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CHAPTER 2

Towards a model for team learning in multidisciplinary emergency management command-and-control teams³

Abstract

Emergency management teams have the duty to perform immediately, reliably and effectively in case of an emergency, crisis or disaster. The teams are composed of members who are diverse in expertise, experience, parent organization and familiarity. This makes these teams ad hoc multidisciplinary teams that have to perform in a reliable and effective way as quickly as possible. Our expectation is that team learning is very important for establishing team effectiveness. In this chapter, we take a first step in the development of a model of team learning in emergency management teams. We use the operational emergency management team which is responsible for coordinating the effects of the crisis on the area around the scene as an illustrating team. In summary, we state that reliable and effective performance in these teams requires connectivity about the task and team (i.e., available knowledge and opinions are shared using communication, leading to shared visions and intentions). This connectivity can be established by using team-learning behavior and face-to-face-communication and developing a Transactive Memory System (TMS), a shared situation awareness, shared or team mental models of the task, the team and how to cooperate in the team.

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1. Introduction

When regional or national crisis situations and disasters occur, a crisis management organization is developed, consisting of several ad hoc multidisciplinary teams with responsibilities for the practical, tactical and strategic levels. Different organizations cooperate in these teams: the police force, fire brigade, government, medical care organizations, water management departments, and the military. Each organization delivers a representative who is on duty at the time of the emergency, crisis or disaster. This means that the composition of emergency management teams varies over time.

These emergency management teams have highly skilled members cooperating to perform urgent, unpredictable, interdependent and highly consequential tasks while simultaneously coping with frequent changes in team composition (Klein, Ziegert, Knight, & Xiao, 2006). They have a clear common goal, a mix of experience and resources and a task that calls for team work (Edmondson, 2003; Baker, Day, & Salas, 2006). This team work has to be an immediate response to a crisis situation. Due to the frequent changes in team composition, these emergency management teams lack a history as a team. These teams, therefore, need to learn how to cooperate in the most reliable way in that particular team composition under the specific circumstances that appear in the crisis situation at hand in a very short period of time. Table 1 presents a summary of the characteristics of ad hoc multidisciplinary emergency management teams.

Moynihan (2009) points out that emergency management teams need to develop intra-crisis learning which refers to developing new insights and knowledge about the present crisis during the emergency management process. Past research has not been specific about how these teams manage to learn how to approach the specific situation at hand in cooperation and how this can be supported. There has been some research about team learning in surgery teams and trauma teams (i.e., Edmondson, Bohmer, & Pisano, 2001; Edmondson, 2003; Michinov, Olivier-Chiron, Rusch, & Chiron, 2008), but little in the field of emergency management. Therefore the aim of this article is to explore what it means to perform in a reliable way as an emergency management team and how learning can be described in these teams according to the team-learning literature. Doing so, we aim to add to our understanding of the concept of intra-crisis learning (Moynihan, 2009). In the next section, we describe the emergency management team, using the operational team (OT) as an illustration.

Table 1. Characteristics of ad hoc multidisciplinary emergency management teams (Klein, Ziegert, Knight & Xiao, 2006; Edmondson, 2003).

Team

- Highly skilled members
- A mix of experience and resources
- Interdependent
- Frequent changes in team composition

Task

- Urgent, immediate response needed
 - Unpredictable
 - Highly consequential
 - With a clear common goal
 - In some cases, also training their novice members
 - Calls for team work
-

2. One type of emergency management team in the Netherlands: the operational team

The emergency management structure in the Netherlands depends on the span of the crisis. Every region in the Netherlands has three separated team levels: the first level is the on-scene-command-team (OSCT) responsible for the work to be done in the field defeating the source of the incident and, by doing so, works “right here and now”. The second level is the operational team (OT) responsible for the area affected by the incident. This OT has to act on what can be foreseen to happen in the next couple of hours. The third level is the policy team (PT) responsible for the strategic process and decisions related to, for instance, the evacuation of citizens. This team is concerned with the consequences of the incident that can occur in the next couple of days. The OT is responsible for the information flow between the OSCT at the scene and the PT.

When there is an (expected) effect area caused by a source that is out of control for an OSCT, an OT is composed. When the effect demands strategic decisions, a PT is added and becomes a regional composition of members when several districts of a region are involved. When the incident has effects on a national level the Dutch national government gets involved. In this explorative article, we focus on the OT, since this team is at the center of activities and has a key position in the communication process between the team layers.

