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Fostering Creativity with Mental Model Templates for Preparations to National Emergencies

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Abstract

National Emergencies set the need for quick responses and actions from all institutions that are responsible for national security and/or citizens' health. Planning for addressing national emergencies in general is characterized by uncertainty, risk, and time pressure. Furthermore, given the infrequent occurrence of emergencies, a significant number of stakeholders lack the necessary experience. Consequently, they need more time to assimilate the incoming information into their mission-planning process and finally to propose the appropriate courses of action. An antidote to the above difficulties can be the appropriate training in combination with the enhancement of the stakeholders' creativity. In order to achieve that, we propose a novel methodology of creating mind map templates, based on creativity techniques, for specific operations that can be applied to national emergencies. Our methodology, called "MEMOS", was developed according to the relative theoretical frameworks and then tested with a case study, including hypothetical security scenarios in national emergency situations. The proposed templates can be used as inspiration tools or idea tanks in order to guide and speed up the process of course of action development in mitigation planning for similar future security operations.

Keywords: Creativity, National Emergencies, Mental Model Template, Mitigation Planning, Scenario-based Training.

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1 Introduction

One of the primary missions of governmental agencies is to remain consistently prepared for emergency responses. Safeguarding citizens, their properties, and the natural environment consistently poses a challenge for stakeholders in any governmental institution. Although it seems that there is plenty of time for preparation for an emergency response, experience has showed that time is never enough (Turoff, 2002). Predicting all the factors of an emergency situation and being fully prepared for immediate action often appear impossible. The specific details that shape the response to each emergency typically emerge shortly before or after the incident. However, exchanging information during an emergency is not always feasible (Pettersson et al., 2021). Thus, the decision-making procedure in emergencies is always under time pressure and uncertainty (Patton & Flin, 1999).

Experience and previous knowledge in handling emergencies are factors that can facilitate the decision-making procedure (Jennex, 2005). As national emergencies occur rarely, experience of

the staff involved in the decision-making procedure is considered negligible. While prior knowledge is beneficial, it's important to note that, in many cases, each new emergency situation is unique, with its own distinct characteristics that may differ significantly from previous incidents. Thus, one way that staff involved in decision-making process can gain experience is through realistic training. More specifically, scenario-based training offers trainees the opportunity to learn and apply their learning to realistic experiences (Errington, 2005).

Conversely, planners typically rely on a range of skills to formulate proposals for courses of action during emergencies. According to Planning Institute of Australia (2004) *'more than any other profession, planners have the skill and insight to understand the relationships between government policy, community needs and expectations, environmental impacts, socially acceptable and spatially oriented outcomes'* (p. 4). Planners' creativity has an important impact both on their thinking process and their total product, an effective plan to deal with the emergency (Higgins & Morgan, 2000). Education in the field of planning should be designed in a way that enhances creative thinking as well as developing problem-solving skills (Royal Town Planning Institute, 1998).

Seeking methods to help stakeholders accelerate their decision process in a creative way when an emergency occurs and in parallel guide them using previous experience and knowledge, we have developed a relevant applied methodology called "MEMOS" (MEntal MOdel Structures). MEMOS integrates creativity techniques with the proactive generation of innovative ideas and proposals, aiming to effectively address emergency situations as they occur. Through this approach, we aspire to make a meaningful contribution to the literature on innovative emergency management similar to Orlikowski & Scott (2021).

The proposed methodology focuses on the creation of intuitive mind map templates for different emergency types by involving participants in realistic scenarios. The goal of MEMOS is to provide a theoretical framework for effectively managing emergencies. By aiding stakeholders in enhancing their preparedness and fostering creative thinking, MEMOS seeks to empower them to effectively handle emergency situations. However, MEMOS cannot be characterised as a comprehensive decision-making tool as it does not include all the necessary steps of a decision-making process. For instance, Boyd's OODA loop model constitutes a method of modelling the decision-making process of individuals and includes the following steps: observe, orient, decide and act (Brumley et al, 2006). According to such an analysis of the decision-making cycle (including the feedback process), MEMOS focuses only on the orientation step. In this respect, we claim that it assists stakeholders involved in emergency management to create their own mental models related to emergency situations and develop their own ideas regarding their management.

In order to test the efficiency of MEMOS, we created two hypothetical scenarios of national emergencies. Then, we asked thirty-two students to propose courses of action as part of mitigation plans for these hypothetical scenarios, following MEMOS procedure. All their suggestions were then collected, analysed and categorized. As a result, we created a mind map template for our hypothetical emergencies. We claim that (a) this training procedure enhance stakeholders' creativity, (b) this mind map can be used from officials who have to propose courses of action in real emergency situations that are similar to our hypothetical scenarios; and (c) the creation of similar mind map templates for other types of emergencies according to the needs, can significantly accelerate the decision-making process.

The rest of the paper is organized as follows: section II defines national emergencies and reviews the related work in mitigation planning in case of a national emergency, the use of scenario-based training and the role of creativity in the planning procedure. Section III describes our proposed methodology. Section IV describes a case study based on our proposed methodology,

presents the experimental setting, the scenario, the tools and the parameters of the study, while section V demonstrates the results. The paper closes with the discussion and conclusion section.

2 Theoretical Framework

2.1 National Emergencies

Emergencies are stress situations that force organizations to function in a manner that is different or alternative from their normal operational procedures (Turoff, 2002). Fortunately, these situations occur infrequently, which contributes to a lack of familiarity. In such instances, stakeholders often face heightened stress due to time constraints for response, as lives are at risk, and there is uncertainty about the unfolding events post the emergency (Van de Walle & Turoff, 2008).

A definition of national emergencies given from The Geneva Centre for the Democratic Control of Armed Forces (DCAF) (2005) is the following: *'A state of emergency derives from a governmental declaration made in response to an extraordinary situation posing a fundamental threat to the country. The declaration may suspend certain normal functions of government, may alert citizens to alter their normal behaviour, or may authorise government agencies to implement emergency preparedness plans as well as to limit or suspend civil liberties and human rights. The need to declare a state of emergency may arise from situations as diverse as an armed action against the state by internal or external elements, a natural disaster, civil unrest, an epidemic, a financial or economic crisis or a general strike'*. The moment the president of a nation declares a national emergency, he/she has the power to surpass any legal limitations or regulations in order to protect the nation. Conversely, citizens should conform to the new reality and obey the commands of the government, in order to protect themselves, the environment and civil liberties.

There are several situations that can be characterized as national emergencies. According to Miller (1992) there are the following categories of general environmental uncertainties:

- Political uncertainties (e.g., war, coup d'état)
- Government policy uncertainties (e.g., price control, trade restrictions)
- Macroeconomic uncertainties (e.g., inflations, changes in relative prices)
- Social uncertainties (e.g., riots, demonstrations)
- Natural uncertainties (e.g., hurricanes, earthquakes)

National emergencies arise periodically, each time presenting unique challenges, often influenced by specific factors such as weather conditions. A notable example is the 2019-2020 Australian bushfire season and its health impacts (Australian Institute of Health and Welfare 2020), as well as the 2019 Atlantic hurricane season (Kalkman, 2023). Moreover, some national emergencies occur for the first time, offering no prior experience in dealing with them. A case in point is the national public health emergency related to Covid-19 (Margherita et al., 2021; Garcia Martinez et al., 2022) in which different countries adopted totally different containment approaches that led to diverse outcomes as these are outlined in the relevant literature (Xylogiannopoulos et al., 2021).

Another type of emergency includes terrorist attacks which are very sensitive situations that a government can consider as a national emergency (Wolbers, 2021). Over time, terrorism has been developed into a threat that knows no geographic or geopolitical boundaries. The face of a terrorist threat may appear as the threat of using weapons of mass destruction, such as atomic bombs or biological weapons or attacks with symbolic meaning such as the murder of a politician, in order to create fear in a community or for political purposes.

