to different team learning behaviours, group potency relates positively only to team reflexivity. Moreover, Study 3 extends the research by providing insight into the longitudinal relationship of task interdependence and team structure and three team learning behaviours, namely knowledge sharing, team reflexivity and boundary spanning. Both team learning conditions relate positively to all three team learning behaviours over time. As the results indicate only a marginal relationship over time, it can be assumed that team learning conditions have a greater impact on team learning behaviours immediately (over a short period of time) than over a longer period of time. Therefore, team structure and task interdependence seem to be very important for a high level of engagement in team

learning behaviours in teams in vocational education. Although research indicates long-standing individualism and an isolated positions of teachers (e.g., Vangrieken et al., 2015), this thesis shows that teachers in work teams are highly interdependent for carrying out their tasks successfully. This indicates that the demands on teachers have changed, and other competences are needed to become a profession in this domain.

2) Team learning behaviours and innovative work behaviour. The results of Studies 2 and 3 indicate that a high level of engagement in team reflexivity, boundary spanning and knowledge sharing is important to enhance innovative work behaviour. However, considering the time is crucial because the relationships between various team learning behaviours and innovative work behaviour can change over time. The results indicate that especially at the beginning of a new work task, a high level of engagement in team learning behaviours is very important for work teams in vocational education. Especially high engagement in knowledge sharing and team reflexivity is important for future innovative work behaviour. Although in Study 2 no relationship was found between knowledge sharing and innovative work behaviour, the results of Study 3 indicate the importance of knowledge sharing at the beginning of a work task for the enhancement of innovative work behaviour. Boundary spanning seems to become important later in the year for a high level of engagement in innovative work behaviour. But as also in Study 2 a cross-sectional relationship between boundary spanning and innovative work behaviour was found, boundary spanning at the beginning of a new work task should not be neglected. Rather, it could be assumed that the importance of boundary spanning depends on when the knowledge within the team is missing to accomplish the task, and information from outside is helpful for the team. This can vary from team to team. Storage and retrieval seem less important for a high level of engagement in innovative work behaviour as no relationship was found.

In conclusion, the three team learning behaviours, knowledge sharing, team reflexivity and boundary spanning, are important for innovative work behaviour at all time points. However, it should be noted that some team learning behaviours seem more important than others at certain points in time and should therefore be fostered at those points in time.

3) Team learning behaviours, Task-TMM and team performance. Study 4 shows that a high level of engagement in team learning behaviours (team reflexivity, knowledge sharing, boundary spanning and storage and retrieval) at the beginning of a new work task is important for developing a shared understanding about the work task (Task-TMM) and for reaching a high level of team performance regarding efficiency, effectiveness and innovativeness. Thus, team reflexivity seems to be the most important team learning behaviour for work teams in vocational education as it relates positively to both innovative work behaviour and Task-TMM and team performance.

Developing Task-TMM is important for work teams to reach a high level of team performance. In Study 4 a positive relationship between Task-TMM and team effectiveness was found. High similarity in Task-TMM enables teams to coordinate different actions with consideration of overarching goals (Van den Bossche, Gijselaers, Segers, Woltjer, & Kirschner, 2011) and to adapt more effectively to changing situations (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). No relationship was found between Task-TMM and efficiency and innovativeness. As Task-TMM is measured during the year (at the second measurement point) this missing relationship could be caused by the

time point of measurement. Maybe high Task-TMM similarity is more important for efficiency or more hindering for innovativeness at the beginning of a project than during teamwork. Thus, a high level of engagement in team learning behaviours is more important than high similarity of Task-TMM for work teams in vocational education to reach a high level of team performance.

Although the samples of the study consist of work teams in vocational education, the results can also be used for work teams of other domains for different reasons.

