

A Tool to Assess Learning Processes based on the Cooperation Principle

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Abstract A strategy for cooperation in emergency management has been developed and politically agreed upon by the Rogaland County Council, Norway. The region comprised by the strategy consists of many different actors within societal safety and emergency management. The strategy aims at strengthening the existing cooperation, establishing professional centres and further developing competencies in their emergency response efforts within the region. The region has more than twenty road tunnels either in the planning phase, under construction or in operation. The emergency services have established a new organisation of their cooperation to ensure coordination, learning and supervision. This relates both to exercises and real event operations. An important tool in this respect is a recently developed handbook for cooperative exercises. The book is used in planning, execution and follow-up of all cooperation exercises. In this paper we present our newly developed evaluation model for following up the cooperation exercise guidelines, with special attention to events in road tunnels. We employ a learning model that extends the notion of learning from observed changes to also include confirmation and comprehension of cooperation activities.

1 Introduction

Four principles constitute the basis of the Norwegian emergency preparedness structure - *responsibility*, *similarity*, *proximity* and *cooperation*. The cooperation principle, (re)introduced formally as an overarching, cross-sectoral planning criterion in 2012, implies that authorities, voluntary, private and official actors are individual responsible for establishing appropriate interaction and coordination with relevant parties in all activities regarding prevention, emergency preparedness and

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crises management. In this paper, *cooperation* is used as a translation of the Norwegian term “samvirke”. Our definition of cooperation in emergency management includes both coordination and interaction between different independent actors, vertically and horizontally at all organisational levels.

Interagency coordination is necessary for successful implementation of critical decisions and prevention of overlap, conflicts and miscommunication (Boin et al., 2005). However, such coordination is challenging to obtain. Technical and cultural communication problems can undermine the horizontal cooperation during emergency response (Boin et al., 2005), different terminology and interagency conflicts can add further pressure on the emergency management (Paton and Flin, 1999). In the review of the incidents in Oslo and at Utøya in 2011, the “July 22 commission” points at the lack of ability to coordinate and interact, and to learn from exercises, as two important factors explaining the unfortunate performance of the emergency response (Gjørsv, 2012).

A recently developed handbook in Rogaland for cooperative exercises constitutes the basis for the planning, execution and follow-up. It is a tool aimed for improving practices in and across emergency services. Previous experiences showed limitations in learning from full-scale cooperation exercises due to the participants’ lack of prerequisites (Samvirkeaktørene, 2014). The handbook was published in August 2014, but the principles in the handbook have been applied in planning and execution of cooperation exercises since the autumn 2013. The correlations between the handbook’s exercise concepts and how learning is achieved needs to be further studied. To succeed with the intentions of establishing better cooperation in emergency prevention and management the actors must constantly challenge the learning principles, learning as a phenomenon and the established practice for training activities.

It is necessary to assess and evaluate the regime for follow-up initiated learning processes. This article presents an evaluation model of cooperation exercises based on the handbook’s guidelines with special attention to tunnel fires. The tool is a first edition of parameters that contribute to the learning processes from stimuli, such as exercises, training activities or real events, has been subjected to learners (emergency services and tunnel management actors) until effects are observed. Our evaluation tool is based on a combination of learning theories and empirical data.

2 Theoretical framework for the evaluation tool

Exercises are common means in building experiences and competencies in interagency cooperation (Lonka and Wybo, 2005). In addition to uncover limitations in emergency plans, cooperation exercises contribute to establishing networks and personal relationships between emergency responders from different organisations (Kettl, 2003). Training and exercises are also important tools for emergency responders to acquire and learn how to use necessary knowledge and skills (Lonka and Wybo, 2005, Sinclair et al., 2012, Sommer et al., 2013).

Both the emergency response systems and the context in which they operate can be described as complex, an example is tunnel fire responses (Svela et al., 2016). There

is a need for a holistic view on systems and accident factors, because events, actions and behaviour of the different system components can only be understood by considering their “*role and interaction within the system as a whole*” (Leveson, 2011). The control of safety within a system involves many levels of actors, ranging from the Government at the top-level to the operators at the bottom. Each level applies constraints on the level beneath, through legislation, policies, rules, routines, work instructions etc., thus forming the boundaries for the system’s practice and performance (Rasmussen, 1997, Svedung and Rasmussen, 2000, Leveson, 2011). Such hierarchy of control must be based on adaptive feedback mechanisms and communication to ensure that “*the information needed for decision making is available to the right people at the right time*” (Leveson, 2011). Abrahamsson et al. (2010) argues that a holistic system approach is suitable to deal with the complexity of the situations and systems involved in emergency response.

