Team Learning within the Armed Forces

Frontline Learning

T. Bijlsma

Assistant Professor in Management Sciences at the Netherlands Defence Academy

From Learning Organisations to Team Learning

Subjects such as knowledge management and learning organisations have become extremely important aspects of management literature from the start of the nineteen nineties. Writers such as Nonaka and Takeuchi (1995) and Senge (1990) have ploughed the field for these terms. A striking definition of organisational learning is “making conscious use of learning processes on an individual, group, and systemic level, in order to continuously transform the organisation in a direction that becomes more satisfactory for its stakeholders all the time” (Dixon, 1997, p. 17).

Despite the interest from various academic fields the studies and case studies have not yet led to ‘the model’ (or dogmas) to define the learning organisation. The use of much rhetoric and conceptualisation oftentimes hides the relatively slow, practical progress in this particular area. Harrison states: “(...) However, there is a worrying failure to identify or deal effectively with human issues involved in developing, sharing and using knowledge that flows from workplace learning. This raises the possibility of a narrowly conceived knowledge management approach that produces an ‘obsession with tools and techniques’ and overlooks the centrality of people throughout the knowledge process (...)” (Harrison, 2002, p. XI).

This research within the Netherlands Armed Forces is intended to close the aforementioned gap and places people who reflect centrally in the learning processes at team level. Garrick: “(...) contemporary work-based learning strategies rarely deal in self-criticism, paradox, irony, or doubt, yet it precisely these qualities that give substance to learning” (Garrick, 1998, p. 79). Furthermore, Garrick stresses selfreflexivity and teamreflexivity. Lipshitz, Popper, and Friedmann propose a moment of reflection but at the same time they are reluctant when it comes to the term “learning organisation”: “The concept of the learning organisation, quite fashionable among consultants and managers (Argyris & Schön, 1996), probably is more of a visionary rhetorical device than a realizable empirical entity” (Lipshitz, Popper, and Friedmann, 2002, p. 94). They give organisational learning mechanisms (OLMs) a central place, in other words, OLMs are the core of the learning organisation. OLMs are the reflections and evaluations that are carried out in different forms and at different levels within the organisation. Ron, Lipshitz, and Popper (2006) investigated an OLM at teamlevel: post-flight reviews in an F-16 fighter squadron. They found that even though a learning organisation remains an abstract notion, a learning team can be very concrete. The meso and macro levels can therefore be combined as follows: “Organisational learning can be seen as a process of cascading team learning opportunities, independently carried out, but interdependent in their impact on company performance” (Edmondson, 2002, p. 144). After all, teams, or groups, constitute the
building blocks of an organisation (Argote, 1999) since individuals often cannot handle their jobs on their own. In various disciplines the developments move rapidly, the matter becomes more complex, similar activities are conducted worldwide, and the 24-hour economy finds its way into more and more sectors. “Groups are becoming the basic building blocks of organisations and are vital in rejuvenating them” according to Tjosvold (1991, p. 5). Senge (1990) posits that one of the five disciplines of the learning organisation is team learning. According to Romme, other authors, such as Argyris and Nonaka & Takeuchi, subscribe to this view as well: “Observations of learning processes in a variety of organisations suggest teams can be considered as the key learning unit in organisations” (Romme, 1997, p. 150). The fact that processes and results at team level are adopted by the organisation, resulting in a ‘learning organisation’, is not common use. As various authors have found, many barriers have to be overcome first (Ancona and Caldwell, 1992b; Borodicz and Van Haperen, 2002, Chan, Lim, and Keasberry, 2003; Ron, Lipshitz, and Popper, 2006).

Edmondson defines team learning as follows: “(...) an ongoing process of reflection and action, characterized by asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors or unexpected outcomes of actions” (Edmondson, 1999). He later shortens this to “(...) a process in which a team takes action, obtains and reflects upon feedback, and makes changes to adapt or improve” (Edmondson, 2002, p. 129).

Learning in a military organisation

Ever since the fall of the Berlin Wall in 1989, many Western NATO countries have changed their military capability and because of the expeditionary character of missions, their units find themselves in a dynamic and complex environment. Because of deployments abroad, operational units face unexpected and difficult situations and the fact that this takes place from the lowest operational group level to the highest level of decision-making makes it quite unique. The current threat and the actual war fighting, which is more and more asymmetrical, ensure that units have to be able to act and adapt quickly and swiftly to new situations. Basic combat techniques, drills, and doctrines, constitute the foundation of military operations; however, recent deployments and operations in Iraq and Afghanistan show that falling back on known procedures and trained behaviour is not always useful. Within the Netherlands Armed Forces, the age-old adage ‘train as you fight’ was rewritten to ‘work as you fight’ (Dutch Defence Doctrine, 2005, p. 95) but this entails that knowledge and experiences (how to ‘fight’, how to operate) should be integrated at the right place and time during education in order to use them during training. Apart from the operational units, the support units are also being exposed to new challenges when it comes to transparency, efficiency, customer focus, and thinking in value systems.

Even though the (financial) economic idea is becoming more prevalent within the Armed Forces, the most important issue for its current operational tasks is the prevention of dead and wounded since financial losses can be compensate whereas casualties cannot be. This should be a stimulus for Defence units to learn more quickly and better from its new experiences and challenges than other (non)profit organisations. This means that a proactive learning attitude and support from within the organisation by any means and procedures is required.

During operations the team level is very important. Within the Armed Forces this team level is also referred to as the Smallest Unit of Action (SUA) or Combined Arms Team (CAT). The deployment of military units has become much more complicated because of the many systems and procedures
which are used in current ‘joint’ (with other Armed Services) or ‘combined’ (with other nationalities and led by UN, EU, or a coalition of the willing and able) missions. Moreover, operations mostly continue 24/7 and can take place anywhere in the world (consider the credo of the Dutch marines: ‘qua patet orbis’). When it comes to individual learning there will not be a problem within the Armed Forces since there are many vocational and career courses which are often (obligatory) linked to a certain function or rank. Furthermore, because of the function rotation system it is quite possible for a soldier to find him of herself in a different team (in another functional field) at very short notice. Besides, a gap between the peacetime (operational) management and the operational deployment of units is highly undesirable when it comes to attitude and processes involving team learning. In short, adaptive or learning capacity is essential for a military organisation. Apart from this, the most important operations or decisions are made at the team level; therefore, a professional military team has to be willing and able to learn as a team. Combining the crucial pivot team learning is in a learning organisation, but still not yet studied thoroughly in depth, and the essential role a military team, forced to frontline learning, plays, the central question in this research is how teams within the Armed Forces learn.

Team learning, frontiers

In this research, a team is seen as the combination of a unit, a group, a division, or the managers or key functionaries of a unit, the “management team.” With regard to team learning, this investigation only focussed on the inter-personal learning, whereby team learning is defined by the social processes that also feed organisational learning. Among other things, this includes communication, coordination, and conflict management.

Tjosvold (1991) indicated that reflection is a good way to discover that certain existing processes are less relevant when taking into consideration changes in the environment and ever since, reflection is seen more and more as the core of team learning. Reflexivity also forms the basis of the Deming circle (Deming, 1982) and Kolb’s learning cycle (Kolb, 1984). According to West (1996), reflexive groups have a better and more active view of their work, have a broader time horizon, are more inventive, have more knowledge of mistakes, and anticipate them more quickly. Several investigations have indicated that, among other things, reflexive teams identify problems sooner, handle them better, and are more skilled at making team decisions. In other words, such teams are more equipped to handling mistakes and crises than non-reflexive teams which are more prone to denying mistakes or extinguish fires without examining the underlying causes (West, 1996). Literature shows that reflexive teams are more proactive, are more aware of their environment, have a broader planning, and are more long-term focussed. Moreover, reflexivity would also enhance change processes (of routines) within groups. (Edmondson, Bohmer & Pisano, 2001). In contrast, less-reflexive teams are reactive and are insufficiently aware of their goals, strategies, and processes (West et al., 1997; West, 2000; Carter & West, 1998; Shippers, Den Hartog, Koopman, and Wienk, 2003; Schippers et al., 2005).