Civil unrest is also another situation that can be considered as national emergency, since it includes mass acting ignoring or violating laws. As a result of civil unrest and social instability, governments usually use allavailable means to restore peace and harmony in a society, even violent repression. Data from the 2020 Global Peace Index shows that civil unrest has been doubled over the last decade all over the world (Institute for Economics & Peace, 2020). The categories of civil unrest are nonviolent and violent demonstrations, general strikes and riots. A recent example of civil unrest in U.S. is the Capitol attack from civilians on the 6th of January 2021 or in March 2023, when demonstrations erupted in France in reaction to proposed changes to the pension system (Barrett & Bae, 2023).

Another type of crowd protest is riots. Riots can be broadly defined as a type of contentious collective action, that emerges when individuals or groups without regular access to institutions lashing out in a violent public disturbance against authority, property, or people, on behalf of new or unrecognized rights or to highlight their grievances (Tarrow, 1994). Riots are classified as food riots, police riots, prison riots, race riots, religious riots and sports riots. A recent example of a prison riot happened in Ecuador. On the 23rd of February 2021 riots exploded simultaneously in four prisons in Ecuador where at least 50 inmates were killed. The president of Ecuador declared a state of emergency in the prison system, in order to contain prison violence.

The last three types of national emergencies, terrorist attack against a politician, demonstrations and prison riots belong to social uncertainties, in the context of general environmental uncertainties, according to the categorization of Miller (1992).

Our case study is based on these three types of emergency situations but the proposed mental models methodology can be expanded to deal with other types of emergencies as these were mentioned in the relevant literature.

2.2 Planning for mitigation of National Emergencies

Future events are not always predictable, as future is uncertain (Berkhout & Hertin, 2002). In order to deal with future uncertainties, flexible plans are useful to be developed in a way that can be adjusted to future changes (Malerud & Fridheim, 2018). Furthermore, as the future appears catastrophic with a lot of emergency situations ready to manifest, we must be ready to deal with them at any time (Horn, 2018). Planning in national emergency operations is one of the most important factors that determine the success of the mission. The emergency response from governmental organizations and institutions depends on the type of the emergency, the environment and the scale of impact. As a result, one cannot predict with precision where, how and who are the people and units that must act in an emergency.

In general, emergency response planning is a complex procedure which is mainly based on the experience of the planner in similar past situations, in parallel with the generation of novel ideas to tackle the emergency. However, when mission planning concerns a situation which appears seldom or has never appeared before such as a global pandemic (Xylogiannopoulos et al., 2021), there is a little previous experience that can be applied in the planning process. For this reason, training in planning for emergency situations must be realistic by involving participants in emergency scenarios that might appear in the future. In this way, stakeholders will be knowledgeable about how to act in similar realistic situations (Lima et al., 2020).

According to Van de Walle and Turoff (2008) in emergency management, the major processes are: - Preparedness
- Training
- Mitigation
- Detection
- Response
- Recovery/normalization

In our case, we are interested in preparedness in order to develop a training methodology. The sub – processes of preparedness consist of the following steps (analysis, planning, and evaluation) (Van de Walle & Turoff, 2008):

- Analysis of the threats
- Analysis and evaluation of performance (and errors)
- Planning for mitigation
- Planning for detection and intelligence
- Planning for response
- Planning for recovery and/or normalization

Planning, as part of a decision-making process, belongs to the preparedness phase of emergency management and aims to manage the unexpected situation in a reliable and responsive manner. The first planning procedure that appears in emergency management is planning for mitigation that comes after the analysis of threats and the evaluation of potential risks. Mitigation refers to the ability of detecting an event of emergency before it occurs (Van de Walle & Turoff, 2008). A mitigation plan is useful to be made just after analyzing and evaluating all early warning signals which may point at threats. During the planning procedure, precautionary measures will be suggested to mitigate the possible effects of the identified threats.

It is useful to find out how decisions are made in a planning procedure, in order our emergency training design to be oriented to a more effective and targeted way in decision-making. In general, decisions are made within three directions (Gigerenzer & Gaissmaier, 2011): (a) according to logical thinking, (b) according to statistics and (c) according to heuristic methods. As previously mentioned, an emergency is characterized as a situation that leads citizens to alter their behavior and governments to allow behaviors that are normally prohibited (DCA, 2005). Thus, decision-making according logical thinking in planning of emergencies is not the most appropriate method. Furthermore, when there is lack of experience or lack of previous data in emergencies, statistics cannot help. Thus, heuristics seems to be the main method that should lead planners in decision-making. The heuristic method is a short mental strategy based on information simplification (Muoni, 2012).

There is a significant difference in heuristic methodology, depending on its use in the decision-making process or in the problem-solving process (Deckert, 2017). In a decision-making procedure, heuristics leads to a specific solution of a situation and they usually have a descriptive character (Kahneman & Klein, 2009). On the other hand, heuristics in a problem-solving procedure leads not to specific solutions but to the creation of mental models, consisting of ideas that will lead to solutions (Carlson & Gorman, 1992). More specifically, *'heuristics in problem solving deal with openended problem situations in which the targets are not always clear and there is no obvious rational solutions, and they are prescriptive rather than descriptive'* (Deckert, 2017).

In the proposed methodology, our primary emphasis is on employing heuristics to devise solutions for the selected scenarios. Our objective though is to construct mental models aimed

at mitigating emergencies, rather than prescribing specific solutions, given the often limited availability of precise conditions for any given emergency.

2.3 Scenario-Based Training

A factor that makes decision-making in planning for national emergencies more difficult is that the future is uncertain. Thus, we need to be prepared for multiple, diverse and unexpected events; otherwise, we run the risk of being surprised and found unprepared at the same time (Bishop et. al., 2007). In this context, hypothetical training scenarios can be proved of great value in order to be better prepared to handle an emergency. Scenario-based training is the ability to take complex elements and integrate them into a story that is coherent, systematic, comprehensive and plausible and use it for achieving specific learning outcomes (Erringhton, 2005; 2010).

Scenarios used as tools in the decision-making process can be categorized into *'exploratory'* or *'normative'* (Mietzner & Reger, 2005). Exploratory scenarios, which analyze the present situation and look for actions that will lead to a desired future situation, are mainly used for decision-making in an uncertain future and are based on four assumptions (Berkhout & Hertin, 2002):

- Future is not exclusively a continuation of past relationships and dynamic systems but can also be shaped by human choice and action.
- Future cannot be predicted, however, exploring the future can influence the decisions of the present.
- There is not only one possible future situation; uncertainty requires a variety of future mapping within a "probability space".
- Scenario development involves both rational analysis and subjective judgment. Interactive and participatory methods are therefore required.

Scenario-Based Training uses various scenarios, interactive or not, as key tools of the teaching and learning process (Clark, 2009). This supports active learning strategies (such as problem-solving) and gives trainees the opportunity to learn and apply their learning to realistic experiences (Errington, 2005). Trainees work through a story, based on a problem situation that they need to solve. In other words, trainees apply their knowledge, critical thinking and problem-solving skills in a safe learning environment (realistic learning environment). Erringhton (2010) points out that scenario-based learning strategy is a methodology that aims to promote deep learning and awareness by involving trainees in realistic critical events, where they are forced to take into account a wide range of factors and decisions or think about the results and what they have learned.

As a problem-solving procedure, scenario-based training requires that a specific situation must firstly be recognized as problematic. The Osborne-Parnes Creative Problem-Solving Process highlights that there are six stages in a creative problem-solving process as following (Parnes, 1981):

- Mess-finding (Objective finding)
- Fact-finding
- Problem-Finding
- Idea-finding
- Solution-finding (Idea evaluation)
- Acceptance-finding (Idea implementation)

Objective finding, fact finding and problem finding constitute the first stages in the creative problem-solving process, because they are the starting point of the solution process. Furthermore, the quality of the problem finding determines the quality of the solutions (Runco & Okuda, 1988). Furthermore, idea finding, idea evaluation and idea implementation constitute the second half of the problem-solving process and they are mainly based on the creativity of the stakeholders (Puccio & Cabra, 2012). More specifically, idea finding is about coming up with many blind variations to solve a problem while idea evaluation examines how practical, useful or relevant each idea is.