The OT consists of several members: a team leader, the heads of staff sections and staff section members. Depending on the incident, the staff sections present can be the fire department, the police, disaster medicine, the local or regional government, the navy, water management, internal reporters, logistics, and information management. There is also a team member, the so called “plotter”, with the responsibility for creating a picture of the incident area. These people are gathered in one or two rooms.

The task of the OT is, in short, to organize and coordinate the process needed to get the source and effects of an incident under control in a reliable and efficient way. This means that the team has to develop a collective image of the incident and collect and communicate the information provided by the OSCT and other sources. This image building is done in frequently planned short meetings with the heads of the staff sections and the team leader. The plotter depicts this image and keeps it up to date. Based on this image, the team develops a strategy and actions using formal procedures about, for instance, the division of tasks between the disciplines and protocols based on real incidents. Each time new information is provided, the team needs to check the built image, the strategy and the action plans. To support this process, a situational report is available, kept up to date continuously by the information management section. Between meetings, the staff sections communicate the necessary information with their colleagues in the OSCT, the action center in the field and possible other relevant colleagues and give instructions. Meanwhile, the team leader communicates with the PT. The process of reporting to the citizens is a PT responsibility, though it is prepared by the OT.

The OT is an ad hoc multidisciplinary team. The team is composed of professionals on duty in their parent organizations at the moment an incident occurs. Because of this ad hoc composition, the team members might or might not have cooperated before. Changes in the team composition during the incident happens when the OT has to operate longer than 8 hours because then people are relieved from their duty. The team members vary in discipline, function and parent organization. The different expertise of all team members is needed for the complex task. This demands constructive information sharing and communication. When an incident occurs, the response of the team has to be quick to avoid unnecessary damage and victims. The task is unpredictable due to the development of the incident. The consequences of errors of the OT can be high. A wrong decision can cost lives, as to be expected when the OT, for instance, has underestimated the possible number of victims caused by an expected gas explosion due to a fire. This can lead to a lack of ambulances and hospital trauma centers ready for action. The decision making in the OT clearly has to be highly accurate and is under constant time pressure. Combined with the risks at stake, this can cause stress, possibly influencing the team process and the team members' behavior.

3. Reliable and effective performance in emergency management teams

Team performance in emergency management teams is related to the team goals: getting control of the source of the incident (i.e., a fire) and of the effects (i.e., evacuation of citizens, taking care of victims). Getting control of the source is related with time needed. This is especially relevant in case of incidents that frustrate certain societal

processes, for instance, the mobility of citizens in case of a train accident. Control of the effect concerns the difference between the inevitable damage and the inevitable number of victims of an incident on the one hand and the actual damage and victims on the other.

What is required to work in a reliable and effective way towards these goals as a team under these extreme circumstances? Wilson, Burke, Priest, and Salas (2005) stated that teams such as the emergency management team should function as a High Reliability Team (HRT), described in values and behavior. The concept of HRTs is derived from the literature about High Reliability Organizations (HROs). Originally, the HRO concept was used in research on organizations that are effectively managing and operating complex and hazardous technical systems like air traffic control and, by doing so, maintaining a safe workplace (Roberts, 1990; Rochlin, 1996; La Porte, 1996; Wilson, et al., 2005).

Wilson et al. (2005) have translated the HRO concept from the organizational level to the team level, stating that in practice, the teams create the HRO. They described the idea of an HRT in a model showing values and behavior of HRT members having to perform in a reliable way. In their definition, HRTs are teams that consistently and effectively work interdependently towards a shared goal in a complex and dynamic environment while working under high levels of stress. This definition seems to match the team composition and task of OTs as emergency management teams. For the multidisciplinary OT, this means that the team gets control of the effects of the source of the incident as quickly as possible, so that the number of victims and the eventual damage is as limited as possible.

The behavior of team members should match their parent HRO values, according to Wilson et al. (2005). They identified the following HRO values and HRT behaviors (see Table 2). The first value is sensitivity to operations, which means all members know the “big picture”. Therefore, the team needs closed-loop communications, information exchange and shared situation awareness. The second value is commitment to resilience, which demands a team member’s attitude of serving as a redundant system to avoid, trap and mitigate the consequences of errors. To be able to have this attitude, team members need back-up behavior, performance monitoring and feedback from each other. The third value is deference to expertise, recognizing the value of differences in expertise for the team and the task. Team members need to be assertive to communicate ideas and observations in favor of the team and to give feedback if necessary. The team members need a collective orientation expressed in interdependent behavior and cooperation. Furthermore, the expertise of the team members should be reliable. The fourth value that Wilson et al. (2005) mention is the reluctance to simplify, which means that team members need to recognize the complexity of the task and the task environment and adapt to it. This emerges when team members use planning as a tool to improve performance. It is about setting goals, sharing relevant information, clarifying members’ roles, prioritizing tasks, discussing expectations and environmental

characteristics and constraints. The team also needs adaptability or flexibility to adjust strategies to changing situations and new information. The fifth value is preoccupation with failure. This value is about managing, trapping and quickly learning from errors. This demands a system of error management for feedback and for team self-correction (Wilson, et al., 2005).