Team learning is not, however, a logical thing, even if external stimuli which require change can be distinguished (Gersick & Hackman, 1990). Oftentimes, routines are deeply ingrained and resistance against organisational change is omnipresent. An organisational image that springs to mind in cases like this is Morgan’s ‘organisations as psychic prisons’ (Morgan, 2006). Recognising the necessity of change within organisations but not reacting to it has also been defined as the knowing-doing gap by
Pfeffer and Sutton (Pfeffer & Sutton, 2000), who cite several (known and omnipresent) causes for this gap. A central approach is the action approach which states that ‘if you and your colleagues learn from your own actions and behaviour, then there won’t be much of a knowing-doing gap because you will be “knowing” on the basis of your doing, and implementing that knowledge will be substantially easier’ (p. 25). The focal point in learning is therefore the realisation that it can be done differently and how it should be done, and the application of the newly gained insights. Simply acknowledging, in other words gathering knowledge or skills is too limited in scope. The effect of ‘learning’ will induce the team to change behaviour.

Two gates are distinguished at the system borders when it comes to team learning: to what extent do teams spread the knowledge they gained and to what extent do they retrieve knowledge and experiences from elsewhere? The latter is also referred to as ‘distal learning’ and is the counterpart of ‘local learning’ in which the initiating change of innovation starts within the team (Wong, 2004).

The context of a team probably plays a role in the (form of) learning of a team. So far, research into team learning has mostly been conducted in a specific organisation or within teams with a certain product-market combination. In contrast, the context in which teams of the Armed Forces do their jobs is highly diversified and includes dimensions such as ‘dynamic’ and ‘complex’. This is why a number of contextual variables were taken into account in the current research to further investigate their relation to team learning.

Both (team) learning and the cyclic aspect of development and learning form the preliminary basis needed to define the subject of (team) learning within the Armed Forces more concretely and led to the following definition of ‘team learning’: the gathering of knowledge, competency, and insights by a team by means of inter-personal processes during which the team applies and secures the improvement/the knowledge demonstrably.

The team learning cycle

In this research, the team learning cycle has been defined as consisting of three factors or components: team action, team reflection, and team sensation. Team action, first of all, refers to planning, acting, and securing. Swift and West (1998) define the phase of ‘action or adaptation’ as “action refers to goal-directed behaviours relevant to achieving the desired changes in team objectives, strategies, processes, organisations or environments, identified by the team during the stage of reflection” (p. 20). Securing the processes, procedures, or methods already belongs to simplest quality management systems. Apart from continual demonstrable improvements, the ISO-norms also require processes to be secured (Quality Management Systems, ISO 9004:2000, 2000). The vision behind Total Quality Management (TQM) shows many similarities with the learning organisation (see also Dale, Van der Wiele & Van Iwaarden, 2007).

The second factor is called team reflection, which is done by means of communication. The goal of reflexive activities should be to learn from each other since much knowledge within a team is in tacit knowledge of the team members. Tacit knowledge is described as the combination of the technical, rational, personal, emotional, and intuitive experiences of an individual. Nonaka and Takeuchi (1995) describe this knowledge as the know how, the craftsmanship of a person, including his or her mental models, convictions, and perceptions. The dialogue form is most desirable in the reflection mode since it enhances the exchange of mental models and underlying visions. The dialogue form is also
preferred over the discussion form when it comes to explicit knowledge. In evaluating or reflecting, the content and way of communication can be divided into two levels, namely ‘single and double loop learning’ (Argyris & Schön, 1978). Single and double loop learning is also referred to as ‘exploitation and exploration’ (March, 1991), ‘first and second order learning’ (Lant & Mezias, 1992), ‘incremental and radical learning’ (Miner & Mezias, 1996), and ‘learning I and learning II’ (Bateson, 1972). So, the factor team reflection is built upon single loop -, double loop learning and dialogue.

The third and final central factor in the team learning cycle is team sensation. In order for teams to be able to reflect, a certain degree of openness is a prerequisite because it provides the opportunity to communicate with more depth. McDermott (1995, p. 53) describes this as “the emotional task in appreciating differences is to create an atmosphere of open dialogue and questioning based on respect for each other’s point of view.” If a safe environment is absent within the team, a person would rather remain silent (Edmondson, 1999). This safety is especially important where ‘failure-based learning behaviour’ is concerned: “the findings of this research confirm Edmondson’s notion and show that if people feel emotionally safe, learning from failures is enabled” (Carnelli, 2007, p. 39). Relationships that rely on trust lead to more exchanges of knowledge since people are more inclined to provide information (Andrews & Delahay, 2000; Tsai & Ghoshal, 1998; Penley & Hawkins, 1985; Zand, 1972) and they are more open to receive other people’s knowledge (Levin, 1999; Mayer, Davis & Schoorman, 1995; Carley, 1991). Trust, commitment, and evaluating form the variables of the factor team sensation. The three factors are forming a cycle. ‘Developing’ and ‘learning’ are cyclic processes and the team learning cycle is no exception.

One conclusion that has been drawn based on previous research is that leadership style in a unit within a military context (team action) influences the trust of the team member (team sensation) and vice versa (Van der Kloet, 2005). Moreover, the research also indicated that mutual trust has a positive influence on the willingness to act (Van den Berg, 2009). Seeing as other directions of influence are expedient, the assumption for the current research is that the relations between the different factors are mutually influential.

The complete research model is shown in figure 1 below. The central question in this research “how teams within the Armed Forces learn” can now be more specifically stated as: “how do the three factors and the variables interact when it comes to learning teams?”

The next two paragraphs the author will explore some aspects of this model, first team reflection and after this the gates and the contextual variables.
A much used definition of team reflection in the literature is West’s which states that “group task reflexivity is defined as the extent to which group members overtly reflect upon the group's objectives, strategies, and processes, and adapt them to current or anticipated endogenous or environmental circumstances” (West, 1996, p. 559). West later adapted his definition of team reflection to “the extent to which team members collectively reflect upon the team’s objectives, strategies and processes, as well as their wider organizations and environments, and adapt them accordingly” (Swift & West, 1998, p. 3). From an entity which should be taken into account when implementing what was learned, the (direct) environment has changed to a subject of team reflection. Swift and West explicitly state that the organisation itself (its goals, strategies, and processes) should be looked into. According to the definition, team reflection includes planning and acting (adapting them). The planning can also be perceived as a bridge between reflection and action. In the planning phase concrete goals are set and a planning is made to achieve these goals. Previous researchers already concluded that reflexivity is an important factor for the effectiveness of teams that are involved with complex decision-making processes (West, 1996; West, Garrod & Carletta, 1997). Amongst others, the teams partaking in this investigation were the command centre of a frigate and a flight Apache helicopters.

In their research into ‘post-flight reviews’ within an F-16 squadron of the Israeli Air force, Ron, Lipschitz and Popper (2006) showed that, besides having a learning function, a thorough evaluation also has an added psychological and sociological value. This does not mean, however, that social team processes in all their aspects, automatically lead to homogenous teams, nor that this is wanted. It was proved, for instance, that a team’s innovation is improved by the presence of minority standpoints, provided team reflexivity takes place at higher levels (De Dreu, 2002). “This effect was as hypothesized, and grounded in the idea that minority dissent increases divergent thinking and creativity, but that conscious reflection on strategies and objectives is needed in order to process dissenting viewpoints, to shift the good from the bad ideas and problem solutions, and to help implement new ideas, products, and services” (De Dreu, 2002, p. 294).
Dialogue is central to intense reflection. Learning is greatly improved when people think together, question each other’s (half) ideas, and exchange ideas. Wanting to be right, defending, taking sides and debating are not part of having a dialogue. In order to have a dialogue many more conditions have to be met. Bohm (1996) posits discussion opposite dialogue.

**The Gates and Contextual Variables**

The fact that a team is learning does not necessarily lead to a learning organisation. This could, for instance, be attributed to the absence of communication between teams (Ancona & Caldwell, 1992b). In turn, this means that whatever is learned at the team level has to be dispersed and teams should be open to receiving knowledge and experiences from other teams, indicated as ‘dispersing’ and ‘distal learning’ respectively in the research model. In order to gain more insight into the core of team learning, namely team reflection, the location of where the communication takes place (‘locus’) is very important as well; do people learn more from each other in an informal setting (at the coffee machine) or during formal meetings (team meetings). In the model this dimension is represented in the variable ‘informal learning’.

