Participatory Design of Digital Crisis Management Training

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ABSTRACT

The integration of digital tools into crisis management training is essential for preparing students and practitioners to respond effectively to increasingly complex environments. Current crises typically involve actors across regions and nations, and scenarios that require collaboration between different sectors and departments. Budget and time constraints, as well as environmental concerns, make it difficult to organize frequent, large-scale exercises across borders and sectors. To prepare for this, we need to create digital environments for synchronous training exercises.

In this paper, we present the TeleTraining in Crisis Management project. We report on a participatory, cross-national design process for developing a digital system that supports realistic, interactive crisis exercises. Through a user-centred 2-day ideation workshop involving 16 participants from three countries, key learning and operational needs were identified, and the next step is to use this input to design a learning management system for exercises, test and evaluate.

Keywords

Crisis Management, Learning Management Systems (LMS), Participatory Design, Ideation

INTRODUCTION

Crisis management requires a different approach to how we manage more routine-based emergencies. Crises are irregular, can have massive societal impacts, and available resources can be insufficient to manage the situation. Collaboration within and between sectors and borders is a key success factor in crisis response (Pan & Rajwani, 2021; Rautiainen, 2022). Current crisis collaboration exercises are criticized for limited usefulness because organizations tend to prioritize individual tasks over collaboration, and because exercises tend to be dominated by the strongest culture and by mechanical behaviour (Berlin & Carlström, 2014; Sørensen et al., 2019).

To address these challenges, we need to develop exercise techniques and pedagogical strategies that can be applied across borders and organizations, as well as technological systems that can support cross-border exercises in ways that provide mutual benefit for all partners. We need a flexible and joint approach to crisis mitigation and response, based on a common, research-based, and participatory scientific foundation, preferably one that is both adaptable, accessible, user-centric and low cost. As a big part of the problem is related to people and how they act, we need to involve the stakeholders in addressing the problem, hence we argue for a participatory design approach. Participatory design involves the engagement of stakeholders when designing systems or solutions, following established structures and methods to elicit the concerns and needs of users, and making sure that the solution developed addresses the problem (Bødker et al., 2022).

That is exactly what the TeleTraining in Crisis Management (TTCM) project aims for: To develop a curriculum, model and learning management system (LMS) that supports crisis management exercises across borders and organizations. TTCM is a collaboration between Scandinavian academia, public sector and emergency response organizations. The project has three key objectives: 1) Create a curriculum and exercise manual for cross-border exercises. 2) Create a user-centric LMS using participatory design methods for conducting synchronous online exercises. 3) Assess the LMS, curriculum and exercise manual on students and practitioners.

In this paper, we focus on the second objective and present the findings from the ideation phase of the LMS creation. In this phase, the goal was to engage students and practitioners in identifying challenges and ideas for the system, to function as input for the team creating the LMS. In the remainder of the paper, we present our theoretical background related to co-creation and participatory design, describe our research approach and case, and present the findings from the first stage of the process. Finally, we present our conclusions about using participatory design as a method for designing crisis management systems and present future plans for the project. Our research questions are as follows: RQ1: What challenges and needs do cross-border stakeholders identify for synchronous digital tabletop exercises? RQ2: What design requirements follow for an LMS that supports such exercises?

THEORETICAL BACKGROUND

Crises are increasingly transcending national borders, but barriers related to cost, geography, legislation, and culture hinder effective training (Khorram-Manesh, 2023). However, training is essential for crisis management and digital training platforms offer a viable alternative to physical exercises, that can help overcome the challenges mentioned above (Sultan et al., 2021), if the correct mix of technologies, interactive and pedagogical methods are applied (Alexander, 2003; Fan et al., 2021; Hofer et al., 2021). In our literature review of TeleTraining in crisis management, we found a range of pedagogical approaches, technologies and scenarios where online training can contribute positively to crisis management skills, and we found that proactive approaches such as experiential and collaborative learning seem to be good approaches, along with technologies allowing remote and synchronous collaboration – as long as the technology is integrated with pedagogical solutions (Sørensen et al., 2025).