This overview of values describes behavior that should lead to a reliable and effective team work process needed by teams such as emergency management teams, according to Edmondson (2003) and Baker et al. (2006). Baker et al. (2006) stated that teamwork is distinct from task work (e.g., firefighting) and that knowledge and skills for the task are not enough. Team work means anticipating the needs of others, adjusting to each other's actions, and having a shared understanding of the problem to solve and how the procedure should happen. Baker et al. (2006) have summarized the characteristics of effective teams explored in prior research that relate to this teamwork (see Table 2). They stated that every team member needs certain knowledge, skills, and attitudes (KSAs). These KSAs are not related to a function or to expertise. These KSAs make it possible for a team to function in a reliable and efficient way.

When we analyze the characteristics resented in Table 2, we recognize that the behavior and KSAs all relate to a reliable and effective process for performance. It is not about the content of the task. Even expertise, mentioned in the HRT model, is a process feature, since the authors' statement is that team members must value each other's knowledge and actions and take them into consideration. We could say that both models shed light on the social behavior of team members needed for reliable performance.

There are several characteristics highlighted in the characteristics of HRTs (the first column in Table 2) that are less prominent in the characteristics of team work (the second column in Table 2). Compared to the team work model the description of HRTs in particular highlights coping with the high risks and stress level and dealing with the complexity of the task. The related behaviors are the need for closed-loop communications, a shared situation awareness, flexibility, valuing expertise, error management, and team self-correction. This is not mentioned in the team work model. Besides this difference, the importance of team leadership is mentioned in the team work model, but not in the framework for HRTs.

Important to notice is that the HRT characteristics are a theoretical framework. Research is needed to explore the reliability and validity of the list. Here we use the team work model and the HRT model to develop an idea of what it could mean to perform in a reliable way as an emergency management team and from there we derive the possible needs for team learning.

Table 2. Characteristics of high reliability teams (Wilson, Burke, Priest & Salas, 2005) and team work (Baker, Day & Salas, 2006).

Characteristic values and behavior of HRTs (Wilson, Burke, Priest, & Salas, 2005)	Team knowledge, skills and attitudes (KSA's) characteristic for team work in effective teams (Baker, Day, & Salas, 2006)
<p><i>Value: Sensitivity to operation</i></p> <ul style="list-style-type: none"> - <i>Closed loop communication:</i> "To exchange information accurately and clearly and acknowledge receipt of information". - <i>Information exchange:</i> "The ability to speak clearly, concisely, and in an unambiguous manner with other team members". - <i>A shared situation awareness:</i> "The team's ability to develop shared mental models of the environment". 	<p><i>Team leadership</i> (Cannon-Bowers et al., 1995; Sims et al., 2004; Barach & Weingart, 2004): "The ability to direct and coordinate the activities of other team members, asses team performance, assign tasks, develop team KSAs, motivate team members, plan and organize, and establish a positive atmosphere".</p>
<p><i>Value: Commitment to resilience</i></p> <ul style="list-style-type: none"> - <i>Back-up behavior:</i> "The capability to give, seek and receive task instructive feedback. Assisting team members to perform their tasks". - <i>Mutual performance monitoring:</i> "Team members ability to monitor team members performance and give constructive feedback". - <i>Shared mental model:</i> "Team ability to share compatible knowledge pertaining to individuals' roles in the teams , the roles of fellow team members, their characteristics, and the requirements needed for effective team interaction". 	<p><i>Back up behavior</i> (McIntyre & Salas, 1995; Porter et al., 2003): "The ability to anticipate other team member's needs, through accurate knowledge about their responsibilities. The ability to shift workload among members to achieve balance during high periods of workload or pressure".</p>
<p><i>Value: Deference to expertise</i></p> <ul style="list-style-type: none"> - <i>Assertiveness:</i> "The willingness of team members to communicate ideas and observations in a manner that is persuasive for other team members". - <i>Collective orientation:</i> "Interdependent behavior in task groups". - <i>Expertise:</i> "Knowing how to do something well and is gained through experience". 	<p><i>Mutual performance monitoring</i> (McIntyre & Salas, 1995): "The ability to develop common understandings of the team environment and apply appropriate task strategies in order to accurately monitor teammate performance".</p> <p><i>Communication</i> (McIntyre & Salas, 1995); "Exchange of information between a sender and a receiver irrespective of the medium".</p>
<p><i>Value: Reluctance to simplify</i></p> <ul style="list-style-type: none"> - <i>Adaptability / flexibility:</i> "Team's ability to gather information from the task environment and adjust their strategies by reallocating their resources and using compensatory behaviors such a back-up behavior". - <i>Planning:</i> "Setting goals, sharing relevant information, clarifying member's roles, prioritizing tasks, discussion expectations, and environmental characteristics and constraints". 	<p><i>Adaptability</i> (Cannon-Bowers, et al., 1995; Kozlowski, et al., 1999; Klein & Pierce, 2001): "Ability to adjust strategies based on information gathered from the environment through the use of compensatory behavior and reallocation of intrateam resources. Altering a course of action or team repertoire in response to changing conditions (internal or external)".</p> <p><i>Shared mental models</i> (Klimoski & Mohammed, 1994; Mathieu, et al., 2000; Stout, Cannon-Bowers, & Salas, 1995): "An organizing knowledge structure of the relationship between the task the team is engaged in and how the team members will interact".</p>
	<p><i>Mutual trust</i> (Bandow, 2001; Webber, 2002): "The shared belief that the team members will perform their roles and protect the interests of their team mates".</p>