First, the teams are comparable regarding the definition of work teams. All teams are embedded in the organisational context, consist of two or more individuals who interact socially and are interdependent accomplishing their tasks. Second, the teams are comparable with teams from other domains regarding the characteristics of the team tasks. All participating teams worked on non-routine, knowledge-intensive tasks relevant for the organisation. Third, they are comparable in their team composition. The teams are interdisciplinary regarding team members' qualifications, responsibilities in the college and the subjects they teach. Teams with the same task characteristics and with a similar team composition can be also found in other domains, such as R&D teams (cf. Huang, 2009; Liu, Schuler, & Zhang, 2013). Regarding research on work teams in vocational education, it was asked if these teams met the definition of teams described in the conventional work team literature or whether they should be better called groups (unit of independent individuals) or collaborations between friends (Vangrieken, Dochy, Raes, & Kyndt, 2013). As teams differ from groups in task interdependence and team structure (Salas, Burke, & Cannon-Bowers, 2000), this thesis shows that there are teams in vocational education that meet the criteria of real work teams and are comparable with work teams in other domains. Thus, the results of this thesis can be used to foster work teams with described work tasks and characteristics across different domains.

Despite the general transferability of the results to other domains, there could be some domain-specific results which may not be directly transferable to teams in other domains.

The missing effect between knowledge sharing and innovative work behaviour in Study 2 could be a domain-specific result. Because the participating teams worked together before the first measurement point, the teams could have already built a common knowledge base that includes all relevant knowledge for accomplishing the task. A second reason could be that the teachers knew each other because they had worked together on other projects and built in that way a common knowledge base.

Moreover, the importance of team structure could be a domain-specific result. Although studies from other domains indicate the importance of team structure (e.g., Bresman & Zellmer-Bruhn, 2013), in vocational education team structure seems to be one of the most important team learning conditions because it relates positively to all examined team learning behaviours. As most of the teachers work individually in their everyday work and have the same positions, it could be more important to create a clear team structure by dividing roles and responsibilities more clearly than in other domains, where a natural hierarchy of team members is given. In contrast to other domains (e.g., Van den Bossche et al., 2006), group potency seems to be less important for a high level of engagement in team learning behaviours of work teams in vocational education as it relates positively only to team reflexivity.

8.2 Conclusion

Four studies were conducted to answer the following research questions of this thesis:

> 1) *How do team learning conditions, team learning behaviours and innovative work behaviour relate and change over time?*
> 2) *How is team learning characterised in work teams in vocational education?*

Different team learning behaviours are important for different team learning products (both behavioural and cognitive ones) at different time points as well as for team performance regarding effectiveness, efficiency and innovativeness. The relationships between team learning behaviours and innovative work behaviour change over time. This indicates that various team learning behaviours are important for a high level of engagement in innovative work behaviour at different time points. While it is crucial that the work teams engage in knowledge sharing and team reflexivity at the beginning of a new work task, during the year they should gather task-relevant information from outside the team. In summary, the results of this thesis indicate that teams that engage in team learning behaviours, especially in team reflexivity, boundary spanning and knowledge sharing, engage more in innovative work behaviour. Thus, such teams might be able to develop innovative solutions for the different challenges their organisation faces. Moreover, such teams develop a shared understanding about their tasks and reach a higher level of team performance. Therefore, it is important to ensure that teams engage in team learning behaviours.

As the results show, a possibility to increase the engagement in team learning behaviours different team learning conditions can be used. Especially team structure and task interdependence are important team learning conditions for fostering engagement in team learning behaviours. Regarding the time point, the results show that as early as at the beginning of a new work task the team members should be interdependent for accomplishing that task, and a clear team structure should be created. These findings answer research question 1.

Based on the outlined results research question 2 can be answered as follows: Team learning of work teams in vocational education is characterised by a high engagement in team learning behaviours that is stable over one school year. The high level of engagement in the team learning behaviours of the participating work teams indicates that domain-specific characteristics, such as long-standing individualism (cf. Vangrieken et al., 2015), are not hindering factors for team learning of work teams in vocational education.

This high engagement in team learning behaviours can be caused by a high task interdependence and clear team structure. The results indicate that teams in vocational education have a clear structure with clearly defined roles and their team members depend on each other for accomplishing the team task. Moreover the importance of team reflexivity for various learning products and the less importance of knowledge sharing for innovative work behaviour than in other domains can be described as characteristics of team learning in vocational education.