This strong focus on collaboration and involvement in literature, along with the challenges identified, leads us towards participatory design as an approach to the problem. Participatory design involves the engagement of stakeholders when designing systems or solutions, following established structures and methods to elicit the concerns and needs of users, and making sure that the solution developed addresses the problem (Bødker et al., 2022). While involving stakeholders is common in many research methods, participatory design requires genuine participation and power sharing, where stakeholders are involved early and often (Duea et al., 2022), with the goal of creating mutual learning and co-creation of solutions using for example workshops and shared objects such as mock-ups and storyboards to articulate problems, needs ideas and solutions (Seo et al., 2025). Participatory design should also be rooted in, and seek to uncover, stakeholders situated knowledge and everyday experiences, as lived experience [with crisis management training] and local knowledge are essential resources for systems embedded in complex organizational settings (Marion Lara Tan et al., 2024). Participatory design usually involves a set of techniques such as co-design workshops, stakeholder mapping, user scenario building and collaborative ideation and prototyping (Bødker et al., 2022), and in software development design thinking is a common method to structure these activities (Reynante et al., 2021; Schliwa, 2019).

Participatory design is useful in crisis management settings for a number of reasons: Crisis management involves socio-technical complexity and requires careful coordination and collaboration, because of the many actors involved (emergency services, municipal and regional agencies, NGOs, citizens etc.). Participatory design can help discover and reconcile diverse requirements and work practices, which leads to systems that better support situational awareness, coordination, and decision-making (Marion Lara Tan et al., 2024; Seo et al., 2025). Participatory approaches have been shown to reveal context-specific constraints and inform technological development that supports how people work in real life (Seo et al., 2025). Finally, digitalization has tended to encode assumptions about those needs matter, and which actors get to define what effective response means. This

has led to certain services being over-prioritized and thus to poor results. Participatory design involving relevant stakeholders explicitly addresses power relations and seek inclusion. This can strengthen the perceived legitimacy of digital tools (Marion Lara Tan et al., 2024).

METHODOLOGY AND CASE DESCRIPTION

The project follows Hevner's design science approach (Hevner et al., 2004), where the objective of the research is to create a set of artefacts in a real-world setting – i.e. The curriculum, method and LMS. Design science involves research (development and evaluation of artefacts) based on real-world needs, situated in human, organizational or technological contexts, and both use and contribute to the existing knowledge base through applying existing research frameworks, models, methods and theories and reporting back how these affected the current research.

Design science research follows three cycles: The relevance cycle, or the real world, which is where we get our research questions and demands from. For TTCM, this is a series of iterations where various members of the project have been involved in crisis management training and systems development, and over time have identified the need for better training methods and tools. The second cycle is "design", where the actual artefact design and evaluation take place (in our case the LMS, curriculum and method), and the third cycle is "rigor", which refers to existing methods, theories etc. In our case, this means participatory/design science as method, and the 3LC exercise model as out theoretical framing. The 3LC exercise model was created on the basis of earlier research showing that police, ambulance, and fire and rescue services typically train either one after another or alongside each other, rather than engaging in fully coordinated, simultaneous training (Berlin & Carlström, 2015) The cyclic view refers both to the need for continues updates within each cycle, but also to the need for relevance, rigor and design to overlap (Hevner, 2007). In this paper, we primarily report on the first iteration of the design cycle, and our use of participatory design as method.

To structure our participatory design of the LMS, we have applied design thinking as our concrete method, following the steps in the Swedish innovation guide ("innovationsguiden"). The innovation guide is a six-step method for user involvement, where you 1) identify challenges/problems and stakeholders. 2) Explore the needs and experiences of the stakeholders. 3) focus and prioritize the most relevant challenges and problems for the relevant stakeholders. 4) generate ideas on how to solve the challenges and problems and translate these into more concrete solutions. 5) Assess the ideas through prototypes and user testing of prototypes and 6) implement and assess the final solution. The process is iterative between steps, so the "final" solution should always be seen as work in progress.