However, even a certain degree of openness, or team sensation, does not mean that it is self-evident for teams to reflect. Chances of people entering in a reflexive discussion are very slim when they are very busy of working on routine (Gersick & Hackman, 1990). When studying team reflection within the (various) teams, many more situational or contextual circumstances can be discerned, all of which have to be taken into consideration. This counts especially for the object of this research: Armed Forces. Seeing the nature of the work of the teams this can vary from very dynamic (deployment under operational circumstances) and complex (deployment under operational circumstances with ‘joint’ or ‘combined’ units, against an irregular opponent and with various high-tech weapons systems) to stable and simple. These greatly varying circumstances under which military units have to operate have been defined as the ‘three block war’ by American General Krulak (Krulak, 1991). He first distinguished that units operating in the same area of responsibility can simultaneously be performing operations at three different levels within the use of force continuum and with three different tasks: humanitarian assistance, peace-keeping operations (with the accompanying rules of engagement), or combat operations. The ‘three block war’ concept describes the most important situational factors within which these teams operate (and learn): dynamics, complexity, and interests. The term dynamics refers to the dynamics experienced in its environment by the team, which obviously varies strongly per (type of) team in both operational and peace-time circumstances. Complexity indicates to what extent tasks, responsibilities, and authorizations within a team are complex or comprehensive. Large differences between teams can occur. The complexity of a task can flow from the cooperation with others (joint, combined, governmental and non governmental organisations NGOs) or from the systems which are used (the technology of information management systems in command centres). The different interests that can be at play during a team’s deployment are certainly visible in two of the three ‘blocks’: humanitarian assistance and peace-keeping operations. Cooperating or negotiating with NGOs, policymakers, authorities, warlords, and businessmen is quite normal in these settings. In order to be able to perform these tasks well a good understanding of the interests that are at stake is necessary. The variable interests is defined by the various possible (conflicting) advantages or interests that others around the team could have, obviously also during peacetime operational management.
When it comes to team demographical variables, research has shown that the diversity (or heterogeneity) of the team increases the chances of reflection. According to West, such chances are rare in homogeneous teams, yet diversity in status and power decreases reflexivity (West, 1996, p. 566). It is therefore of paramount importance for both diversity and homogeneity to distinguish between the many dimensions. After investigating the last forty years of diversity investigations, Williams and O’Reilly concluded that “under ideal conditions increased diversity may have the positive effects predicted by information and decision theories. However, consistent with social categorization and similarity/attraction theories, the preponderance of empirical evidence suggests that diversity in teams is most likely to impede functioning” (1998, p. 120).

Research by Ancona and Caldwell shows that a spread in the duration of team membership (‘tenure diversity’) is beneficial to task related team processes (Ancona & Caldwell, 1992a). Another research into diversity within teams (with diversity variables such as race, gender, age, function, ‘company tenure’, and team size) in relation to conflicts and performances showed that several direct and indirect relations exist (Pelled, et al., 1999). Their conclusion is that “overall, these patterns suggest a complex link between work group diversity and work group functioning” (p. 1). Because of the function rotation system, teams within the Armed Forces show a significant spread in the duration of membership with a maximum duration of three years.

Hypotheses

Based on the literature study and the resulting research model, team learning is defined by three factors. Just like Edmondson (1999), West et al. (1997), and Bohm (1996), this research considers reflection as the core of the cyclic team learning process. This leads to the following hypothesis:

1. Team learning consists of three separate factors (team sensation, team reflection, and team action) which show mutually recurrent relationships.

Researchers have concluded that reflexivity is an important factor for the effectiveness of teams which are concerned with complex decision-making processes (West, 1996; West, et al., 1997). In this research, Krulak’s ‘three block war’ doctrine not only provided Complexity but also Dynamics and Interests. It is reasonable to assume that military teams, who work in a complex and dynamic environment, are more reflexive than other teams. This assumption also goes for those military teams that operate in environments where many or large interests are at stake. This led to the second hypothesis:

2. Both highly complex and dynamic teams, as well as teams where large interests are at stake, show more team reflection than low complex and dynamic teams, or teams where interests are not at stake.

New insights can also be dispersed to others teams which can benefit from them after applying and securing them. It is imaginable a team will be approached for advice by other teams more often when team action proceeds better. Success creates attention and provokes others into asking questions. Moreover, the team itself can take initiatives to spread its experiences both on requested and unsolicited. Spreading such experiences is actually the best instigator in order to come to a learning organisation. The third hypothesis is:

3. A positive relation exists between team action and dispersal.
Research Methodology

This investigation into team learning was conducted among over 50 teams of the Netherlands Armed Forces, spread across the different Armed Services. The following methods were used during this comparative research:

- A longitudinal investigation by means of questionnaires for both the team members and management with a zero measurement (T0), a measurement taken after six months (T1), and a final measurement taken after one year (T2).
- Semi-structured interviews with several team members, commanders or team managers, and other possible stakeholders.
- Observations during visits and over longer periods of time (sea voyages).

In order to process the answers to the questions, 106 in total, a 5-point Likert scale was used. A number of variables were derived from internationally validated questionnaires. SPSS was then used to process the 868 questionnaires that were returned. The questionnaire that was given to the team members resulted in a response rate of 80% (from 64 teams) at the first measurement, 72% at the second (from 59 teams), and 70% at the final measurement (from 50 teams). Appendix A describes the questionnaire. Deployments to mission areas abroad constituted the main reason for the decrease in the number of participating teams. In total, 41 interviews apart from many talks and meetings during observation periods were conducted at 29 teams.

The three methods used to gather the relevant data (observations, interviews, and questionnaires) both serve as a source and a method triangulation. The source triangulation was further deepened by giving a questionnaire to the team’s commander (at each measurement). This questionnaire concerns those variables a commander should be able to perceive: Acting, Securing, Dispersing, and Evaluating. Apart from these variables, the questionnaire also included the same three open questions as those used in the questionnaire for the team members.

Several teams were also followed more intensively because ‘ethno-data’ (data from within) are a widening of the research. Participatory observation at a number of teams or units seemed to be the best possible choice and was made possible by commanders. Stablein writes about participatory observation that “participant observers listen, learn, take notes, converse, interview, ask questions, test preliminary understandings, watch, read, count, and anything else that seems to ‘help’ them understand the meanings of the world [i.e. team learning, TB] they are exploring” (Stablein, 1999, p. 264). One of the teams that was studied more in-depth was the management team of a Royal Marechaussee (Military Police) district. Over the course of a year 15 meetings were attended and relevant documents were made available. Other teams which were studied more in-depth concerned the teams aboard two frigates. During a period of two weeks the teams could be followed; one team while participating in a large-scale international exercise (Joint Caribbean Lion), the other during an operational deployment (UNIFIL, United Nations Interim Force in Lebanon). Finally, in order to gain more insight into the processes that work in teams, the author spent a couple of days as an observer on board of a frigate during the FOST-training (Flag Officer Sea Training). The FOST-training is the final and in-depth education phase of a ship’s crew and takes place in Plymouth, UK by professionals so called seariders. After this training, the ship can be deployed operationally to NATO-standards. In
all three cases, observations, interviews, and discussions provided more insights into (team) learning aboard a ship.

Data analysis

In order to verify whether the variables show a regular distribution, the Kolmogorov-Smirnov test was used; a normal distribution occurs when $p > 0.05$ (Field, 2005). The KMO-index (Kaiser-Meyer-Olkin) is an indication of the compactness of the correlation patterns of the questions. To determine the possible number of factors in a variable, the Kaiser-criterion was used (eigenvalue bigger than 1). The Cronbach’s alpha was used to determine the reliability of the variable measured.

The explorative analyses were done per sample test (T0, T1, and T2) with $n$ respectively being 316, 261, and 212. The variables Trust, Commitment, Evaluating, Planning, Acting, Single loop and Double loop learning, and Interests turned out to be good components.