2.1 Learning and experience in emergency response work

The concept of learning is subjected to different definitions and perspectives (Braut and Njå, 2009). The individual cognitive approach views learning as acquisition, using individual factors to explain the development of competence. While the socio-cultural approach focuses on learning as participation, and explains the development of competence through contextual factors (Sommer et al., 2013, Sommer, 2015). It can be argued that the two approaches complement each other (Sommer, 2015, Sford, 1998, Sommer et al., 2013), and in order to understand how emergency workers develop their skills and knowledge, these two approaches must be combined. Sommer et al. (2013) have developed a model for learning in emergency response work based on such a combination, cf. figure 1.

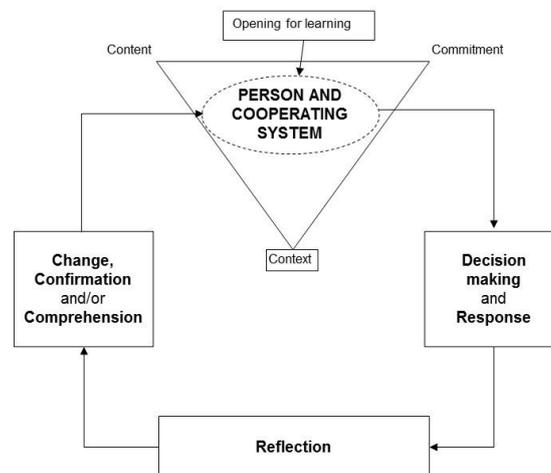


Figure 1, Learning model adapted from Sommer et al. (2013)

This model sees learning as a continuous process. The starting point for understanding learning is the individual (the person) placed within the contextual elements of

content, context and *commitment* (Sommer et al., 2013, Sommer, 2015). The practical and theoretical content of the learning activities, such as skills, behaviour, how to interpret situations or the use of equipment, must be relevant in order to improve performances. Social climate, relationships, trust and openness are conditions affecting the learning environment, which constitutes the context. The individual's commitment to the learning activities also strongly influences what and how much learning that occur (Sommer et al., 2013, Sommer, 2015). In this theory it is believed that individual learning in concert creates the organisational and cross-organisational learning, even though it is not an equation of simple aggregation of the individual learning.

During real emergency situations or exercises the emergency workers must be able to consider relevant situational cues in their decision-making. The result of these decisions are the individuals' behaviour and response, which in the end form the outcome of the emergency or exercise situation. Through subsequent reflection on their performance, the individuals can learn from their experiences, and this will influence the individual performance in following situations (Sommer et al., 2013, Sommer, 2015).

The outcome of learning can be categorized as *change, confirmation* and/or *comprehension*. Learning results have traditionally been expressed as changes in structure, behaviour, cognition, processes or organisations, but the model for learning in emergency response work also includes confirmation and comprehension as potential results from learning (Sommer et al., 2013, Sommer, 2015, Braut and Njå, 2009). Confirmation is some kind of positive reinforcement verifying that the emergency workers' normal practices, tools and existing skills are working very well. Learning as comprehension occurs when the emergency workers gains a deeper understanding of existing practices, tools and behaviour. A more comprehensive understanding of the mechanisms working in different emergency situations in and across organisations and how different practices and behaviour can provide possibilities or limitations, enable emergency workers better prepared when facing new situations (Sommer et al., 2013).

2.2 The evaluation model directed at cooperation exercises

Emergency workers need to meet emergency situations in a functional way. They must be able to know which tasks to implement in which situations, be familiar with own tasks and how to perform them satisfactorily, and assess the results of their own behaviour (Njå and Sommer, 2010). Because exercise situations never will be identical to real situations, the objective of exercises are to develop competencies and knowledge that can be generalised to similar real-life situations.

A method for evaluating the quality of a training and exercise program must consider the interaction between the situation characteristics, the individual's competencies and the probability of personnel showing functional behaviour in the situation. An evaluation must analyse the type of situation (scenario) used in the exercise and if it matches "real life", it must define the personnel's level of competence and the behavioural objectives of the exercise. The chosen evaluation method can start with

either situation, person or behaviour when assessing if the exercise is a suitable way of establishing required connection between the three (Njå and Sommer, 2010).