The aim of the project is to create and test a working prototype of a LMS for cross-border crisis management training in Scandinavian countries, implementing the curriculum and methods we have identified in the project. Further, the aim is to involve students and practitioners as much as possible. In this paper, we report on the participatory activities conducted so far.

The TTCM project started with a group of scientists with extensive experience of crisis management training, both on- and offline. They identified a need to create exercises with better learning outcomes and applied for a project to achieve this. In 2025, the project team worked on literature reviews and mapped pedagogical methods, and in 2026 we will use this to structure an online exercise platform, centred around a learning management system.

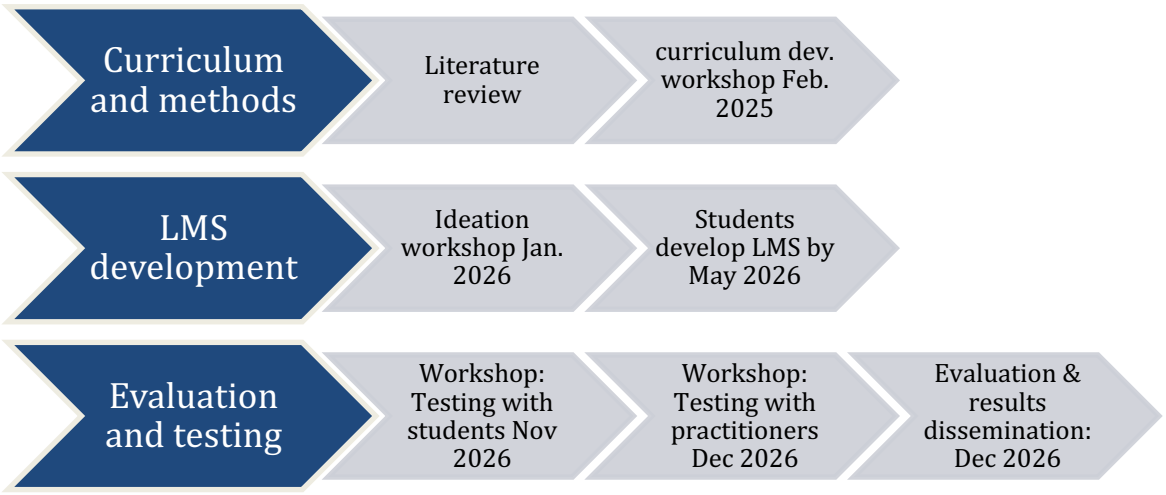

Figure 1: Project timeline.

In January 2026 we conducted a workshop with students and practitioners from Norway, Sweden, and Denmark. The students represented cybersecurity, health, and crisis management. Practitioners represented health and were aided by faculty with experience as practitioners in health, civil defence and from the police. The aim of the workshop was to map challenges and generate ideas for the creation of the LMS, and as such covered the first four steps of the innovation guide. The output of the workshop has been shared with five student groups, who are developing the LMS. Later, when the prototype LMS is ready, we will conduct two additional workshops to test and refine it with Scandinavian students and practitioners. The timeline of the project is illustrated in figure 1 above.

RESULTS

In this work in progress paper we report on the ideation workshop held in Gothenburg January 2026. The two-day workshop had 16 participants from Norway, Sweden, and Denmark, and consisted of students,faculty,y and practitioners from the health sector.

Day1 – exercises: Getting to know the format

Day 1 consisted of a welcome session, where participants were informed about the project and expected outcomes, and a brief introduction to crises management exercises. We then proceeded to do two different tabletop exercises, with different scenarios and differing levels of instruction and preparation. Both exercises involved participants being divided into groups and moving to different rooms, where the exercise was conducted through a Zoom meeting. The purpose of this was twofold: First, we wanted the participants to experience a synchronous digital exercise, as not all participants were familiar with the format. Second, we gave vague instructions and preparations to the participants, to see how they managed a crisis with a lot of unknowns and no preset rules, roles or procedures. After each exercise, we had a plenary debrief to collect feedback and insight from the participants.