The factor analysis for the variable Securing showed that one question was significantly different from the other four questions and the Cronbach’s alphas were relatively low. Without question one, the variable loads clearly for one component and the Cronbach’s alphas are good. A similar pattern was found for the variable Dialogue, which seemed to consist of two components. In itself this was not surprising since this variable questions both dialogue and the frequency of evaluating. After rotation one component is formed by six questions, all six of which coincide with the notion of dialogue. The three questions concerning the frequency of evaluating were left out for the variable Dialogue. Based on a factor analysis of these three items, they could constitute a separate variable, yet unfortunately the Cronbach’s alphas are too low: 0.61, 0.59, and 0.61 respectively. When considering the eigenvalues of Distal learning, this variable about how team members learn produces two components: 3.0 and 1.1, 3.0 and 1.1, and 3.0 and 1.2. The Cronbach’s alphas at each of the three measurements were 0.79. The correlation and component matrices indicated that the last two questions appeared to be separate from the other four, which is verified by the factor rotation. The reason for this difference lies in the fact that the first four questions were taken from Wong’s questionnaire (2004), whereas the remaining two were formulated by the author in order to study the aspect of ‘weak ties’. Based on this finding it was decided to use the original list for Distal learning and to remove the final two questions.

The factor analysis for Dispersing ($k = 7$) show it consists of two components. The two highest eigenvalues are 3.0 and 1.1, 3.0 and 1.3 and for T2 3.3 and 1.3. The reliability of the components is quite reasonable since the Cronbach’s alphas are 0.75, 0.72, and 0.78 respectively. The negatively worded fifth question seems to be the principal cause for this division into two components and removing this question the variable can be looked upon as one component. At T0, the factor analysis for the variable Informal learning ($k =12$) showed four components and after rotation six questions appear to constitute one component. Factor analysis clearly shows one component. Other components derived from the factor analysis do not yield a separate variable. From the correlation matrix and the results in table “Cronbach’s alpha if item deleted” shows that one question is the interfering item for the variable Complexity and omitting this question results in one component and Cronbach’s alpha increases. For the variable Dynamics it appeared to be one question which led to two components and a lower Cronbach’s alpha. This question was thus also omitted. Table 1 shows the results.
<table>
<thead>
<tr>
<th></th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>k</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Team sensation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust</td>
<td>12</td>
<td>3.77</td>
<td>0.61</td>
</tr>
<tr>
<td>Commitm.</td>
<td>5</td>
<td>3.47</td>
<td>0.79</td>
</tr>
<tr>
<td>Evaluating</td>
<td>3</td>
<td>3.51</td>
<td>0.73</td>
</tr>
<tr>
<td>Team action</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning</td>
<td>6</td>
<td>3.68</td>
<td>0.74</td>
</tr>
<tr>
<td>Action</td>
<td>6</td>
<td>3.50</td>
<td>0.65</td>
</tr>
<tr>
<td>Securing</td>
<td>4</td>
<td>3.55</td>
<td>0.70</td>
</tr>
<tr>
<td>Team reflection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single loop</td>
<td>18</td>
<td>3.62</td>
<td>0.61</td>
</tr>
<tr>
<td>Double loop</td>
<td>6</td>
<td>2.89</td>
<td>0.70</td>
</tr>
<tr>
<td>Dialogue</td>
<td>6</td>
<td>3.31</td>
<td>0.67</td>
</tr>
<tr>
<td>Distal learn.</td>
<td>4</td>
<td>3.29</td>
<td>0.71</td>
</tr>
<tr>
<td>Dispersing</td>
<td>6</td>
<td>3.29</td>
<td>0.65</td>
</tr>
<tr>
<td>Informal lear</td>
<td>6</td>
<td>2.80</td>
<td>0.73</td>
</tr>
<tr>
<td>Contextual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interests</td>
<td>3</td>
<td>2.84</td>
<td>1.02</td>
</tr>
<tr>
<td>Complexity</td>
<td>5</td>
<td>3.92</td>
<td>0.65</td>
</tr>
<tr>
<td>Dynamics</td>
<td>3</td>
<td>3.54</td>
<td>0.75</td>
</tr>
</tbody>
</table>

K= number of items; M= mean; SD= standard deviation; α= Cronbach’s alpha ; Measurement: five point scale (1-5)

Table 1

Aggregation of individual results to team results

The interrater agreement index, rWG(j) (James, Demaree, and Wolf, 1984) was used to test whether individual member’s scores for the group-level variables could be aggregated to the group. The mean rWG(j) of more than 2,400 values was 0.92 with a variance of 0.006. There were 53 rWG-values lower than 0.70, which is a critical value according to George (1990). From those 53, 44 belonged to the variables Interests, Dynamics, and Evaluating, each consisting of three items.
The mean rWG scores for these variables are also the lowest ones: 0.79, 0.85, and 0.89 at T0, T1, and T2 respectively. It is, however, a well known fact that the more items (j) constitute a variable, the higher the rWG(j) value will be (Castro, 2002). Overall, these results provided strong evidence of adequate within-group agreement and between-group differentiation, thereby supporting the aggregation of the scores to the group level.

Since the number of participants (N) had decreased by a factor of approximately 5 or 6 when moving from the individual level to the team level, an extra data screening was needed. With the current N for the teams the data had to be checked to see whether they could be parametrically tested. These assumptions also go for the application of Structural Equation Modelling (SEM; Kline 2005) and concern the normal distribution of data, outliers, multicollinearity, reliable and valid data, and ‘missing data’.

Based on the judgement of the skewness and kurtosis with z-scores and the histograms, the data are thus perceived as being normally distributed. Some outliers do occur but they are not distinctly interfering with the results of the calculations.

A first measure for determining multicollinearity is interpreting the correlation matrix. Multicollinearity occurs when R > 0.9 (among others Tabachnick and Fidell, 2007). Examining the correlation matrix (bivariation) shows that 0.9 is only approached once. Other factors of importance in determining multicollinearity are Tolerance and the VIF (Variance Inflation Factor) of the Collinearity Statistics; cause for concern arises when the VIF-value reaches 10 (Field, 2005; Myers, 1990). Tolerance is the reciprocal value of VIF. According to Field (2005), Menard (1995) uses a value of 0.2 for Tolerance in order to determine whether multicollinearity exists. For those clusters of variables in which multicollinearity could occur, regression analyses were conducted at each of the three test phases. The VIF-values did supersede 10 and Tolerance did not go below 0.2, indicating that multicollinearity is not a threat.

Reliability and validity had both been investigated at the individual level. Furthermore, the reliability analysis showed good Cronbach’s alphas. By means of factor analyses one or more items were removed from several factors in order to produce solid constructs. Upon analysing the aggregated data, two ‘missing data’ surfaced. The choice was then made to use the simple method (‘mean substitution’; Tabachnick and Fidell, 2006; Kline, 2005) to determine the mean for these variables at those test phases.

The commanders of each team were also given questionnaires. These questionnaires deal with the variables that they can perceive: Action, Securing, Dispersal, and Evaluating. The number of respondents at each of the three test times was 28, 32, and 18. Upon comparison of the two groups team members and commanders by means of a T-test (two-tailed) the differences do not appear to be significant. This source triangulation shows that the results for the commanders do not differ significantly from the teams during any of the three test times.

**Hypothesis 1**

In order to be able to investigate the validity of hypothesis one, Confirmatory Factor Analysis (CFA) with the use of Structural Equation Modelling (SEM) is used in the AMOS-programme (Analysis of MOment Structures).
The model at T0 with the three factors (with associations) and their total of nine variables (each factor accounting for three variables) does not seem to match the data at first glance. The Chi-square test is significant (p=0.000), the RMSEA is 2.220 (with 90% confidence interval 0.175 and 0.266). The CFI is 0.864 and the SRMR is 0.0756. The data were extrapolated from one and the same questionnaire so some association between the error terms could have occurred (Kline, 2005). By drawing a minimum of associations the model fit grows. The standardized estimates of this multi-dimensional model for T0 are presented in figure 2.

![Figure 2: the CFA-model at T0](image)

The Chi-square test is not significant (p= 0.075), the RMSEA is 0.089 (with 90% confidence interval 0.00 and 0.153), the CFI is 0.982 and SRMR is 0.0437. All the results from the fit-tests are good and the RMSEA is moderate. The correlations between the latent variables are high as expected (0.88 and 0.94 twice) and the coefficients are significant (p< 0.001). The factor loadings, also referred to as the regression coefficients, between the latent and measured variables are significant (p< 0.001). The correlations drawn between the error items are slightly less significant (p< 0.001 for three and p< 0.01 for two).
The same model, with the same associations between the error items, fits for T1 (see figure 3).