Characteristic values and behavior of HRTs (Wilson, Burke, Priest, & Salas, 2005)	Team knowledge, skills and attitudes (KSA's) characteristic for team work in effective teams (Baker, Day, & Salas, 2006)
<p><i>Value: Preoccupation with failure</i></p> <ul style="list-style-type: none"> - <i>Error management</i>: "Based on understanding the nature and extent of error, changing conditions found to induce error, and determining and training behaviors that decrease errors". - <i>Feedback</i>: "Team's ability to provide constructive feedback, seek feedback on own performance, and accept feedback from others". - <i>Team self-correction</i>: "Team's ability to monitor and categorize their own behavior to determine its effectiveness, which generates instructive feedback so that members can review performance episodes and correct deficiencies". 	<p><i>Team / collective orientation</i> (Driskell & Salas, 1992; Shamir, 1990; Wagner, 1995): "Propensity to take other's behavior into account during group interaction and the belief in the importance of the team goal's over individual member's goals".</p>

4. Team learning needs of emergency management teams

Derived from the characteristics of a reliable and effective team process, as described in the team work model and the HRT model, the central mission for team learning seems to be creating a connection between the members. This connection idealistically means that the available knowledge and opinions are shared using clear communication, leading to shared visions and intentions. The reliability of the OT's performance means getting control over the effects of the incident as quickly as possible and limiting the number of victims and damage.

There is a connection and agreement needed for the task, resulting in shared situation awareness, a shared or team mental model of the task, and shared or team mental models of the team. This seems to be a basic need for a team to perform in a reliable and effective way. In addition, the team needs to develop a connection about how to communicate and cooperate, the behavioral "rules of the game". We could also say that the team needs to develop a reliability culture. This reliability culture refers to the norms, shared perceptions, work ways, and informal traditions (La Porte, 1996) needed for reliable performance. It is about the creation of a team connection on:

- the social structure and communication pattern of the team (what information is shared with whom and who is the informal leader?)
- error management (what happens when an error occurs and how do we make use of mutual performance monitoring, back-up behavior, feedback and team self-correction?)
- cooperation (what is our level of adaptability and flexibility and how do we make use of planning?)
- collective orientation (to what extent are we a team and what are our boundaries?).

The team members need to establish an internal task-related connection and a team-related connection. The logic of this division is illustrated in Table 3 by the questions that team members possibly have at the start and during the team cooperation process. These questions can be answered through a process of team learning.

Table 3. Team learning needs in emergency management teams.