For the first exercise, participants were divided by nationality and given a brief description of a scenario to solve. The scenario was to produce a strategy for informing students in Southern Europe about preparedness from a Scandinavian perspective – and to produce talking points for a 45-minute online meeting to summarize the preparedness advice from Scandinavian authorities. The exercise time was 20 minutes.

Each group had a member of faculty present. Here, we purposefully gave little instruction about how they should organize, about roles, responsibilities, or procedures for the exercise. One group was tasked with managing the discussion, apart from that there were no instructions. The idea was to have the participants experience a feeling of disorganized chaos and see how they managed to organize themselves in a stressful situation with little time, not enough information, and unclear goals.

For the second exercise, the scenario was as follows: A passenger aeroplane has cash-landed in international waters, 100 km north-west of Gothenburg. An international rescue operation is underway. Sweden is the closest

country and has been given responsibility for coordinating the rescue. Patients are flown to a hospital in Gothenburg. Because the flight is full of Scandinavian students, student representatives from the Scandinavian countries (the participants in the exercise) has been tasked with setting up a centre for students and next of kin. The objective of the exercise is to prepare a meeting on objectives, services offered by the centre, resource needs, coordination with other actors, risk management, media liaising and a plan for liquidation and normalisation. Exercise time was 40 minutes.

The participants were given more, but still not sufficient, instructions. The participants were provided relevant background information about the situation, the exercise had a clear goal (set up a centre for students and next of kin), roles were described (student representatives from their respective universities), one group was given a coordinating role, but the responsibilities were still not clear, nor did we establish a structure, clear steps or procedure for the exercise.

After each exercise, we had a plenary debriefing session to discuss what worked and which challenges the participants experienced.

In the first debrief, three issues were recurring: language, technology and structure. Even though the Scandinavian languages are similar and the people of the three countries understand each other, there are words and phrases that mean different things, and the organization of crisis management is also different between the three countries. The responsible department in one country is a sub-division of a non-responsible part in the other, which creates confusion about the chain of command and whom to communicate with.

Second, the technology itself presented some challenges. There were varying degrees of competence related to Zoom use. One of the groups attempted to set up a shared whiteboard for notes and situational awareness, but the other groups did not understand how to use this. The participants used their own laptops, which led to issues with audio/speaker quality, making the language barrier even more difficult to transcend. One of the groups tried to use the chat to alleviate this problem, which had some effect. There were suggestions to use language transcription and translation technologies in future exercises.

Finally, the structure and lack of rules were discussed. As expected, the lack of a playbook with clear rules and procedures made it extremely difficult to manage the scenario within the limited timeframe. There were no clear roles, no rules, no designated leader, and the participants were thus not able to establish a mutual understanding of either the problem or how to solve it. When the exercise ended, the three groups had three quite different opinions about what they were supposed to do. In a real-world scenario, this would have been a disaster – and unfortunately, we have seen examples of real-world scenarios being managed as badly. A well-known example is the terrorist attacks in Norway on 22 July 2011, where the subsequent evaluation by the concluded that the lack of shared situational awareness, unclear coordination, and delays in decision-making significantly reduced the effectiveness of the response (Norwegian Official Report, 2012). Similarly, during Hurricane Katrina in the United States in 2005, investigations involving the Federal Emergency Management Agency found that unclear responsibilities, poor communication, and the absence of a common operational picture among responding agencies contributed to severe delays and inadequate assistance to affected populations. In both cases, the absence of clear structures, procedures, and shared understanding did not merely create confusion, but directly contributed to the escalation of an already critical situation (The White House & Executive Office of the President, 2006).