![Figure 3: the CFA-model at T1](image)

Chi-square= 28.798 (19 df)

The Chi-square test is not significant (p= 0.069), the RMSEA is 0.094 (with 90% confidence interval 0.00 and 0.160), the CFI is 0.978 and the SRMR is 0.0413. All the results from these fit-tests are good, although the RMSEA is lower but still adequate. The correlations between the latent variables are high and significant (p< 0.001). The regression coefficients (between the latent and measured variables) are also significant (p< 0.001). The correlations drawn between the error items are not significant (p varying from 0.012 to 0.28, showing three correlations < 0.1). At T0 and T1 the explained variance of the three latent variables is high.

At T2 no possible model can be fitted since the covariance matrix of the latent variable showed already in the unidimensional model negative values. The correlation between Team sensation and Team action is 1.05. At no manner an applicable model fits.

Because the results of the not-allowed model are in line with the results of T0 and T1, the model is presented (with the same associations between error items as in the earlier models) in figure 4.
Nearly all regression coefficients are somewhat lower, those of Securing and Double loop learning having dropped considerably compared to T0 and T1.

Figure 4: the invalid CFA-model at T2

The Chi-square test is significant (p= 0.014), the RMSEA is 0.131 (with 90% confidence interval 0.059 and 0.199), the CFI is 0.943 and the SRMR is 0.0599.

The table below provides an overview of the correlations between, and the explained variances, of the latent variables at T0 and T1.

<table>
<thead>
<tr>
<th>T0 – T1</th>
<th>Team sensation</th>
<th>Team action</th>
<th>Team reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team sensation</td>
<td>0.85 – 0.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team action</td>
<td>0.94 – 0.95</td>
<td>0.85 – 0.84</td>
<td></td>
</tr>
</tbody>
</table>
As table 2 clearly indicates, the correlations and explained variances hardly show any differences between the two test times (T0 and T1). For both T0 and T1, the regression coefficients between the measured variables, the indicators, and the latent variables are shown in tables 3.

<table>
<thead>
<tr>
<th>Team reflection</th>
<th>0.88 – 0.87</th>
<th>0.94 – 0.96</th>
<th>0.92 – 0.91</th>
</tr>
</thead>
</table>

Table 2: Correlations and explained variances at T0 respectively T1

As table 3 shows, the differences between the two test times are larger than those in table 2 but they are still relatively small. The absolute average difference between both regression coefficients is 0.04 with the average difference being -0.006. From these results it is clear that the indicator Evaluating is strongest in Team sensation. For Team action the strongest indicator is Planning, whereas Single loop learning is the strongest for Team reflection. This is in complete accordance with the outcomes of T2.

The first hypothesis is therefore confirmed. The three hypothetically developed factors (latent factors) continually show strong regression coefficients with the three measured variables of which
these three constructs consist. It also suggests (strong) mutual relationships between Team sensation and Team reflection, between Team action and Team reflection, and between Team sensation and Team action.

**Hypothesis 2**

The analysis of the second hypothesis consists of investigating the relationship between each of the contextual variables with each variable for the factor Team reflection. This analysis is done after each of the three test times (T0, T1, and T2). The correlation coefficients between Complexity and Single loop learning are 0.324 (p< 0.01), 0.560 (p< 0.001), and 0.188 (not significant) respectively. It can therefore be said that a significant correlation (two-tailed) exists between the two variables for the first two test times. The cross table including the variables split at the median can be found in table 4.

<table>
<thead>
<tr>
<th>Cross table</th>
<th>T0 Single loop</th>
<th>T1 Single loop</th>
<th>T2 Single loop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
<td>N</td>
</tr>
<tr>
<td>Complexity</td>
<td>Low</td>
<td>19</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>31</td>
<td>33</td>
</tr>
<tr>
<td>χ²(1) = ; p=</td>
<td>3.065; n.s.</td>
<td>12.348; &lt; 0.001</td>
<td>0.321; n.s.</td>
</tr>
</tbody>
</table>

Table 4

It is apparent that the hypothesis is only confirmed at T1 since there is a significant relation between a high or low degree of complexity experienced and much or little Single loop learning. Low complex team (teams that experience little complexity in their field of work) score lower for Single loop learning whereas highly complex teams apply it more. This coincides with the hypothesis when it comes to Single loop learning of the factor Team reflection.

The correlation coefficients between Complexity and Double loop learning are 0.348 (p< 0.01), 0.327 (p< 0.05), and 0.129 (not significant) respectively. Just as with Single loop learning the data for the first two test times are significant (two-tailed). The relations between the split variables show no significant relations. This also holds true for the relations between the split variables Complexity and Dialogue.

The correlation coefficients between Dynamics and Single loop learning are R= 0.237 (not significant), R= 0.181 (not significant), and R= 0.151 (not significant). As the results show, none of the values are significant (two-tailed).

Table 5 shows that for two test times there seems to be a significant relation between teams that experience much or little dynamics and whether they do much single loop learning.
It also indicates that low dynamic teams (teams experiencing little dynamics in their field of work) tend to show single loop learning less often and that highly dynamic teams apply more single loop learning. With the non-significant correlation coefficients between both variables in mind this is quite a good result.

For the three different test times, the correlations between Dynamics and Double loop learning are R= 0.295 (p< 0.05), R= 0.261 (p< 0.05), and R= 0.091 (not significant) respectively. For the first two test times there appears to be a significant correlation (two-tailed) between dynamics and double loop learning, just like the variables complexity and double loop learning. Upon separating the variables it turned out that there are no significant relations.

The correlation coefficients between dynamics and dialogue are 0.226 (not significant), 0.359 (p< 0.01), and 0.235 (not significant) respectively. The same principle applies here as it does for the variables complexity and dialogue since a significant correlation is only proved for T1. It also occurs in the cross table where variables were separated again a significant correlation only exists at T1 (χ²(1)= 4.911; p< 0.05). Teams experiencing little dynamics have a tendency to conduct less dialogue whereas teams that perceive themselves as more dynamic often use dialogues when communicating.

For single loop learning and interests the correlation coefficients are R= -0.106 (not significant), R= 0.147 (not significant), and R= -0.126 (not significant). As the analysis shows, none of the results are significant (two-tailed). The cross table below is the result after separating the variables.

<table>
<thead>
<tr>
<th>Cross table</th>
<th>T0 Single loop</th>
<th>T1 Single loop</th>
<th>T2 Single loop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
<td>N</td>
</tr>
<tr>
<td>Dynamics</td>
<td>Low</td>
<td>21</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>31</td>
<td>33</td>
</tr>
<tr>
<td>χ²(1)= ; p=</td>
<td>8.971; &lt; 0.01</td>
<td>4.911; &lt; 0.05</td>
<td>0.720; n.s.</td>
</tr>
</tbody>
</table>

Table 5
Table 6

As the table shows, a relation exists between the separate variables at T0 and T2. Teams where Interests are less at stake apply more single loop learning and teams where Interests are more prominent apply less single loop learning. Looking at those before, these relations are the opposite way.

The correlation coefficients between Interests and Double loop learning are respectively 0.059 (not significant), 0.286 (p< 0.05), and 0.119 (not significant) for T0, T1, and T2 respectively. Separating the variables yields no significant relations, something which also applies to the variables Interests and Dialogue.

Considering the outcomes of the analysis it is not possible to make a judgement on Team reflection in relation to the strength of the three contextual variables. The second hypothesis can’t be supported. Within the factor Team reflection Single loop learning seems to be the variable with the strongest and most reliable correlations to the other twelve variables. A conclusion that can be drawn on the basis of the results described above is that highly complex and highly dynamic teams apply single loop learning surprisingly more than less complex and less dynamic teams. Seeing as the former teams have to take into account more variables in their immediate environment and in their work processes, and the fact that these variables are more susceptible to change, makes it more probable that such teams will have to meet, take decisions, and evaluate more often than the latter.

Hypothesis 2, reconsidered

Making a subdivision in terms of operational and non-operational teams is also possible. The assumption is that the non-operational teams function in a more stable environment while the operational teams operate in a dynamic environment. In this research, an operational team is defined as a team that, upon deployment, takes part in (combat) actions in a mission area or directly commands such actions. This definition is based on the term ‘operational’ taken from the Dictionary of Military Terms (Bowyer, 1999): “involving the possibility of real combat”. A non-operational team does not take part in or directly command combat actions; its primary processes comprise support or managerial activities such as teams that are part of training and educational institutes and logistic or staff units.