Team learning needs in Emergency Management teams	
Team characteristics	
Team	
<ul style="list-style-type: none"> - Highly skilled members - A mix of experience and resources: expertise diversity (differences in the knowledge and skill domains in which members of the team are specialized as a result of their work experience and education (Van der Vegt & Bunderson, 2005). - Interdependent - Frequent changes in team composition 	
Task	
<ul style="list-style-type: none"> - Urgent, immediate response needed - Unpredictable - Highly consequential - With a clear common goal - In some cases, also training their novice members - Calls for team work 	
Goal: Performance improvement	
<ul style="list-style-type: none"> - Getting control of the source of the incident (i.e. a fire) , measured in time. - Getting control of the effects of the incident (i.e. evacuation of citizens, taking care of victims), measured by a comparison between the inevitable damage and the inevitable number of victims of an incident, and the actual damage and number of victims. 	
Team learning needs	
<i>task related connection</i>	<i>Team related connection</i>
<ul style="list-style-type: none"> - Shared situation awareness - Shared or team mental model of the task - Shared or team mental models of the team 	<ul style="list-style-type: none"> - The social structure and communication pattern of the team - Error management - Cooperation: adaptability, flexibility and how do we make use of planning - Collective orientation
<i>Illustrating team questions</i>	<i>Illustrating team questions</i>
<ul style="list-style-type: none"> - What is happening? - What is the source and what are the (expected) effects of this incident? - What will be our strategy and what actions do we plan? - What am I supposed to do and what will others do? - Who has what KSAs in this team and is going to do what? 	<ul style="list-style-type: none"> - With who am I working today, who is the team leader? - Do I trust these others in their competences? - What does that mean for my behavior? - Do I trust us as a team in our flexibility, adaptability, communication patterns? Will we be able to manage this crisis as a team, even when things get tough? - Do I feel okay in this team, in this atmosphere?

5. Team learning in ad hoc multidisciplinary emergency management teams

Now that we have defined what team learning in ad hoc multidisciplinary teams probably is about, we explore the process of team learning that we expect to occur in these teams. In our view, teams learn when they change what they do or how they do it as a group. Edmondson, Dillon, and Roloff (2007) have identified three distinct areas of research that provide insight into how teams learn, each with its own definition: 1) Outcome improvement: team learning is performance improvement, usually efficiency improvement; 2) Task mastery: team learning is task mastery; 3) Group process: team learning is a process of sharing information and reflecting on experience. Considering the learning needs of ad hoc multidisciplinary emergency management teams, to get connected to the task and the team, we state that team learning should both be a process of task mastery to create the task-related connection in the team, and a group process to establish the team-related connection and. We elaborate on these two aspects in the following sections.

5.1 Task mastery to establish a task-related connection in the team

Team learning in this view focuses on task mastery. Task mastery is an outcome of communication and coordination that builds shared knowledge by team members about their team, task, resources and context. The measure of success is how well the team has learned its task (Edmondson, et al., 2007). For emergency management teams, the task changes every time. Task mastery is an issue of relevance each time a team starts an emergency management process.

In the description of HRTs and team work (Table 2), the shared or team mental model is suggested as a concept for characterizing the task connection that emerges in a team. Mental models are organized knowledge structures that allow individuals to interact with their environment and shared or team mental models contain collectively owned long-term relevant knowledge which team members bring to a situation (Canon-Bowers, Salas, & Blickensderfer, 1999; Cooke, Salas, Cannon-Bowers, & Stout, 2000). Shared or team mental models are needed by teams that lack enough possibilities for communication (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). The emergency management team is a good example of a team lacking these possibilities. The shared or team mental model literature states that a shared understanding of the task, team, equipment and situation improves team effectiveness (Kozlowski & Ilgen, 2006). That is a motivation for focusing on developing these shared or team mental models in emergency management teams. The concept of shared or team mental model in the context of the on-scene-command-team (OSCT) is elaborated in Chapter 3.

Another concept related to the shared or team mental model is the team situation model. This concept refers to shared knowledge, in terms of mutual understanding and

agreement among team members, as well. The difference is that it highlights the dynamic nature of this knowledge. This knowledge changes over time and is developed during cooperation. Therefore it contains short term knowledge. A team situation model is defined as “the mental representation associated with a dynamic understanding of the current situation (i.e. environment, task, team) that is developed by team members moment by moment” (Rico, Sánchez-Manzanares, Gil, & Gibson, 2008: 167; Cooke, et al., 2000). Research supports the assumption that a team situation model is positively associated with team performance (DeChurch & Mesmer-Magnus, 2010; Cooke, Kiekel, & Helm, 2001; Kozlowski & Ilgen, 2006; Lim & Klein, 2006; Mathieu, et al., 2000; Mohammed, Ferzandi, & Hamilton, 2010; Rentsch & Klimoski, 2001; Van den Bossche, et al., 2006).