Concerning the problem-finding procedure, problems can be categorized as "given problematic situations" and "problem search situations", depending on the amount of the initially given information (Csikszentmihalyi & Getzels, 1971). Problem search situations ensure that individuals are motivated internally, as they are engaged in problem-finding procedure and work on topics of their own choosing (Runco & Nemiro, 1994). So, they are expected to have an intrinsic motivation. Unstructured problems which offer little initial information, such as just the objective of a given situation, constitute a good chance for individuals to enhance their creativity in problem-solving. A given objective which will be the initial point to engage participants in a creative problem-solving procedure must answer the question *'what is the goal, wish, or challenge upon which you want to work?'* (Parnes, 1981).

A key feature of the scenario-based training strategy is that trainees use a variety of learning activities to improve their skills. The sequence of learning activities in which they are involved, leads them to discover the learning objects on their own (Burden & Byrd, 2010). Furthermore, trainees who perform carefully constructed and authentic learning activities in a scenario are meticulously guided to learn the relevant concepts and processes as well as to develop their heuristic experiences (Clark, 2009).

We believe that scenario-based training, is the appropriate technique for our proposed approach. This method proves effective in enabling participants to cultivate their own experiences (Erringhton, 2005; 2010) in emergency situations characterized by uncertainty and unpredictability (Van de Walle & Turoff, 2008).

2.4 Creativity in the planning procedure

Despite there being a substantial amount of literature on the term creativity, a nearly unanimous consensus among experts in this domain is that creativity involves originality (Runco, 2004). The National Advisory Committee on Creative and Cultural Education (NACCCE) (1999, item 29) described creativity as '*imaginative activity fashioned so as to produce outcomes that are both original and of value*'. In general, creativity can be defined as the development of novel and useful ideas of any kind and in any domain (Amabile et al., 1996). As initial studies focused more on the individual creativity, the last twenty years there has been an increasing awareness of the social dynamics involved in creativity (Jeffrey & Craft, 2001).

Creativity depends mainly on divergent thinking ability and can be analyzed by examining four main characteristics of human responses to problems (Torrance, 1966; 2001):

- ***fluency:*** the number of relevant responses
- ***flexibility:*** the number of different categories or shifts in responses
- ***originality:*** the number of unusual yet relevant ideas, as determined by statistical infrequency
- ***elaboration:*** the number of details used to extend a response

Furthermore, creativity may be practiced and developed through the use of tested teaching techniques either on individual or team level (Taylor, 1972). The use of techniques for developing creativity allows people to consider a wide range of alternative solutions to every problem and to improve productivity and work quality. Moreover, creativity techniques are methods that promote original thoughts by facilitating divergent and convergent thinking and can be facilitated by the use of Information Computer Technology (ICT) (Clements, 1995).

There are a lot of creativity techniques in the literature. Some examples of the most frequently used techniques are the following (Stein et al., 2014):

- Copycat (searching for same circumstances and acting with the same way)
- Picture tickler (looking relevant pictures and trying to be inspired of solutions)
- Expert excitation (considering what experts in a domain suggest and try to find a solution according to that)
- Synectics (trying to find out how a circumstance is connecting with other thing maybe will lead you to a solution)
- Morphological analysis (analysing the components of a situation will help to arise new ideas)
- Storyboard (posing the given facts in a logical way and try to guess the end)
- What if (trying to answer random hypothetical questions)

An effective emergency management is based on improvisation, including social activities that are carried out in non-routine, typical or unexpected ways (Mendonca et al., 2001; Kendra & Wachtendorf, 2003). For this reason, emergency response officials and planners should encourage creativity rather than been reluctant of suggesting anything new or unusual (Webb & Chevreau, 2006). In an emergency situation creativity is cultivated during the planning stage as well as at the stages of implementation, response and post learning (Kendra & Wachtendorf, 2002). Especially, at the planning stage, creativity acts as a catalyst for improvisation (Kendra & Wachtendorf, 2002).

Creativity may lead stakeholders in emergencies to make efficient decisions even in unprecedented situations (Higgins & Morgan, 2000). Every idea that is unusual, unconventional or unique from past decisions can be characterized as a creative choice which can lead to a solution of a problem in an emergency (Sommer & Pearson, 2007). Training for planners in order to enhance creativity in emergencies should be organized in a practical way with scenarios that simulate realistic uncertain situations rather than theory based learning (Bastian, 2008).

The proposed methodology integrates creativity in the training process. Training that emphasizes idea generation in order to vouch for innovative solutions in unprecedented situations can be an important part in every emergency.

3 Proposed Methodology

As we have discussed earlier, national emergencies are situations that are characterised by stress, uncertainty, time pressure and risk (UN, 2004). In addition, because they seldom appear, there is no relevant experience in mitigating this kind of situations by the staff involved in the decision-making process. Moreover, it is crucial to mitigate an emergency when it just appears and certainly before its climax (Twigg, 2003). So an effective mitigation plan is necessary.

Guidance based on experience can assist stakeholders in devising prompt and efficient plans. Consequently, we propose a training methodology for mitigation planning in national emergencies

with the following objectives: a) providing involved staff with practical experience in emergency scenarios, and b) fostering the development of mental models that encompass ideas and choices for courses of action within hypothetical contexts. These mental models serve as valuable tools for inspiring individuals tasked with proposing courses of action for future mitigation plans. The proposed mental model is designed to address challenges posed by limited time or lack of experience.

It is crucial to distinguish between deciding and choosing, as planning involves a decision-making process that arises from the presence of various alternatives (Beresford & Sloper, 2008). According to Weizenbaum (1976) and Loeb (2021) "deciding" is a computational activity, something that can ultimately be programmed but "choice" is the product of human judgment. In an emergency, deciding cannot be programmed since there are a lot of uncertainties and thus for an effective decision-making procedure it is helpful to have a lot of choices available that have been produced using human judgment. Our methodology aims to provide pertinent ideas for mitigating emergencies. In essence, it seeks to furnish multiple options in the decision-making process for addressing emergency situations.

Our effort is focused on creating an innovative decision-making process distinct from traditional approaches. Specifically, the proposed methodology aims to assist stakeholders to overcome the challenges posed by time constraints by providing readily applicable ideas as solutions for specific problem situations. These ideas (solutions) have been meticulously designed for our hypothetical scenarios mirroring real national emergencies, prepared well in advance. Engaging stakeholders in the creation and exploration of these hypothetical scenarios not only equips them with valuable experience but also enhances their preparedness to tackle analogous real-life situations.

Figure 1 presents the overview of the proposed methodology for creating mental models for mitigation planning in national emergencies, called "MEMOS" (MEntal MOdel Structures).

In Figure 1, the central column outlines the primary steps of the MEMOS methodology, including the development of the training environment, the creative problem-solving process, idea categorization, and mental model creation. Comprehensive details for each step are supplied, such as the development of the training environment, where the fundamental elements of the scenarios are presented. The same approach is applied to the subsequent steps, involving the presentation of the fundamental elements for each stage. The left side of the figure illustrates the actions undertaken by trainers in each step, while the right column outlines the corresponding steps for the trainees.