The above indicated that highly dynamic teams apply single loop learning remarkably more than low dynamic teams. Therefore, the first research question of this section is to what extent operational teams score higher for Single loop learning than non-operational teams. Table 5 is the starting point for this research question. At T0 26 operational and 38 non-operational teams are involved in the investigation; for T0 the table is presented below.

<table>
<thead>
<tr>
<th>Cross table, T0, N= 64, splitting at median</th>
<th>Single loop learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>
The expected number of operational teams is shown in parentheses when assuming independence of the separation of Single loop learning and Dynamics. The table clearly shows dependence for operational teams when it comes to the division of high/low Dynamics and applying much/little Single loop learning ($\chi^2(1)=8.47$). Especially operational teams are applying much Single loop learning in a high dynamic environment.

Table 7

<table>
<thead>
<tr>
<th>Dynamics</th>
<th>Low</th>
<th>5 (9)</th>
<th>3 (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>2 (4)</td>
<td>16 (9)</td>
</tr>
</tbody>
</table>

Each cell: number of operational teams (expected in case of independency)

The dependence between Single loop learning and Dynamics is also visible at T1 for the (non)operational teams ($\chi^2(1)=9.14$). At T2 the number of participating operational teams had dropped to 16. At T2 there is no relation between the separated variables ($\chi^2(1)=3.50$, with the threshold being 3.84!). Based on the results of the calculation for T0 and T1 it can therefore be concluded that operational teams in particular apply single loop learning a lot when in highly dynamic circumstances.

Table 8

<table>
<thead>
<tr>
<th>Cross table, T1, N= 59, splitting at median</th>
<th>Single loop learning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Dynamics</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>5 (7)</td>
</tr>
<tr>
<td>High</td>
<td>0 (4)</td>
</tr>
<tr>
<td>High</td>
<td>6 (4)</td>
</tr>
<tr>
<td>High</td>
<td>12 (7)</td>
</tr>
</tbody>
</table>

Each cell: number of operational teams (expected in case of independency)

The dependence between Single loop learning and Dynamics is also visible at T1 for the (non)operational teams ($\chi^2(1)=9.14$). At T2 the number of participating operational teams had dropped to 16. At T2 there is no relation between the separated variables ($\chi^2(1)=3.50$, with the threshold being 3.84!). Based on the results of the calculation for T0 and T1 it can therefore be concluded that operational teams in particular apply single loop learning a lot when in highly dynamic circumstances.

This leads to the second question of this section, to what extent is Single loop learning applied more by operational teams. This question is analysed by means of an independent t-test for each of the three test times. At T0 operational teams seem to apply more Single loop learning than non-operational teams (M=3.77 as opposed to M=3.54). The difference clearly is significant: t(62)=2.227 and p=0.015 (one-tailed). Operational teams also appear to apply more Single loop learning at T1 than their non-operational counterparts (M=3.73 vs. M=3.65), yet the difference is clearly not significant: t(57)=0.758 with p=0.226 (one-tailed). Finally, the average of Single loop learning appears to be higher for non-operational teams at T2 than it is for operational teams (M=3.69 vs. M=3.65 for operational teams), however, the difference again is clearly not significant: t(48)=0.423 with p=0.337 (one-tailed).
All in all, operational teams do not apply Single loop learning more than non-operational teams, yet for two out of three test times the conclusion is that as the dynamics increase, operational teams apply more Single loop learning. From more in-depth differential analyses between operational and non-operational teams of the other variables it appeared (for two test times) that operational teams spread their knowledge and experience more than non-operational teams.

**Hypothesis 3**

The analysis of the third hypothesis shows that Securing has the strongest relation with Dispersing and that Action has the weakest relation (table 9).

<table>
<thead>
<tr>
<th>Correlation coefficient R</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispersing</td>
<td>0.51</td>
<td>0.39</td>
<td>0.64</td>
</tr>
<tr>
<td>p(two-tailed)</td>
<td>&lt; 0.001</td>
<td>&lt; 0.05</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Table 9

SEM is applied next. The standardised CFA-model for T0 is shown in figure 5.

![Figure 5](image)

During the fit-tests used to determine whether the model is applicable for all three test times (table 10) it becomes clear that the RMSEA scores badly. The other indicators are good.

<table>
<thead>
<tr>
<th></th>
<th>$\chi^2$ (df)</th>
<th>$p$</th>
<th>RMSEA = (90%) interval</th>
<th>CFI</th>
<th>SRMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>3.385 (2)</td>
<td>0.184</td>
<td>0.105; 0.000-0.292</td>
<td>0.989</td>
<td>0.0337</td>
</tr>
<tr>
<td>T1</td>
<td>4.251 (2)</td>
<td>0.119</td>
<td>0.139; 0.000-0.327</td>
<td>0.973</td>
<td>0.0434</td>
</tr>
</tbody>
</table>
The regression coefficients of Team action to Dispersing are grouped closely and are relatively high; the average of the three test times is 0.62. The explained variance of Dispersing by Team action is relatively high, averaging 38%. Therefore, the third hypothesis is supported since there appears to be a positive relation between Team action and Dispersing.

Results of the qualitative analysis

The questionnaire

The final three question of the questionnaire were open questions. An analysis of the answers to these questions consisted of a thematic categorisation of these answers. At T0, 172 respondents had answered question 1 (54%), at T1 141 respondents (54%), and at T2 107 respondents (50%). In itself these numbers are relatively high. Question 2 was answered by 192 respondents at T0 (61%), by 145 respondents at T1 (56%), and by 118 at T2 (55%). The results of the analysis for question 3 are 137 (43%), 115 (44%), and 86 (40%). Team members were especially interested in question 2, at least according to the results of the analysis.

The answer to question 1 (which suggestion do you have to become (an even) better learning team?) were very diverse. Some people answered “none actually”, while others were very specific in their answers (“keeping a ‘log’ of the progress of a tactical exercise. This (growing) document should describe the action plus the resulting ‘lessons learned’.”) Some respondents only had just sufficient room to write down their answers since they provided a number of suggestions; one respondent had nine suggestions for improvement.

The results have been organised according to theme. By far the most common theme is Communication. Many answers include more and better structured meetings and internal communication. Some plead for more informal meetings and contacts. Communicative aspects, such as listening, openness in communication, and logging agreements made are also mentioned. A second theme was Evaluation. Many respondents would like to see more and better evaluations take place: “rather 3 short ones per month than 1 long, boring evaluation”. Suggestions range from “more evaluations during exercises” to “staff appraisals taking place 4x per year”, rather than the prescribed once a year. The theme Procedures contained suggestions for recording procedures and being held to them. Remarks made with respect to this theme included: “more structure in activities, better mutual role divisions, and tighter (more efficient) procedures ensure more possibilities to make improvements and secure these” and “procedures, experiences, and exceptions should be recorded in a ‘work instruction’.” Seeing as quite a few respondents mentioned Distal learning-Dispersal as a means of exchanging knowledge with similar teams, this theme was included in the analysis as well. Lessons learned require people to log knowledge and experiences. One respondent replied that “knowledge should be passed on and secured among team members.” Yet another theme concerns Cooperation to which respondents expressly stated they would prefer to continue working together and doing exercises together for longer periods of time. Scores for the theme Teambuilding are also

<table>
<thead>
<tr>
<th>T2</th>
<th>5.660 (2)</th>
<th>0.059</th>
<th>0.193; 0.000-0.390</th>
<th>0.921</th>
<th>0.0619</th>
</tr>
</thead>
</table>

Table 10
reasonable. For this research, only those scores were included when respondents actually used the word teambuilding in their answers. Teambuilding is a method to discuss the aforementioned themes and to make agreements about them. When it comes to the theme *Time*, many respondents indicate suggestions for improvement outside of the team, higher up in the chain of command: allow more time for preparation and execution. The final theme is called Higher command and serves somewhat as a collection theme in the sense that just like at the theme Time, suggestions are being looked for higher up in the organisation and respondents frequently mention money, personnel policy, reorganisation, and planning.

With the exception of the last two themes, the others cover the variables from the research model because of the answers given by the respondents. The only variable not explicitly mentioned is Evaluating, yet the answers to all the questions are all implicitly related to this variable since they contain suggestions to “become a(n even better) learning team” and by that become more effective, more efficient, and/or more innovative.