The three layers in the circular model in figure 2, represent the different levels in the emergency response system hierarchy, starting with the individuals in the inner circle. In order to evaluate if and how learning has taken place through exercises, we claim that expressions of change, confirmation and comprehension must be identified, qualitatively or quantitatively on different levels in the participating organisations, from the individual level up to the level where regulations and general operative standards are made, cf. figure 2.

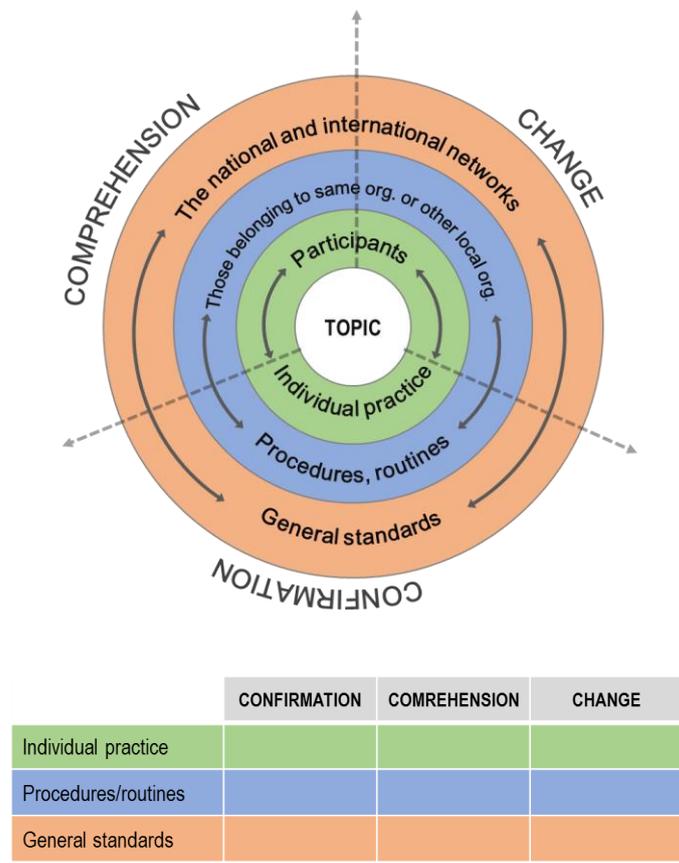


Figure 2, Model for studying and evaluating cooperation exercises

2.3 The evaluation tool

The control loop that forms the basis of the handbook for cooperative exercises is consistent to the feedback mechanisms described above (Leveson, 2011). Each step in the exercise process shall be subjected to evaluation and subsequent feedback in

order to make necessary adjustments before initiating the next step in the process, in which cooperation activities are specifically focussed.

Content, context and commitment

Content, context and commitment are the elements that constitutes a person's learning of cooperation tasks. Thus the concerted development of skills and knowledge depend on a combined approach to learning and how the exercise is designed in order to make the participants receptive to learning. According to the handbook for cooperative exercises the evaluation shall clarify experiences and weaknesses for further action, and for use in developing and improving both the cooperation between the organisations and the individual agencies (Samvirkeaktørene, 2014). This process is vital in order to obtain learning as confirmation, comprehension and change at all levels in the emergency response system. There need to be explicit cooperative goals for the exercises, which will be considered through the assessments;

Content:

- Identification of boundary objects
- Phenomena involved
- Flexible vs. standardised cooperative behaviour
- Motor vs. cognitive collaboration behaviour
- Responsibility and decision making
- Communicative challenges

Context:

- Physical requirements of joint forces
- Mental requirements of joint forces
- Emotional requirements of joint forces
- Contact with physical energy
- Training arenas

Commitment:

- Degree of individual involvement in cooperating tasks
- Instructors' competencies
- Motivational aspects
- Participant competencies and preparations
- Socio-cultural factors including boundary awareness

Decision making and response

Decision-making and response corresponds to individuals' performance in collaboration with others in the training situation. Individuals' behaviour and response is thus a result of the decisions they make in specific contexts, which consequently form the outcome of the emergency situation. Important features of the tool are as follows:

Decision making:

- Information processing (use of available information, search for additional information etc.)
- Situational awareness
- Ability to recognise relevant situational cues
- Mental simulation
- Communication and coordination
- Development of tactics and measures

Response:

- Choice of action
- Allocation and use of available resources
- Performance of tasks

Reflection

Reflection is a vital prerequisite for learning, thus exercises must facilitate such activities. Collective debriefings are necessary in order to discuss and exchange experiences across different organisations. Discussions directly after the exercises are perceived as valuable, and concluding evaluation and collective debriefing has been requested by exercise participants during international studies (Berlin and Carlström, 2014, Berlin and Carlström, 2015, Andersson et al., 2014).