The first step of our proposed methodology is the preparation of the *'training environment'*. Trainers make hypothetical scenarios in which trainees are engaged with their previous experience (real or training). The training environment focuses on the desired results, based on realistic situations, characterised by ambiguity/uncertainty and concluding on a challenge or an objective. The second step is the *'creative problem-solving procedure'* that needs to be followed by the participants. Trainers should first introduce the theory of the decision-making procedure to trainees and subsequently engage them in scenarios where they take on the role of officials. In this capacity, trainees are tasked with proposing courses of action that will be incorporated into mitigation plans. Trainees should initially work independently and later collaborate in teams. Furthermore, they should experience working without time constraints initially and then transition to performing tasks under time pressure. This will lead to a variety of course of action suggestions. The creative problem-solving process culminates in the idea production stage, facilitated by creativity techniques. This stage is characterized by the utilization of information as an inspiration tool, ultimately resulting in a collection of suggested ideas. The third step is *'idea categorization'*. Trainers collect all the suggested courses of action from the previous step and attempt to identify their main ideas

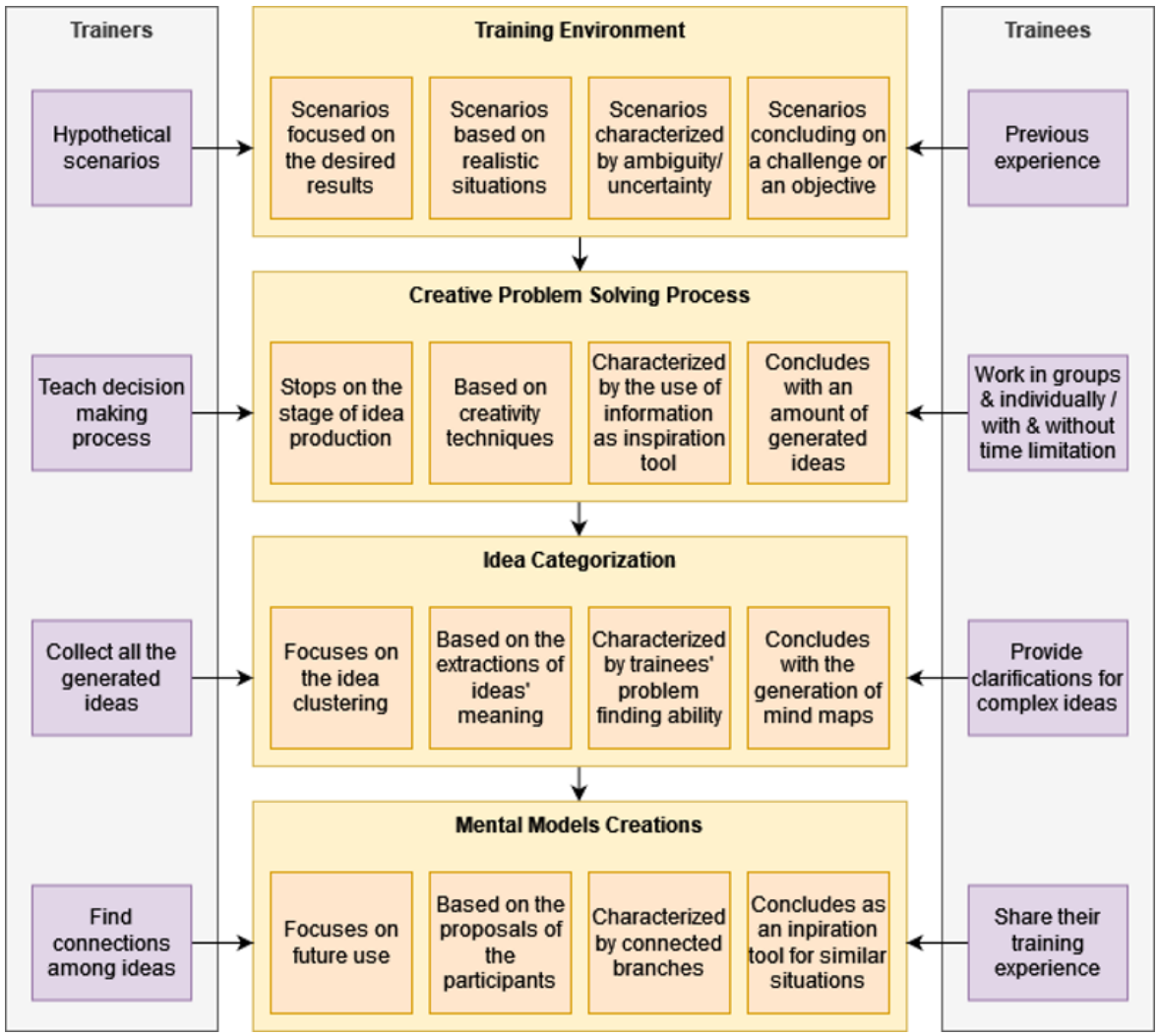

Figure 1. "MEMOS" methodology

and classify them accordingly. In the same step, trainees provide clarifications to trainers regarding their complex ideas (if there is such a case), in order to better define their suggested courses of action. Idea categorization involves grouping ideas based on the extraction of their meaning and relies on the problem-finding ability of the trainees. As trainers organize the clusters of ideas in an image, the idea categorization step concludes with the mental model template creation, which is the last step of the proposed methodology. In this step, trainers find connections among trainees' clusters of ideas. The developed mental model, derived from the participants' training experiences, can serve as an inspirational tool for addressing similar situations in the future.

To evaluate our proposed methodology, we conducted a case study. We opted for the case study approach as it facilitates comprehensive explorations of complex issues within their real-life contexts (Yin, 2009). Emergencies are inherently complex due to high risks, uncertainties, and time pressure (Van de Walle & Turoff, 2008). In our case study, students actively participated in real-life hypothetical emergency scenarios, allowing us to assess their fluency and originality in idea creation. The specifics and outcomes of the study are elaborated in the following section.

4 Case Study

4.1 Description

The study took place at the Hellenic Air Force Academy (HAFA) in the context of one-week online course related to the European Common Security and Defense Policy (CSDP) offered to international civil and military students. More specifically, twenty-two cadets from military academies and ten students from civil universities studying International Relations (21 male and 11 female participants in total) coming from seven different European countries (Greece, Italy, Romania, Portugal, France, Bulgaria and Poland) were invited to provide solutions to a number of real CSDP mission scenarios (EEAS, 2021) in which they had no previous experience. CSDP aims at fighting against insecurity and conflict in European Union. More specifically, *'CSDP enables the Union to take a leading role in peace-keeping operations, conflict prevention and in the strengthening of the international security. It is an integral part of the EU's comprehensive approach towards crisis management, drawing on civilian and military assets'* (EEAS, 2021).

Our study took place the last two days of the module. Participants had been attended three days of lectures relevant to CSDP missions, before they participated to our study. The study was organized in two phases. In the first phase (phase A), every participant had to express ideas individually, as potential solutions for mitigation planning to a given scenario of a CSDP mission. The ideas were submitted electronically to the course instructors using an open-question form. In the second phase (phase B), an online lecture presenting decision-making strategies and creativity techniques took place using a synchronous teleconference platform. In the lecture, plenty of examples of social media platforms that can enhance creativity were also demonstrated. Then, the participants forming teams consisted of four members were asked to remotely collaborate using an online collaborative platform and in parallel discussing their ideas using the same synchronous teleconference platform used for the presentations. The aim of the collaborative task was to express their ideas for mitigation planning in a given scenario of a CSDP mission, different from the scenario they had processed in the first phase. The deliverable of the study was a collection of proposed courses of action in mitigation planning for particular national emergencies scenarios, in order to create a mind map template.

The development of courses of action in the mitigation planning of a CSDP scenario represents a practical activity for participants in the experiment. These participants are likely to be stakeholders in comparable real situations in the future. The task requested did not entail detailed mitigation plans for CSDP missions but rather focused on presenting key ideas for addressing the emergency situation outlined in the scenario. The evaluation of each idea (recommended course of action) was not examined. There was not any restriction in idea production. In every phase of the study, different scenarios (challenges) were used.

4.2 Comprehensive Result Approach

We used a comprehensive approach to collect a variety of suggested courses of action. During phase A, participants operated individually and faced no time restrictions when proposing courses of action. They received their mission through an electronic form and were free to respond at their own pace. In phase B, the same participants worked in teams and they had to suggest their proposals in limited time. Moreover, in phase B, teams were encouraged to use creativity techniques and information ticklers from social media platforms as inspiration tools. In other words, we collected information from social media platforms and we used them as inspiration tools in creative techniques, with the purpose to enhance their creativity and their problem finding skills. The creativity techniques and social media platforms used in phase B are shown in Table 1.