The second open question in the questionnaire was about the possibilities that the team or team members use in order to share knowledge and experience with other stakeholders. It seems there are many oral and written structures to exchange information, both formally and informally. One respondent of an operational team summarised it as follows: “The hierarchical and functional chains of command. The informal network. Both structurally.” An Apache pilot answered the question quite extensively and in depth: “(De)brieﬁng pre and post ﬂights with all participating pilots; talk to more experienced pilots; follow classes; have a clear handover to the relieving team; create open cultures (which are partly there already) in which people can own up honestly to mistakes made; meet each other outside the workplace.; gather information from other armed forces; have monthly meetings between pilots, commanders, safety ofﬁcers, and others.” The answers all indicate that much knowledge is passed on via oral communication. In short: “Talk; talk a lot and with ‘all layers of the population’.” Though it was not requested from the respondents, relatively many of them indicated there is a great need to increase the quality of the sharing of knowledge.

The third open question continued on the train of thought set out in question two and asked for more opportunities to share knowledge and experience. The answers to question three did not provide any new insights, other than those already mentioned in question two.

The open questions for commanders were identical to those questions put to the team members. In their answers for question one, many respondents referred to improving communication, both within and between teams. This is something that could be achieved quite simply by “listening to each other even better”, but also by using a more extensive solution provided by one commander: “take more time to formally/structurally exchange knowledge and experience; take notes and make those notes available for both members of the team and members of other teams.” Yet another respondent refers to the entire learning cycle: “explicitly store experiences from exercises (a kind of internal FIR [First Impression Report, TB] and ensure that those experiences are always consulted in the planning, briefing, and execution of new exercises.” Someone else answered that “keeping a kind of log in which lessons learned can be noted down in concept format. This could purely serve as a memory aid, future reference, or as a draft version for the standard lessons learned database.”

Answering the third question relatively many commanders addressed the issue of setting up and compiling a lessons learned database or indicated that certain discussion forums could be used.
Three concrete examples of ICT-supported suggestions were to “use the WEB (webpage) more often with lessons learned (with the possibility for reactions)”, “set up a knowledge database/helpdesk”, “a central mailbox to which questions can be mailed.”

From the answers of the open questions the variables from the research model could be distinguished quite clearly. Most notably reflection and communication were perceived as very important. The above distinction also became apparent from the interviews that were conducted.

**Royal Marechaussee -case**

Over the course of one year, the author attended fifteen management team meetings of a KMar-district (Military Police) and had access to relevant documents. This management team, consisting of 14 people was also one of the teams that answered the questionnaire used in this research.

The case description, which has not been included in this article, indicates that the research model (the factors Team sensation, Team action, Team reflection, the other variables and their relations) fits perfectly within the activities and behaviour of the management team of a KMar-district, supporting the first hypothesis. Besides this, it provides a good example of how (team) learning processes initiate or accompany change. It can even be said that a cultural change took place as a result of, or by using, such intensive team learning processes. The cyclic process showing the factors moves in an upward spiral. With respect to the second hypothesis there are no remarks to this case. The hypothesis was not supported and the management team is not an operational team according to the definition.

In comparison with other participating teams, the KMar-team consistently gave low scores for itself for the different variables. Several reasons could be the cause for this occurrence. First of all, the KMar-team was a newly formed team. Moreover, the KMar-organisation had just gone through a reorganisation but many decisions and actual changes still had to be implemented during the year. The KMar-organisation was going through the most fundamental of changes for any organisation: a cultural change. The case description also indicates that the team itself had to shed its own culture by attaching less value to the hierarchy within the team and more to each other’s professionalism. Referring to the third hypothesis, during the research period of a year a wonderful example of dispersing newly adopted team norms to another team had taken place (Bijlsma, 2009). With regard to Team sensation it can also be said that in relation to most of the other participating teams, the management team only convened as team once every two weeks. Moreover, a number of team members were dislocated in Southern Holland. Specifically informal learning scored high. It would seem that team members are looking for own means to fulfil the, for a starting team undoubtedly great, need of knowledge and experience.

**Frigates**

During the course of the sailing periods aboard the three frigates, the central question was “to what extent can the results of the quantitative analysis be distinguished in the frigate cases?”

The special part of this part of the research lies in the fact that the three cases concerning teams aboard frigates are cases that took place in three different contexts. The most important contextual difference is the pressure, or even threat, from outside. During the FOST-case the mission specific training was perceived as a pressure cooker in which external professionals provide the teams with a
lot of knowledge and experience in a learning, coaching environment in a relatively short amount of
time. In other words, the FOST-period serves as a catalyst for (team) learning processes. Overall the
pressure is high because the result in the final test in the last week of the training weighs heavy for
the higher command and sounds for several years. The second case takes place in an international
exercise called Joint Caribbean Lion and reveals a less dynamic learning environment. However, the
ship was also the station ship (Dutch representing ship) in ‘the West’ resulting in the operational
deployment and pressure always being very current. This case also shows that the people aboard the
ship have to be able to quickly switch to an important task of the station ship: fighting seaborne drug
trafficking. The threat of hostile actions was most prevalent in the third case since the ship was part
of the UNIFIL-operation. The independent setting up, training, and education of a professional
‘boarding team’ is a good example of a learning team. While sailing off the Lebanese coast, the rustic
but ever watchful and alert lifestyle on board the ship could quickly shift to an incredibly dynamic
one in case of a suspected rocket attack or an attack with high speed vessels.

It was found that the factors, variables, and relations from the research model are very recognizable
in all three of these frigate cases. The rest of this paragraph will therefore describe the results of the
analysis of the three hypotheses for these three cases.

A strong mutual influence of the three factors (Team sensation, Team action, and Team reflection)
appeared to exist aboard these ships. During the FOST-training this is even the focal point of the
training. The attitude at the start of this training is that people are motivated to “show the English
just how good we really are” already feeds team sensation. The fact that all the exercises witnessed
by the author were thoroughly evaluated indicates that team reflection and team action are very
strongly related to one another. Within these two factors the reflections also produced (new) plans
that were most often secured, something which obviously, operating in learning situations mostly
happened during the FOST-training. In turn, the team sensation is increased even further by the
(mostly) good results or the positive atmosphere and end of the evaluation. The variables of Team
sensation (Trust, Commitment, and Evaluating) are easily recognised as such because of the attitude
of the seariders towards the teams. By their professionalism and their coaching attitude they support
team sensation by means of their behaviour towards the teams and because of their commitment
and enthusiasm they provide good role models. Seeing as the teams are only thoroughly tested for
the first time during the FOST-training, this period serves as a catalyst for the team sensation.
Because of the intensive cooperation within the team the trust, commitment, and evaluation of the
own team is actually being established.

One example taken from all (three) ships is the food. If the galley team has not prepared the food in
time, or has not prepared it fully (enough) it will immediately show in a direct reaction of the
customers (the Action within team action). This reaction, in turn, forces chefs to evaluate (team
reflection) and to make improvements (Planning). It goes without saying that all these things
together influence the team sensation of the galley team quite directly. The interviews showed that
‘bad’ food leads sailors being less motivated. This negative atmosphere also persisted in the
communication, cooperation, and activities of people, and, thus, teams.

With regard to the second hypothesis the quantitative analysis showed that in highly dynamic
situations operational teams apply single loop learning much more than non-operational teams. All
teams on board of a ship can be considered operational teams, working in a reasonably dynamic
environment; truly low dynamic teams do not appear to exist on a ship. Nonetheless, the author observed that those teams that operate in a more dynamic environment apply single loop learning much more often than those teams that operate in a less but still dynamic environment. The head chef of the aforementioned galley-team for instance indicated that he works with independent chefs who know what their tasks are and how they have to do them. If they do not know how to do something, they can fall back on their cooking books, for instance. Evaluations, therefore, hardly ever take place since the processes are repetitive and predictable, and the people are adults. On the other end of the Dynamics scale is the boarding team of the UNIFIL-mission. In principle this team has been trained already but they have to keep training. The exercise that the author took part in was very minutely evaluated and single loop learning was done with the entire team. For the helicopter crew (each frigate has his own helicopter) evaluations are part of their standard operating procedures; every flight has to be evaluated. Even though not every sortie (flight) takes place in a dynamic environment (sometimes even literally), the team should be considered a highly dynamic team. The same applies to the command central team. For both these teams, single loop learning is the order of the day and is applied very intensively.