Another concept related to the shared or team mental model and the team situation model is the transactive memory system (TMS). This system consists of processing and structuring information, characterized by encoding, storing, retrieving and communicating information within the team (Wegner, 1986; Hollingshead, 2000; Lewis, 2003; Lewis, 2004; Kozlowski & Ilgen, 2006). Through a TMS, the individual memories of team members are linked, so that team members have a shared awareness of who knows what and form a group information-processing system (Kozlowski & Ilgen, 2006).

Lewis (2004) has shown that a TMS is positively related to performance. Zhang, Han, Hempel, & Tjosvold (2007) confirm that a TMS is positively related to team performance, as well as task interdependence, cooperative goal interdependence, and supports innovation. The TMS seems to mediate between team characteristics and team performance. Especially in teams with different work-related expertise, Hollingshead (2000) has shown that a TMS is useful, since people then learn and recall more information in their own area of expertise. Here, member familiarity plays a role in the sense that familiarity is a moderator of the relation between distributed expertise and the TMS: the more familiarity, the stronger the relation (Lewis, 2004). The consequence of having a TMS is that members can rely on one another to be responsible for specific expertise and are freed of the ineffective process of developing knowledge that is already available in the team (Lewis, 2003). A team develops a TMS through interaction (Gibson, 2001; Palazzolo, 2005; Wegner, 1986) and especially face-to-face communication (Lewis, 2003).

We expect that emergency management teams can benefit from having and developing a TMS, especially because of the proved relation with performance, expertise diversity, task interdependence, cooperative goal interdependence, support for innovation, team member familiarity, team members' perception of others' expertise and face-to-face communication. All the characteristics are potentially present in ad hoc multidisciplinary emergency management teams.

In sum, for team learning for task mastery, different concepts are relevant: shared or team mental models, team situation models, and the transactive memory system. Kozlowski and Ilgen (2006) stated that these concepts should be clarified, be more

distinct from each other, and be further developed. This will be a goal of Chapter 3 where we develop a context-specific team learning model for one type of emergency management teams, the on-scene-command-team (OSCT).

5.2 Group process to establish a team-related connection

The second area of research relevant for understanding team learning in emergency management teams conceptualizes team learning as a group process. This is about the learning behavior in teams, taking into consideration the effect of managerial and contextual factors (Edmondson, et al., 2007). Different descriptions of learning behavior can be discerned. Edmondson (1999) described the team-learning behaviors of seeking feedback, discussing errors and seeking information and feedback from customers and others. This is individual behavior. There is also a stream of research focusing on team reflexivity. This is about the extent to which teams reflect upon and modify their functioning (Edmondson, et al., 2007). Others have made a distinction between learn-how and learn-what behavior (Tucker, Nembhard, & Edmondson, 2006, in Edmondson, et al., 2007). The question is what kind of learning behaviors are used by emergency management teams.

Research has shown that different factors influence team learning focused on the group process. The team climate, especially team psychological safety (the shared belief that a group is safe from interpersonal risk-taking, Edmondson, 1999), plays a role. Edmondson has concluded that learning behavior helps translate effective team design and leadership into team performance team. The role of the team leader has an influence as well (Edmondson, 2003): the team leader can promote team psychological safety and, hence, learning behavior. Edmondson (2003) found this in surgical teams.

6. Conclusion

Our reasoning about team learning in ad hoc multidisciplinary action teams like emergency management teams is that via face-to-face communication, using team learning processes, the team members develop knowledge about who knows what in this team (TMS) and develop shared or team mental models and team situation models containing knowledge about the situation, task and team, and about the way the team cooperates. We expect this to support team effectiveness. The factors we argue that influencing this process are team psychological safety, team leader behavior, task interdependence, cooperative goal interdependence, support for innovation and differences in expertise between team members, team member familiarity and team members' perception of others' expertise.

This broad exploration of team learning in emergency management teams leads to several interesting research questions. The most important question is what team

learning processes the members of emergency management teams exactly use to develop a shared understanding about what is going on and needs to be done concerning a specific emergency situation and how this influences the eventual team effectiveness. The role of shared or team mental models, team situation models, and the transactive memory system as structures that support the development of this shared understanding needs to be explored as well as their interrelations. In such research, it is inevitable to acknowledge the dynamic nature of the emergency management team. The use of team learning processes and the development of facilitating structures for shared understanding will evolve over time and should be studied that way. The next Chapters of this dissertation are related to these questions.