Table 1. Creativity techniques and social media platforms used in phase B

Creativity Technique	Social Media Platform	Social Media Object
Copy cat	YouTube	Videos
Picture tickler	Google Pictures	Pictures
Expert excitation	BrainyQuote	Quotes
Sinectics	Google Maps	Map information
Morphological analysis	Dictionary	Definitions
Storyboard	X (Tweeter)	Pictures & stories
What if	Instagram	Pictures & stories

4.3 ICT Platforms used in the course

Restrictions due to the COVID-19 pandemic did not allow our course to take place in a classroom. Thus, we used a variety of ICT platforms in order to achieve our goals and simulate as much as possible a face-to-face classroom. Regarding the ICT platforms, *'Google forms'* were used for collecting the individual's initial ideas in scenarios in phase A. *'Big Blue Button (BBB)'* was the main teaching platform that was used for synchronous communication for the presentation of the theoretical parts of the lectures but also during the syndicate work with the breakout sessions in phase B (Figure 2). *'Milanote'* was also used as an online collaboration platform and it was setup as a common space for collaboration. The board of each collaboration space contained the scenarios of the mission, cards with a short description of each of the different creativity techniques that had been presented during the lectures and white space in each card to write down any ideas that had been produced using the specific creativity technique. Links to social media platforms or other online resources were also provided to facilitate the quick access of the students to the specific resources in phase B. The collaboration space in *'Milanote'* can be seen in Figure 3. All the participants and the instructors were able to communicate only via the above-mentioned ICT platforms during the course.

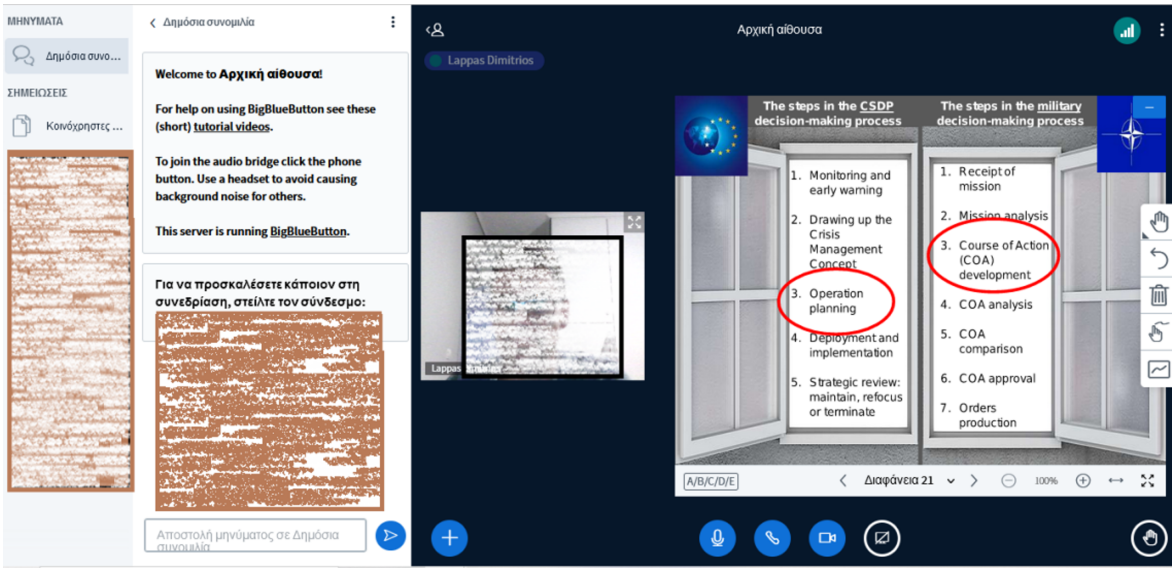

Figure 2. The "Big Blue Button" teaching platform

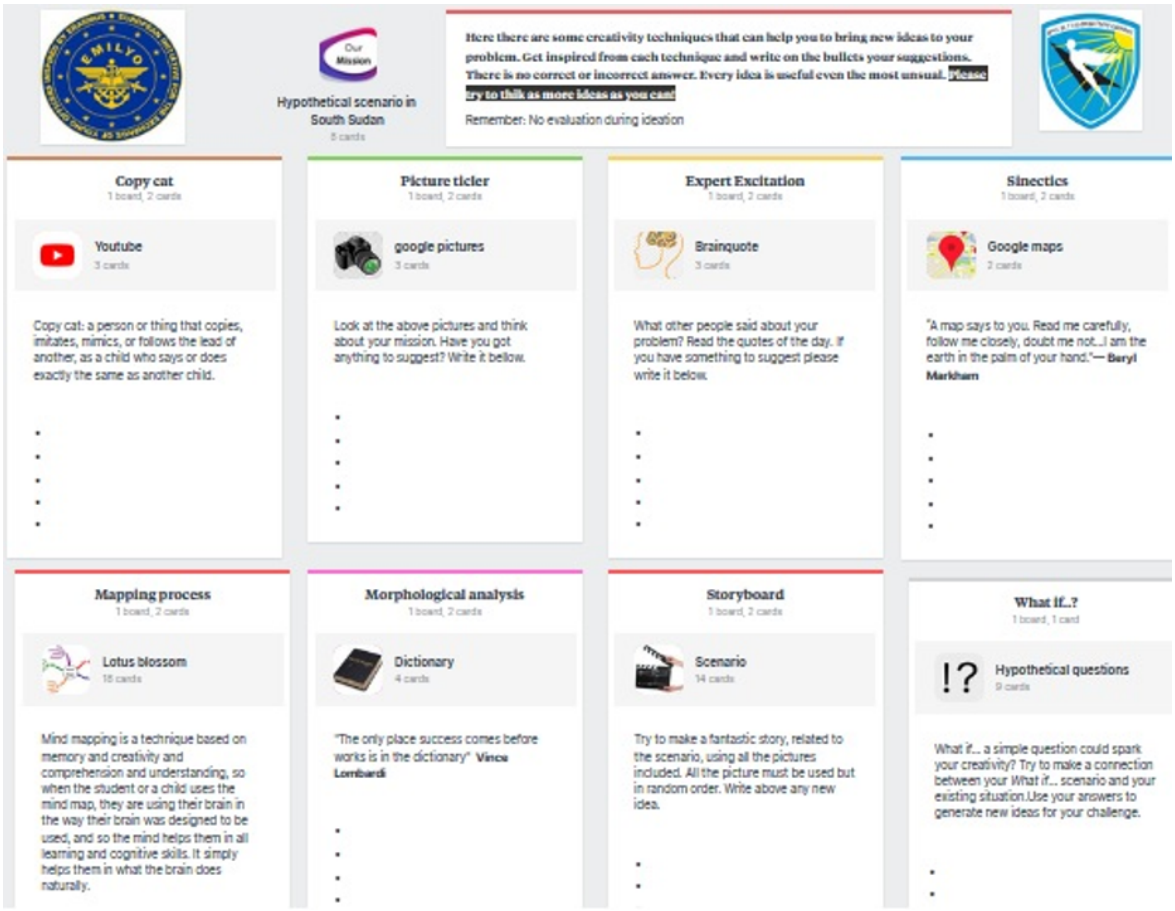

Figure 3. The collaboration space as it was set up in "Milanote"

4.4 Scenarios

The application of MEMOS started with the creation of the two scenarios. Each given scenario was segmented into two challenges, requiring participants to put forth courses of action. More specifically, the two scenarios were the following:

Hypothetical scenario in phase A

> *'A foreign dignitary will visit Palestine tomorrow in order to meet official political persons. There is a piece of information that terrorist teams will attempt to attack the foreign dignitary before his arrival to the presidential palace. There have also been scheduled demonstrations against his arrival in the same area. Special Police and Military Forces are asked to take over the security operation. As an EU official, you are invited to suggest innovative proposals that will help the local authorities to plan the security measures for the protection of the dignitary.'*

More specifically, the challenges posed by the specific scenario were the following:

a) Terrorist teams will attempt to attack the foreign dignitary before his arrival to the presidential palace.
b) Demonstrations against foreign dignitary's arrival will take place around the presidential palace.