A positive relation between Team action and Dispersal was also found after analysing the third hypothesis. During the FOST-training the learning cycle is so intense and fast that a team does not have time to disperse the experience and knowledge gained outside the actual ship itself. There are plenty of opportunities to spread experiences aboard. In an intensive learning environment a team can and will share knowledge and experiences with other team members much more freely than in a normal work environment. Apart from this, lots of functional information has to be spread to certain other teams since these teams have a link to processes of the own team during the mission specific training. The author himself experienced quite clearly that people truly felt the need to share experiences with each other. This could partly be due to an innate wish to reduce tension.

Dispersing experiences gained was also done in Joint Caribbean Lion and during the UNIFIL-mission but then specifically to functionaries on other ships. The teams on board are well tuned into each other and often need to share fewer experiences after such exercises, unless unique incidents during exercises or operational actions are involved. The experience gained from acting as a station ship in ‘the West’ and as a participant to the UNIFIL-operation provides unique knowledge. Furthermore, the interviews indicate that officers and NCOs share a lot of knowledge (whether asked to do so or not) with their colleagues on other ships. This specifically goes for those ships that are next in line to relieve the ship in question of its duty. After the FOST-period has been completed the ship’s crew is ‘interrogated’ by the next crew to enter the FOST. Team action (planning, executing, securing knowledge) has a strong, positive relation with the dispersal of knowledge and experience.

Both the model and the results from the quantitative analysis match the three frigate cases quite well.

Discussion and implications

First of all, this research has shown that learning by teams can indeed be split into the three aforementioned activities or processes (factors): the team or we feeling, the reflection or evaluation, and the execution or action as a team. The three factors influence each other strongly which means that they amplify each other and that all three are necessary in order to shape the processes
involved in team learning. The more implicit factor team feeling is equally important to a team as the explicit factors team reflection and team action.

One result of the investigation is that also teams working in a complex and/or dynamic environment apply more single loop learning than those teams operating in a simple and/or stable environment. Because of their processes and/or environment, the first type of teams is, confronted with a lot more (unexpected) variation and will, therefore, have to be more adaptive in nature. Such a team will naturally have to convene and evaluate more often. In other words, such a team will apply much more single loop learning than a team in a less dynamic environment.

For one important aspect of a learning organisation, spreading new knowledge between teams, it has to be taken into account that team action plays an important role. Within team action, securing new insights by a team is a strong determiner for the dispersal of knowledge gained.

Where the KMar-case is concerned a change of organisational culture occurred as a result of intensive discussions because of a constantly recurring point on the agenda: integrity. On the FOST-frigate the common ground, which also happened to be their assignment, was Mission Specific Training and Learning which rose to great heights within the short amount of time. The team learning model was very useful in describing this process and it can therefore be assumed that the model used in this research can also be used to describe and analyse High Reliability Organizations (HROs) (Weick & Roberts, 1993; Weick & Sutcliffe, 2007) of HR-teams.

The outcomes of this research seem to be quite representative for the Netherlands Armed Forces. The research model was designed by combining previous research and building on it. A number of hypotheses were taken from other research done at non-military organisations. The findings about relations between variables in this research match the results of research done in other organisations. One logical assumption is, therefore, that the conclusions of this research also apply to (teams of) non-military organisations.

References

Argote, L., (1999), Organizational Learning: Creating, Retaining and Transferring Knowledge, Norwell, MA, Kluwer
Bateson, G., (1972), Steps to an Ecology of Mind, New York, Ballantine
Berg, van den, C.E., (2009), Soldiers Under Threat: An Exploration of the Effect of Real Threat on Soldiers' Perceptions, Attitudes and Morale, Breda, Netherlands Defence Academy
Bijlsma, T., (2009), Teamleren bij de Nederlandse krijgsmacht, [Team learning at the Dutch Armed Forces], Den Haag, Koninklijke De Swart


Chan, C.A., Lim, L & Keasberry, S.K., (2003), Examining the linkages between team learning behaviors and team performance, *The Learning Organization*, vol. 10, nr. 4, 228-236


Dixon, N.M., (1999), *The Organizational Learning Cycle, How We Can Learn Collectively*, Aldershot, Gower


George, J.M., (1990), Personality, affect, and behavior in groups, *Journal of Applied Psychology*, vol. 75, nr. 2, 107-116


Kloet, I.E., van der, (2005), *A Soldierly Perspective on Trust, a Study into Trust within the Royal Netherlands Army*, Tilburg, Thesis Tilburg University


Kruлak, C.C., (1999), The strategic corporal: leadership in the three block war, *Marines Magazine*, January

Levin, D.Z., (1999), *Transferring knowledge within the organization in the R&D arena*, unpublished doctoral dissertation, Northwestern University, Evanston, IL


Myers, R. (1990), Classical and Modern Regression with Applications, second edition, Boston, Duxbury
Nederlandse Defensie Doctrine, [Dutch Defence Doctrine], (2005), Defensiestaf, Den Haag
Swift, T.A. & West, M.A., (1998), Reflexivity and Group Processes: Research and Practice, Sheffield, University of Sheffield
Tjosvold, D., (1991), Team Organization. An Enduring Competitive Advantage, Chichester, John Wiley and Sons Ltd


Appendix A

Measured variables by questionnaires

- For the variable Trust within the factor Team sensation a scale was used that was developed by Van der Kloet (2005) who investigated trust among soldiers of the Royal Netherlands Army. In her research Cronbach’s alpha for the variable trust was 0.88.

- In order to measure team Commitment, Allen and Meyer’s validated affective commitment scale (1990) was used (De Gilder, et al., 1997). Seeing as the affective commitment scale is a measuring instrument that measures commitment at an organisational level, the questions were rephrased to the team level by replacing the word ‘organisation’ with ‘team’.

- For measuring Evaluating three questions were developed by the author that respectively questions the team’s effectiveness, efficiency, and innovation.

- The variable Planning belongs to the factor Team action. To measure this variable Schippers’ et al. (2005) Planning scale was used. Their Cronbach’s alpha was 0.80.

- Schippers at al. study also provided the variable Action. One question was added to the existing five questions (which had a Cronbach’s alpha of 0.79).

- Five new questions were developed for the variable Securing.

- The factor Team reflection is the focal point of the research model. The team reflection instrument developed by Schippers et al. (2005) distinguishes between two subscales of Reflection: Single loop learning and Double loop learning. These two separate constructs have a reasonable discriminatory validity. Schippers et al. do not mention the Cronbach’s alpha here.

- Ten questions developed by the author concern Dialogue. The variable Dialogue was divided into two different types of communication: debate and dialogue. Six items question the dialogue and one item is used to question debate. Three more items concern the frequency of evaluating.

- For the variable Distal learning, the 4-item questionnaire developed by Wong (2004) was integrally used (Cronbach’s alpha = 0.84). These questions were expanded by two additional questions about ‘weak ties’, since distal learning and weak ties are closely linked.

- The variable Informal learning should provide an insight into the context the learning takes place (locus). Do people learn more in formal meetings or at the coffee machine (Dixon, 1999)?

- The seven questions for the variable Dispersing were formulated by the author.

- The variable Interests is one of the contextual variables, the questions for which were developed by the author.
• Volberda’s flexibility scan (1998) was used for the variable Complexity and expanded with two items formulated by the author.

• The questions for the variable Dynamics are also based on Volberda’s flexibility scan (1998).

• A number of questions taken from the Team demography were incorporated in the contextual variables and concern aspects such as team size, how long the person in question has been active in the team, and the number of previous functions performed within the Armed Forces.

• The questionnaire ends with three open questions. On the one hand, this provided respondents with the opportunity to add their own comments with regard to team learning. On the other hand, it provided them with the opportunity to provide opinions about the team’s present situation or with ideas for the future.

The questions are:

1. Which suggestions do you have to become (an even better) learning team?

2. Which possibilities does the team use, or do different team members use, to exchange knowledge and experience with other stakeholders? To what extent are these possibilities used structurally?

3. Which other opportunities do you see in order to exchange knowledge and experience between the team or team members and other stakeholders?