Although domain-specific results were found, such as the importance of team structure or the missing effect of knowledge sharing in Study 2, the results are also relevant for

domains in that teams are implemented with similar characteristics of work tasks (non-routine, knowledge-intensive tasks) and in regard to team composition (stable and interdisciplinary team members). Moreover, the consistent results of this thesis with results from studies in other domains indicate that team learning in work teams in vocational education is characterised similarly to that of team learning in work teams with similar team and task characteristics in other domains. Thus, the results of this thesis can be used to understand team learning and behavioural change in work teams in other domains and to support these work teams. However, team composition and type of team task should be considered in transferring the results to other domains because these characteristics can lead to different results across different domains. For instance, teams working on tasks that are not knowledge-intensive do not have to engage to a great extent in certain team learning behaviour, such as knowledge sharing, because it is not necessary for accomplishing their task. Moreover, by accomplishing such tasks the team members could be less interdependent and thus the team members interact less than if they had to be interdependent.

Finally, these outlined characteristics of team learning in vocational education indicate that work teams are comparable with work teams from other domains. Therefore the results of this thesis should be considered by discussing the view on work teams in vocational education and possible domain-specific hindering factors (cf. Vangrieken et al., 2013, 2015) for team learning in vocational education from another perspective.

8.3 Limitations and implications for future research

Although this thesis provides insight into the relationship between team learning behaviours and innovative work behaviour over time especially in work teams in vocational education, there are some limitations that provide opportunities for further research.

The first limitation refers to the domain-specificity of the results. Previous research indicates domain-specific characteristics of team learning, and certain results of this thesis can also be considered as domain-specific. However, as the selected teams are in accordance regarding their team characteristics and task characteristics, as mentioned, the results of this thesis are valid for similar teams in other domains and can be used to support such teams. Also, when other studies from different domains were compared, both inconsistent and consistent results across different domains were found, as shown by Study 1. Therefore, replication studies in different domains are necessary to determine exactly which results are caused by the domain. Moreover, future research on team learning should use samples with teams from different domains and integrate those sub-samples in one study. Both replication studies and studies that take into account teams from different domains could help to identify domain-specific relationships and domain-specific characteristics of team learning.

As some results are consistent with results from other domains, future research should also pay attention to the importance of the work tasks, team goals, team stability and team composition. Because the teams were selected regarding certain team and task characteristics, such as the interdisciplinary nature of the teams, it can be assumed that these characteristics are very important and are possible reasons for differences in team learning. For example, in this thesis the teams are interdisciplinary and work on non-

of team members' familiarity with the team's work and their behaviour within the team. External individuals cannot assess the team's work adequately because they often do not have sufficient insight into team processes, for instance, they do not participate in team meetings. Moreover, even though observations would be more objective, cognitive activities, such as idea generation, are not observable and cannot be captured by other individuals.

A final but important implication for further research refers to the theoretical foundation of team learning. As described in this thesis, there are many different conceptualisations and theoretical models of team learning. However, these are based on different theoretical approaches. For instance, the integrative model of Decuyper and colleagues (2010) is based on GST (Bertalanffy, 1968) and complexity theory (Jörg, 2004), but learning theories and social theories are neglected. Others base their models, for example, on social learning theory from Vygotsky (1978). A common, general and solid theoretical basis is missing. Therefore, further research should focus on integrating findings and theories to develop an adequate and general theory of team learning. As this thesis indicates consistent results with other domains in which similar teams work, theory development should focus on one type of team that is represented in various domains, such as the work teams described in this thesis.

An initial approach for theory development can be to integrate different aspects of theories that are important for team learning, such as general system theory and organisational, social and individual learning theories. Moreover, social psychology and also work and organisational psychology can provide first steps by developing a team learning theory for work teams.

8.4 Practical implications

Fostering team learning behaviours. All studies of this thesis show that a high level of engagement in team learning behaviours is essential for work teams to reach goals and perform efficiently, effectively and innovatively. One possibility to foster team learning behaviours is fostering team learning conditions.