Hypothetical scenario in phase B

'Across Europe, a rebel that killed more than 100 people in Juba (Sudan's capital) in the 2013-14 crisis, was arrested two days ago. The guerrilla will be transferred, from Europe to Juba, by air and then to Yei town by an internal flight. Then, he will be transferred to Yei's prison where he will serve his sentence. Relatives of the victims during the 2013-14 crisis are expected to protest against the arrival of the guerrilla. They have already demanded for a death penalty and not just his imprisonment. Many of them have arranged a rally against him at the Yei's airport, during his arrival. There are also reports that actions against him will take place upon his arrival. On the other hand, prisoners of Yei's prison center are about to start an uprising and, after taking the situation into their own hands, they are going to execute him exemplarily. The government intends to take all the necessary measures to avoid this tough situation and seeks assistance from the European Union to ensure the safe transport of the detainee to prison and to ensure his safety in prison. As an EU official, you are invited to propose innovative ideas that will help the design of the security aspects of this mission, both on arrival at the airport and during the imprisonment.'

The challenges set by the specific scenario were the following:

a) Relatives of the victims will try to attack the guerrilla at the airport.
b) Prisoners are about to arrange a prison riot.

5 Results

5.1 Idea categorization using MEMOS

Participants' responses were initially gathered, and the primary idea for mitigating the emergency outlined in the scenario was extracted. Subsequently, responses were categorized based on the fundamental idea proposed as a course of action. Given that the presented problems were unstructured, participants were presented with a challenge containing minimal information, compelling them to identify objectives and define the problems to be addressed in their assigned missions. Therefore, the first task was to identify objectives. Following this, participants sought relevant facts and information to define the problem. Ultimately, they proposed courses of action based on their problem-solving process.

For example, to the given challenge *'terrorist teams will attempt to attack the foreign dignitary before his arrival to the presidential palace'*, a team suggested four courses of action in mitigation planning as following:

- *'The convoy of cars transferring the foreign dignitary should use an unpredictable route.'*
- *'Traffic ban should be imposed around presidential palace.'*
- *'Use of an armored vehicle is necessary.'*
- *'A helicopter overseeing the transportation of the foreign dignitary should be used.'*

The above proposals were the answers of the following problems defined by participants:

- How can we be unpredictable during the car transfer?
- How can we create a safety environment around presidential place?
- What if a terrorist shoot the VIP car?

- How can we have the best information of what happens around the convoy?

Furthermore, by analyzing the above answers, it appears that the main ideas they expressed are deception (alternative route), traffic control (traffic ban), special equipment (armoured vehicle) and surveillance (use of a helicopter). In a similar way, all the answers collected (353 totally), were clustered in seven categories: Information, Surveillance, Deception, Police Control, Traffic Control, Secrecy and Special Equipment.

Moreover, there were answers (17 in total) that did not belong to any of these aforementioned categories. These answers were characterised as *'other'*. An example of an idea in this category is the following course of action in preventing prison riot: *'relatives of the prisoners should be invited to visit prisoners, in order to ask them not to riot but wait for their release from prison which may come very soon. That action might lead prisoners to revisit the idea of participating in the riot'*.

By aggregating all participants' ideas and applying the final step of MEMOS, we formulated a mental model for mitigation planning in security missions, pertinent to those explored in our case study. This mental model serves as a checklist for the swift and effective generation of mitigation plans for future emergency situations, encapsulating the perspectives of 32 individuals. Figure 4 illustrates the evolved mental model (step 4 of MEMOS), crafted through the classification process (step 3 of MEMOS) of the mitigation proposals collected during our case study.

Figure 4 adopts the shape of a lotus blossom, chosen for its clarity in conveying the essence of our mental model template to a broad audience. At the heart of the figure (a white circle outlined in blue) resides the core purpose of the template, posing the question of precisely what we aim to achieve. In our specific instance, the purpose is Mitigation Planning for Security Missions. Surrounding the central circle are smaller colored circles linked to the main circle by thick lines. Each colored circle represents the category of the ideas on how to address the primary purpose of our template These categories are derived from clustering participants' responses in step 3 of MEMOS. Finally, all the colored circles are interconnected by same-colored rectangles, each expressing specific ideas pertinent to the idea category in the colored circles. These ideas present the concrete courses of action that could potentially be adopted in the planning process to mitigate a similar emergency situation as the one depicted at the center of the visualization. For instance, in a mission aimed at safeguarding a convoy of political figures en route to the EU Parliament from a potential terrorist threat, we can focus on a single idea category or a combination of them to mitigate the security threat. More specifically, we can select the *'Deception'* category and apply the *'Alternative car route'* idea. The former can be used in combination with the *'Traffic ban'* idea from the *'Traffic control'* category. Finally, we can extend the mitigation plans by adding the *'Helicopter Surveillance'* idea from the *'Surveillance'* category.

5.2 Creativity Assessment

Given the significant role of creativity factors in emergency management (Higgins & Morgan, 2000), it is intriguing to explore whether this influence can be observed in our research. When comparing the two phases, a notable distinction in the fluency of ideas became apparent. To be more specific, participants in phase B, collaborating in teams and employing the creativity techniques provided on the online collaborative platform, surpassed the number of ideas generated in phase A (phase A: 160 ideas, phase B: 193 ideas, totally 353 as mentioned in section 5.1). While the disparity in idea fluency between the two phases does not reach statistical significance, it becomes interesting when considering that, in phase B, teams had considerably restricted time to articulate their ideas. This stands in contrast to phase A, where individuals could freely express their opinions by completing the Google form without any time constraints. Additionally, in

Figure 4. Mental model template for mitigation planning in security missions

phase B, it was observed that there was more extensive elaboration of their ideas throughout the development of the courses of action. It is estimated that the extent of idea elaboration was the result of teamwork, where team members wanted to present the details of their proposals to the other members. Comparing idea flexibility between the two phases is not viable as specific problems with predefined conditions were provided, restricting participants to suggest solutions solely within those parameters. Finally, there were more original ideas in phase B than in phase A (in phase A there were 3 original ideas and in phase B there were 14 original ideas). An idea was characterized as original if it did not belong to any of the answer group of ideas, as they were categorised from the trainee's answers (Torrance, 1966; 2001).

To statistically compare the observed difference in the number of original ideas (3 in phase A versus 14 in phase B), we employed Pearson's chi-squared test (X^2), a statistical method used for sets of categorical data. This test assesses the likelihood that any observed difference between the sets occurred by chance. Notably, the disparity in the number of original ideas was found to be statistically significant, in this case as X^2 $(1, N = 353) = 5.5214$, $p = .018785$, $p < .05$ (N: the number of samples in both phases; a p-value less than 0.05 is typically considered to be statistically

significant). The aforementioned statistical findings indicate that creativity (generation of original ideas in our case) can be augmented by implementing the MEMOS methodology.

6 Discussion

The greater the number of alternatives developed in a decision-making process, the higher the likelihood that one of them will lead to the desired final situation (Torrance, 1966; 2001). However, developing alternative courses of action in emergencies presents challenges, primarily due to time constraints and often, limited experience among the staff involved in the decision-making process (Jennex, 2005; Patton & Flin, 1999). Providing guidance in the development of alternatives through ready-made choices serves as a catalyst in the decision-making process.