The time factor is paramount. Debriefing immediately after the exercise is important to share observations about the event and discuss the reception narrative and which individual and collective features of the exercise content, context and commitment that were interesting for learning. Participants and organisations must be encouraged to carry out step two of the reflection, which is digging deeper into the experiences, much in line with root cause assessments. By providing process feedback the participants are given information to make them understand what led to a particular outcome. Critical cues and judgements about actions should be the focus of the emergency workers reflection (Sommer et al., 2013). Informal discussions and assessments are as important as a formal gathering some days after. Thus the study of cooperation exercises must include an evaluation of the debriefings and their contribution to reflection, which we present as questions:

- Is the narrative agreed upon or is there opposing views?
- Did the collective debriefing contain elements of Gibbs' reflection circle (1988); descriptions; feelings; evaluation; analysis; conclusion; action plan?
- Did the participants focus on process rather than outcome?
- How was uncertainties presented and discussed?
- How is trust between individuals and organisations reflected?
- Which boundary objects were important, and did the debriefing concentrate on being aware of boundaries of future cooperation?

- If there were alternative interpretations – did the debriefing include discussing other strategies?
- Did the debriefings clarify the cooperative abilities, confirming good practice?
- Did the debriefings identify areas in which the cooperation exercise provided new knowledge and need for changes?

Change, confirmation and comprehension

Identifying expressions of change, confirmation and comprehension from cooperation exercises, dependant on trust, understandings of responsibilities, phenomena involved, etc., have been scarcely studied in the research literature. Our model in figure 2 tries to grasp the dynamics of the individuals at the core and how general standards at the national and international networks are influenced. Our approach is explorative and it will be developed during the research activities of exercises and real event assessments started up in Rogaland.

In order to properly understand the concepts of change, confirmation and comprehension, our research is directed at describing inferences, activities developed, measures and expressions of individual and collective reflections being internalized in the individuals, the organisations, and across organisations and networks.

Change in:

- Response actions
- Plans, procedures
- Situation assessment
- Practical handling
- Participants experiences from the exercises

Confirmation of relevant:

- Cooperation and teamwork
- Self-evaluation
- Knowledge acquired
- Working across organizational boundaries
- Joint response work
- Joint situational awareness

Comprehension in the perspective of:

- Physics in the situation development
- Constraints established
- Interaction between services
- Variations in human (victim) behavior
- Responses to toxins from various smoke compositions

A preliminary summary of this work with the new tool is that there is an urgent need for a systematic credible approach to learning. The tool shall no undergo testing, first

and foremost in exercise and training situation, and furthermore as a tool to assess learning from investigations of real events. The success of this approach require that involved actors understand the assessment and acknowledge the assessments and results produced as meaningful input to the services' works.

3 Conclusion

Cooperation in emergency services is necessary in order to achieve a successful emergency response work. It is essential that emergency services has the ability to interact and coordinate resources, as well as learn from exercises. Exercises are significant tools in strengthening skills and improving the cooperative activities between the different agencies involved in crisis management. It is however necessary to study how and if learning takes place as a result of cooperation exercises. The exercise handbook developed in Rogaland is a very good initiative in order to take the cooperative exercises one step further. The intentions and cooperation behind this handbook and its guidelines needs to be maintained and developed.

A main objective with the exercise handbook is to facilitate learning at both individual level and within and across the organisations, as well as identify knowledge gaps and areas where competence needs to be increased. It is therefore needed to evaluate how the handbook provides additional knowledge and competence in the emergency services prevention and management work. Based on the evaluation model presented in this article we wish to examine the correlation between the handbook's exercise concepts and if and how learning is achieved. Our learning evaluation model will be tested in various activities the next year.

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