A starting point to ensure a high level of engagement in team learning behaviours relates to the selection of team members. The results indicate a positive relationship between intrinsic motivation and team learning behaviours. Therefore, employees should be selected as team members who are highly motivated to work within the team. Moreover, it is important to increase team members' motivation during their work. Based on the self-determination theory (Ryan & Deci, 2000), work motivation can be increased by satisfying the basic psychological needs for relatedness, competence and autonomy (Gagné & Deci, 2005). Therefore, external persons such as the school principal, supervisors of the team or the manager in other domains and the team leader should ensure that the team experiences relatedness, competence and autonomy. They should ensure that the team feels challenged but never overstrained and that the team members have different options as to how they work within the team.

A further possibility to foster team learning behaviours is to create a work environment for teams by taking into account certain learning conditions. Specifically, this work environment should be characterised by a high degree of interdependence between the team members to accomplish their tasks and a clear team structure.

The results show that a high degree of task interdependence relates positively to various team learning behaviours. Task interdependence stimulates the actions and interactions of the team and its members (Van der Vegt, Emans, & Van de Vliert, 1998). If team members need each other for carrying out their tasks, they have to share knowledge and resources with each other. Moreover the associated communication, team members recognise if knowledge within the team is missing and can gather information from outside the team.

Especially in vocational education, ensuring a high degree of task interdependence is essential for fostering team members' engagement in team learning behaviours. Because of the long-standing individualism and the isolated position of teachers in daily work, access to informal exchange at the workplace is more difficult than in other domains. Therefore, it is beneficial to create a work environment in which the exchange is necessary to accomplish work tasks. For instance, the team leader should divide tasks only to a small degree so that the team members need each other to accomplish their tasks.

Furthermore, it should be ensured that there is a clear team structure within the team. Clearly structured teams are enabled to monitor and address mistakes better than teams which are not (Bunderson & Boumgarden, 2010). Therefore, it is important that the roles and responsibilities within the team are clearly defined. The school principal, manager or supervisor in other domains should ensure that the team has a team leader. The team leader should define different roles and divide responsibilities within the team. A hierarchy within the team with clearly defined roles facilitates decision making if there is a conflict among team members. Moreover, without hierarchy, knowledge sharing can result in an irrelevant focus on knowledge that is shared (Larson, Christensen, Abbott, & Franz, 1996). If roles and responsibilities within the team are clearly divided the team members understand who has which knowledge and which responsibility, they can exchange knowledge with them if they need information for accomplishing their task. They also know when knowledge is missing and are able to gather information from outside the team.

Like task interdependence, ensuring a clear team structure is particularly important for work teams in vocational education. This is caused by the less formal hierarchy in this domain compared to, for instance, industrial organisations. Moreover, the results emphasise the importance of a clear team structure by indicating a relationship of team structure with all examined team learning behaviours.

These implications should be seen as a starting point to foster the engagement in team learning behaviours. Research also indicates many other team learning conditions that are important for a high level of engagement in team learning behaviours and thus further possibilities to support teams (cf. Decuyper et al., 2010).

Fostering team learning products. Teams were introduced to accomplish tasks that cannot be accomplished by individual employees. This goes, for example, for tasks that are non-routine and knowledge-intensive and which need innovative solutions. Therefore the organisations should support teams to achieve their goals in an effective, efficient and innovative way.

As by fostering team learning behaviours, the desired team learning products can be fostered. It is important for organisations but also for the team and the team members themselves to raise awareness of the ongoing importance of team learning behaviours rather than at specific time points. However, it is important to note that different team

learning products should be fostered in a targeted manner by various team learning behaviours at different time points. In other words depending on which team learning product is aimed at, engagement in the team learning behaviours relevant to the specific team learning product should be ensured.

Although work teams are implemented in vocational education that works on projects to improve the current state of their college, such as the integration of refugees, quality assurance or school management, there is only a few times during their working hours for team meetings. Teachers still spend a lot of time working individually in classrooms and cannot communicate with other team members during this time. Therefore, it is important to create a learning culture that enables or facilitates engagement in team learning behaviours. For instance, the school principal has to allocate time for team meetings.