In our endeavor to provide valuable aids to emergency planners, we have formulated the MEMOS methodology. This method revolves around scenario-based training and the application of creativity techniques to construct mental model templates for alternative solutions within the decision-making process. Our proposed methodology offers a structured approach, enabling trainees to enhance their creativity and problem-solving skills through hypothetical emergency scenarios. Subsequently, trainers compile trainees' responses and create mental model templates by conceptually linking the provided answers. These templates can enhance future decision-making processes in emergencies (Van de Walle & Turoff, 2008).

To further elaborate on this, stakeholders engaged in devising solutions for emergencies, aiming to be thoroughly prepared and responsive in every situation, can benefit from employing our methodology. The initial step involves crafting hypothetical scenarios that closely resemble the anticipated emergency. Following this, organizers should assemble a group of individuals to participate in the discussion of these scenarios. Utilizing creativity techniques, participants will propose solutions to address the hypothetical emergency. All generated ideas will be systematically collected and categorized based on their main characteristics. This compilation of ideas for each emergency can then be stored and readily accessed in the event of an occurrence of such an emergency.

In our effort to evaluate our methodology, we devised two hypothetical scenarios depicting national emergencies, encompassing a terrorist attack, demonstration, and prison riot. Subsequently, we systematically followed the steps outlined in the MEMOS methodology, ultimately constructing a mental model template. This template incorporates ideas for the development of courses of action in mitigation planning specifically tailored for the security missions mentioned.

While we do not claim that this template will singularly guide planners to discover the optimal solutions for their planning challenges, we firmly believe it serves as a valuable starting point in seeking creative alternatives to security challenges. This template encapsulates ideas suggested by 32 participants trained to function as planners in security missions. Certainly, our case study has inherent limitations. Firstly, it necessitates testing across more emergency cases to fortify the results. Secondly, the findings of our case study must be evaluated by individuals with experience in the emergency domain to determine the effectiveness and feasibility of the proposed ideas. Lastly, owing to the constraints imposed by the COVID-19 pandemic, our study was conducted via internet collaboration platforms and has not been tested in a group of individuals collaborating in person. The latter might have impacted the idea generation process, as it remains uncertain whether all participants actively contributed on the online collaboration platform. In a comparable team collaborating in person, it's possible that all participants were more engaged, leading to increased productivity.

7 Conclusions

Enhanced preparedness for handling emergencies translates to a more effective response when required (Turoff, 2002; Patton & Flin, 1999). Essentially, well-prepared emergency responders can intervene proactively both before and during emergencies, safeguarding lives and property. While we all wish for emergencies to never occur, reliance solely on hope is inadequate. It is imperative for all stakeholders involved in emergencies to be adequately prepared to address any potential future emergency. Elaborate advanced planning may not necessarily be the optimal preparation, given that each emergency possesses its unique characteristics. Even the most adaptable plans necessitate time for adjustment to new challenges. Conversely, the critical factor in adapting existing plans may lie in the expertise and experience of personnel, which may prove invaluable. For these reasons, we propose a methodology to deal with future uncertainties, using distilled knowledge created during scenario-based training. The outcomes of the proposed methodology will save time and assist personnel who are involved in decision-making process to think creatively, regardless of their experience level.

Our MEMOS methodology aims to enhance stakeholders' creativity and planning skills, as well as their ability to deal with an emergency. More specific, MEMOS methodology focuses on the creation of mental model templates for any future emergency. Trainees are called to participate in a well-designed training environment with hypothetical scenarios as challenges. Their responses to the challenges should be analyzed and clustered by the trainers in order to create the mental model templates. In this way, the mental model templates offer alternative choices, in the form of ideas for courses of action. Proposed choices can be used in similar future situations as inspiration tool in the planning process, since they do not include plan details, but just ideas that can act as ticklers in the plan development. In this manner, participants engaged in MEMOS will elevate their creative capabilities. As part of our future research, we intend to simulate each idea put forth by participants to evaluate the effectiveness of every proposed solution.

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8 References

Amabile, M., Conti, R., Coon, H., Lazenby, J., & Herron, M., (1996). Assessing the Work Environment for Creativity. *Academy of Management Journal*, vol. 39, no. 5, pp.1154–118.

Australian Institute of Health and Welfare 2020. Australian bushfires 2019–20: Exploring the short-term health impacts. Cat. no. PHE 276. Canberra: AIHW.

Barrett, M. P. & Bae, E. (2023). *Reported Social Unrest Index: May 2023 Update*. International Monetary Fund.

Bastian, M., (2008). *Emergency response: Creativity and training*. Texas A & M University ProQuest Dissertations Publishing, 2008.3347884.

Beresford, B., & Sloper, P. (2008). *Understanding the dynamics of decision-making and choice: A scoping study of key psychological theories to inform the design and analysis of the panel study*. York: Social Policy Research Unit, University of York.

Berkhout, F. & Hertin, J., (2002). *'Foresight futures scenarios'. Developing and Applying a Participative Strategic Planning Tool*. University of Sussex. Sussex, UK.

Bishop, P., Hines, A. & Collins, T., (2007). *The current state of scenario development: an overview of techniques*. *Foresight*. Vol. 9 No. 1, pp. 5-25.

Brumley, L., Kopp, C., & Korb, K., (2006). The Orientation step of the OODA loop and Information Warfare. Retrieved from https://www.academia.edu/37923255/The_Orientation_step_of_the_OO6DA_loop_and_Information_Warfare.

Burden, B, P. & Byrd, D., (2010). *Methods for effective teaching: Meeting the needs of all students (5th Ed.)*. New York: Allyn & Bacon.

Carlson, B., & Gorman, E., (1992). A Cognitive Framework to Understand Technological Creativity: Bell, Edison, and the Telephone. In R.J. Weber & D.N. Perkins (eds.).
Inventive Minds. Creativity in Technology (48-79). Oxford: Oxford University Press

Clark, R., (2009). Accelerating expertise with scenario based learning. *Learning Blueprint*. Merrifield, VA: American Society for Teaching and Development.

Clements, D., (1995). Teaching creativity with computers. *Educational Psychology Review, 7*(2), 141-161.

Csikszentmihalyi, M., & Getzels, J. W., (1971). Discovery-oriented behavior and the originality of creative products: A study with artists. *Journal of Personality and Social Psychology, 19*(1), 47–52.

Deckert, C., (2017). *Creative Heuristics. A Framework for Systematic Creative Problem Solving*. Working Paper. Hochschule Düsseldorf.

EEAS, European External Action Service (2021). Military and civilian missions and operations. Retrieved from: https://www.eeas.europa.eu/sites/default/files/documents/2024/EU-mission-and-operation_2024.pdf.

Errington, E., (2005).*Creating Learning Scenarios: A planning guide for adult educators.* Palmerston North, NZ: CoolBooks.

Errington, E., (2010). *Preparing Graduates for the Professions Using Scenario-based Learning.* Australia: Post Pressed.

Garcia Martinez, M., Bezos Daleske, C., Benítez León, Á., Lalanza Rodelgo, S. M., Orive Espinosa, R., Rubio López, P., & de Hoyos Aragoneses, V. (2022). Empowering patients to co-design Covid-19 responses: the role of online health communities. *R&D Management, 52*(2), 391-406.

Geneva Centre for the Democratic Control of Armed Forces (DCAF). Backgrounder: Security Sector Governance and Reform. October 2005. States of Emergency. Retrieved from: https://www.dcaf.ch/sites/default/files/publications/documents/DCAF_BG_1_Security_Sector_Governance_EN.pdf

Gigerenzer, G. & Gaissmaier, W., (2011). Heuristic Decision Making. *Annual Review of Psychology.* 2011. 62:451–82.

Horn, E., (2018). *The Future as Catastrophe: Imagining Disaster in the Modern Age*. Columbia University Press.

Higgins, M., & Morgan, J., (2000). The role of creativity in planning: The 'creative practitioner'. *Planning Practice and Research*, *15*(1-2), 117-127.