In the following, concrete, practical implications for fostering the specific team learning product are described.

1) Innovative work behaviour. As the results indicate both an immediate and a lagged relationship between team reflexivity and innovative work behaviour, ensuring a high level of engagement in team reflexivity offers a starting point for fostering innovative work behaviour.

In addition to create a work environment, as mentioned previously, team reflexivity can be fostered by encouraging discussions and allowing diverse and critical opinions. Therefore, the school principal or the leader of the teams should ensure that the team is heterogeneous regarding diverse expertise and responsibilities to enrich discussions and thus team reflexivity.

Also, knowledge sharing should be fostered at the beginning of a new work task because the results indicate the importance of knowledge sharing for future innovative work behaviour. To ensure that team members share their knowledge among each other it is helpful to create a climate within the team in which the team members feel safe for interpersonal risk-taking (Staples & Webster, 2008). Moreover, it should be ensured that the team members are interdependent to accomplish their tasks and that the teams have a clear team structure, as mentioned in the previous section.

Finally, high level of engagement in boundary spanning can foster innovative work behaviour. As the results indicate, boundary spanning can be important at the beginning at a new work task as well as later during the work task. The team leader should pay attention if information is missing to accomplish the team task. When he/she notices that information is needed, for instance, the team leader should invite external experts or colleagues that are not part of the team to team meetings. But also the team members should ensure that all relevant information is gathered by communicating with colleagues in their college and also with external persons persistently.

When boundary spanning should be fostered depends on when relevant knowledge in the team is missing. For teams that need task-relevant knowledge at the beginning, boundary spanning can also be an important possibility to foster innovative work behaviour immediately. If team members' knowledge is sufficient at the beginning, it is important to ensure that the team members gather information during the year. This can lead to new perspectives on the task, on problems or on ideas. Having diverse knowledge and multiple perspectives available can, for instance, facilitate the generation of new and appropriate ideas.

2) Team mental models. Additionally, a shared understanding among team members about the work task is important for teams to work effectively. As the results show only a relationship between task team mental models and effectiveness, the manager, the team leader and the team members themselves should be aware that a high level of engagement in team learning behaviours is more likely to lead to a high degree of team performance. However, missing effects between task-related team mental models and innovativeness and efficiency can be caused by the time point of measurement, as mentioned. Therefore, the development of a shared understanding among the team members about the team task should not be neglected. It is crucial for teams to avoid misunderstandings and thus to work effectively. Teams with the same understanding about the team tasks can avoid irrelevant work steps, and all team members can work in the same direction regarding their goal. Storage and retrieval might ensure that the team members develop a shared understanding about the work task. The team leader or school principal/manager should ensure that the team prepares minutes of informal and formal team meetings because in that way the outcomes of activities become visible. Using the same documentation of the agreed team goals, work tasks and shared knowledge can avoid misunderstandings among the team members as they can develop the same understanding. Finally, documentation allows teams to reuse materials as a starting point for future tasks and thereby previous errors can be avoided.

3) Team Performance. The results of this thesis as well as previous research indicates that high engagement in team learning behaviours is crucial for teams to work efficiently, effectively and innovatively. This goes for all team learning behaviours described by Decuyper et al. (2010) and seems to be independent of the domain. Therefore, organisations should foster team learning behaviours that are relevant for the specific team learning product because by this team performance can also be raised.

For instance, reflecting on shared knowledge is essential for selecting relevant knowledge for task accomplishment. Furthermore, reflective teams know the desired and actual status of their work task. This enables the team to identify errors and correct them. Another team learning behaviour that is beneficial for raising team performance is boundary spanning. Gathering information that is missing within the team can lead to new perspectives on the team task or on problems by accomplishing the task and help the team to adopt new ways if necessary (Somech & Khalaili, 2014). How these team learning behaviours can be fostered in detail is described in section 1. As emphasised at the beginning of this section, it is crucial to be aware of the ongoing importance of various team learning behaviours for different team learning products rather than at a specific time point. Therefore, other team learning behaviours should not be neglected as they can be important for certain team learning products as well as a high level of team performance.

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