Institute for Economics & Peace. Global Peace Index 2020: Measuring Peace in a Complex World, Sydney, June 2020. Retrieved from https://www.visionofhumanity.org/wp-content/uploads/2020/10/GPI_2020_web.pdf

International Strategy for Disaster Reduction. (2004). Living with risk: A global review of disaster reduction initiatives. pp. 330–34.

Jeffrey, B., Craft, A., (2001). The universalization of creativity. In A. Craft, B. Jeffrey, & M. Leibling (Eds.). Creativity in education (pp. 1-13). London: Continuum International Publishing Group.

Jennex, E., (2005). What is knowledge management? *International Journal of Knowledge Management, 1*(4), iiv.

Kahneman, D., Klein, G., (2009). Conditions for Intuitive Expertise. A Failure to Disagree. *American Psychologist.* 64 (6), 515-526

Kalkman, J. P. (2023). Radical and Swift Adaptive Organizing in Response to Unexpected Events: Military Relief Operations after Hurricane Dorian. Academy of Management Discoveries, (ja).

Kendra, J., & Wachtendorf, T., (2002). Creativity in Emergency Response After The World Trade Center Attack.

Kendra, J., & Wachtendorf, T., (2003). Creativity in emergency response after the World Trade Center attack, *Beyond September 11th: An Account of Post-Disaster Research*, Special Publication, Natural Hazards Research and Applications Information Center, University of Colorado, Boulder, Co., No. 39, pp.121–146

Lima, F., Raiol, I., Vasconcelos, T., Quintino, A., Pinho, K., Pimenta, R., Ribeiro, R., Silva, V., Soares, A., Nylander, B., Tangerino, T., Feio, A., Sousa, J., Santos, T., Reis, B., Ueno, T., Oliveira, B., Cardoso, D., Costa, M., Caldeira, M., Sousa, B., Coelho, R., Dias, P., Santos, L., Moraes, A., Pacífico, M., Pinto, L., Cruz, M., Soares, T., Bezerra, A., Aguiar, V. and Medeiros, L. (2020). The use of realistic simulation in the training of lay people in Basic Life Support: experience report. *International Journal of Advanced Engineering Research and Science*, 7(9), pp.346-350.

Loeb, Z. (2021). The lamp and the lighthouse: Joseph Weizenbaum, contextualizing the critic. *Interdisciplinary Science Reviews, 46*(1-2), 19-35.

Malerud, S. & Fridheim, H., (2018). Security risk and vulnerability analysis in military operational planning: The why's and how's. *Safety and Reliability – Safe Societies in a Changing World – Haugen et al. (Eds) Taylor & Francis Group, London, ISBN 978-0-8153-8682-7.*

Margherita, A., Elia, G., & Klein, M. (2021). Managing the COVID-19 emergency: A coordination framework to enhance response practices and actions. *Technological Forecasting and Social Change*, 166, 120656. doi:10.1016/j.techfore.2021.12065

Mendonca, D., Beroggi, G.E.G. and Wallace, A., (2001) 'Support for improvisation during emergency response operations', *International Journal of Emergency Management*, Vol. 1, pp.30–38.

Miller, K., (1992). A Framework for Integrated Risk Management in International Business. *Journal of International Business Studies, 23*(2), 311 331.

Mietzner, D. & Reger, G., (2005) 'Advantages and disadvantages of scenario approaches for strategic foresight', Int. J. *Technology Intelligence and Planning*, Vol. 1, No. 2, pp.220–239.

Muoni, T., (2012). Decision-making, intuition, and the midwife: Understanding heuristics. *British Journal of Midwifery*, January 2012, Vol 20, No 1.

National Advisory Committee on Creative and Cultural Education (NACCCE) (1999). All our futures: creativity, culture and education, *Department for Education and Employment*, London.

Orlikowski, W. J., & Scott, S. V. (2021). Liminal innovation in practice: Understanding the reconfiguration of digital work in crisis. *Information and Organization, 31*(1), 100336.

Patton, D., & Flin, R., (1999). Disaster stress: An emergency management perspective. *Disaster Prevention and Management, 8*(4), 261-267.

Parnes, S., (1981). The magic of your mind. Buffalo, NY: *Creative Education Foundation in association with Bearly Limited*.

Pettersson, J., Jonson, C., Berggren, P., Hermelin, J., Trnka, J., Woltjer, R., & Prytz, E., (2021). Connecting resilience concepts to operational behaviour: A disaster exercise case study. *Journal of Contingencies and Crisis Management.* doi:10.1111/1468-5973.12373

Planning Institute of Australia (2004). *Findings and Recommendations of the National Inquiry into Planning Education and Employment*.

Puccio, Gerard & Cabra, John. (2012). Idea Generation and Idea Evaluation. 10.1016/B978-0-12-374714-3.00009-4.

Royal Town Planning Institute (1998). *Accreditation Panel Handbook* (London, Royal Town Planning Institute).

Runco, A., (2004). Everyone has creative potential, in: R. J. Sternberg, E. L. Grigorenko & J. L. Singer (Eds) Creativity: from potential to realization (Washington, DC, American Psychological Association), 16–28.

Runco, A., & Okuda, M., (1988). Problem discovery, divergent thinking, and the creative process. *Journal of Youth and Adolescence, 17*(3), 211–220.

Runco, M. A., & Nemiro, J. (1994). *Problem finding, creativity, and giftedness.* Roeper Review, 16*(4), 235–241.*

Sommer, A., & Pearson, M., (2007). Antecedents of creative decision making in organizational crisis: A team-based simulation. *Technological Forecasting and Social Change*,vol. 74, no. 8, pp.1234–1251. doi.org/10.1016/j.techfore.2006.10.006.

Stein, Suzanne & Aydemir, Mehnaz & Centeno, Hector & Chai, Shengquan & Cooke, Leiane & El-Khateeb, Tarik & Fienberg, Elliot & Han, Yutong & Jennings, Tatiana & Ji, Chen & Ji, Yushan & Jones, Kristina & Kee, Jessica & Li, Tianjiao & Murakami, Sachiko & Olsen, Christopher & Pillai, Harish & Power, Tegan & Rabbani, Rida & Shakdher, Smriti. (2014). Creative Techniques Handbook 2014.

Tarrow, S., (1994). Power in movement: Social movements, collective action and politics. Cambridge, MA: *Cambridge University Press*.

Torrance, E. P., (1966). Torrance Tests of Creative Thinking: Norms technical manual (Research Edition). Princeton, NJ: Personnel Press

Torrance, E. P. (2001). Experiences in developing creativity measures: Insights, discoveries, decisions. Manuscript submitted for publication.

Turoff, M., (2002). Past and future emergency response information systems. *Communications of the ACM,45*(4), 29-32.

Twigg, J. (2003). The human factor in early warnings: risk perception and appropriate communications. In *Early warning systems for natural disaster reduction* (pp. 19-26). Berlin, Heidelberg: Springer Berlin Heidelberg.

Van de Walle, B., & Turoff, M., (2008). *Decision support for emergency situations.* Information Systems and e-Business Management, 6*(3), 295–316.*

Webb, G., & Chevreau, F., (2006). Planning to Improvise: The Importance of Creativity and Flexibility in Crisis Response. *Int. J. of Emergency Management. 3.* 66 - 72. 10.1504/IJEM.2006.010282.

Wolbers, J., (2021). *Understanding distributed sense making in crisis management: The case of the Utrecht terrorist attack. Journal of Contingencies and Crisis Management*.DOI: 10.1111/1468-5973.12382

Wiezenbaum, J., (1976). *Computer Power and Human Reason: From Judgment to Calculation.* San Francisco: W. H. Freeman & Co.

Xylogiannopoulos, K. F., Karampelas, P., & Alhajj, R. (2021). *COVID-19 pandemic spread against countries' non-pharmaceutical interventions responses: a data-mining driven comparative study*. *BMC Public Health, 21*(1), 1-54.

Yin, R. K. (2009). *Case study research: Design and methods* (Vol. 5). sage.

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