In the second debrief, participants agreed that things improved. Here, they were given more instructions and preparation, a clearer goal for the exercise and one group was designated leader of the discussion. The language barrier was a bit smaller, as participants had discussed some common misunderstandings during the first debrief, and this time also spoke more slowly and took care to speak clearly and a bit slower than usual. But the scenario was not resolved, in part because participants went off script and started to discuss issues that did not belong to their group, such as how to take care of patients, who should inform next of kin and other issues that are not relevant to a group tasked with setting up a support centre for students. Communication was an issue, as participants in each group thought everyone had a similar understanding of the situation, while this was far from the case as observed by faculty. Technology was discussed again, and the participants agreed that communicating through a digital platform rather than face to face in the same room requires more structure and more rules. The potential of technology was also discussed, such as using the chat to summarize essential information, or using the Zoom whiteboard or creating a Miro board for situational awareness and decision making or even experimenting with AI to create scenarios or add variation to exercises. Finally, there was discussion about the difference between practice and exercise. Practice involves people from the same organization, with the same role, practicing how to do their own job – i.e. Firefighters practicing putting out a fire. Exercises are far more complex, as they involve multiple actors from different areas, departments and countries trying to work together to solve a complex scenario.

The second debrief can be summarized as follows: while still discussing the three issues of language, structure and technology, the discussion was more focused. The *pedagogical model* for the exercise, and how to reach

constructive alignment between goals, activities and evaluation was discussed more clearly. Language and communication turned into a discussion around common *situational awareness,* and the need to be very precise in communication, for example by saying "I understand the situation like this…" instead of saying "now that we all agree" or being too forceful in claiming how things are. Finally, the discussion on structure turned into a more structured discussion of *process and roles* as part of the pedagogical model. These issues are connected, as a good pedagogical model includes a thorough process description and assigning roles to participants, and this is a precursor to reaching common situational awareness. The table below summarizes the discussion during the two debriefing sessions.

Table 1: Summary of debrief sessions, day 1.

Topics discussed	First debrief	Second debrief
Language and communication	Language difficulties, unclear communication	Discussed as situational awareness
Technology	Technical challenges, skill and knowledge challenges	Still present, but started discussing solutions such as AI scenarios, translation tools, situational awareness templates.
Structure	Unclear process, no leader, lack of clear roles.	Same issues discussed, but more centred around which processes/methods were possible to apply
Pedagogical model	Not discussed	Discussed as important for structuring the entire exercise.

Day2 – Ideation workshop – How to improve online exercises

The first workshop day helped set the stage and get participants in the right mindset for exploring ideas for how to make the exercises better. Day 2 was set up like the first day, with a brief introductory lecture to participatory design, design thinking and the specific method from the Swedish innovation guide.

The participants were then divided into three teams, each with members from at least two of the tree countries. A member of faculty functioned as facilitator. As an Erasmus project, it was important for us to have cross-border collaboration not just in the debrief but also in teamwork. The goal for the workshop was to produce ideas for the LMS (Innovation guide steps 2-4). Thus, the workshop process was divided into three steps:

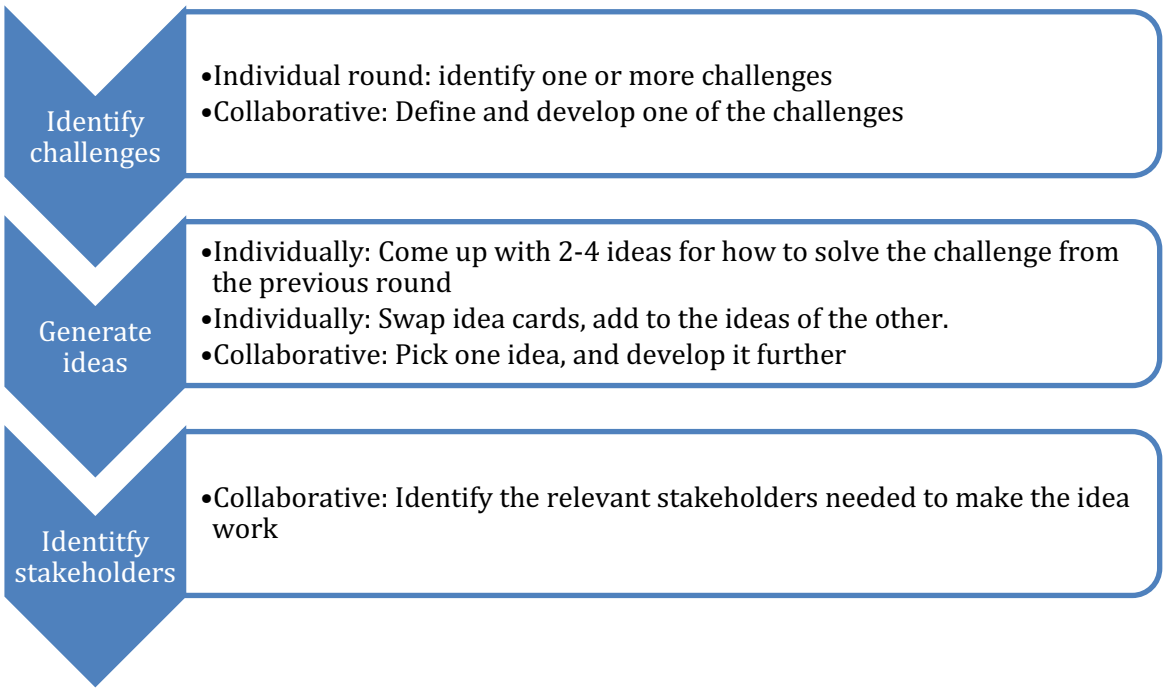

Figure 2: Process for ideation workshop

After some expected initial confusion and discussion about what a challenge or problem means, how to fill in the templates and how much detail to add, the groups worked their way through the three stages. When supervising these kinds of workshops, it is important for the facilitator to make it clear that there are no stupid ideas, that there

is no one correct way of filling templates, and that the process itself is equally important to the outcome. Especially for students, this type of workshop can feel like a test, where they are graded on how well they perform. This is not the mindset you want from an ideation workshop. Here, the purpose is to get participants to think freely and be creative. The critical scrutiny comes in the next step, when discussing the feasibility of turning ideas into artefacts.

The three groups delivered a wide range of challenges and ideas and identified many relevant stakeholders. Three researchers from the project team analysed the notes and comments from the sessions, and applied affinity mapping to categorise and summarise the results:

Phase 1 – challenges. The first phase of the workshop was focused on identifying challenges and needs. Summarized, the groups produced the following challenges:

1. Ensure that exercises train relevant communication skills and how to achieve the exercise goals.
2. Reduce language barriers and ensure effective mutual understanding.
3. Tailor exercises to distinct levels (strategic, tactical, operational).

Phase 1 – needs. To address these challenges, the groups suggested the following needs. Here, we see that the debrief from day 1 impacted the participants' mindset.

1. A shared methodology and language for collaboration.
2. Digital tools for shared situational awareness in digital exercises.
3. Clear roles, hierarchies, and a well-defined meeting and decision-making structure.

Phase 2 – idea development. The three groups produced 18 individual ideas, many of them overlapping. Each group chose one to develop further

1. Development of digital tools for shared situational awareness, including shareable templates and electronic documentation. Development of AI-based tools for translation and scenario generation (addresses challenges 1/need 2)
2. Creation of clear structures for exercises with guidelines for roles, decision-making processes, and follow-up. Addresses challenges 1,3/need 1,3)
3. Establishment of a system that can train the strategic, tactical and operational aspects of crisis management both cross-border/organization and within each country/organization. include AI-based translation to minimize language barriers (Addresses challenges 2,3/needs 1,2,3)

The groups added that development of their ideas should focus on user-friendliness and clarity in systems and communication, that standardization of training materials and exercise methodologies for all levels are essential, and that the LMS should emphasize improved collaboration through shared terminology and understanding.

Phase 3 - Stakeholder Mapping. At this phase, the groups started to run out of time, so the stakeholder mapping should be seen as partial at this stage. Ideally, the stakeholder identification phase should identify the users, the stakeholders who should be involved in development, and stakeholders who should be informed and who could have relevant information. The groups did manage to identify stakeholders for the LMS (users), defined as students, crisis management professionals from various organizations, authorities, and other involved actors. Government officials, local government, affected citizens and colleagues of individuals trained using the LMS were identified as stakeholders affected by the system.

The discussion on stakeholders also led to new needs for:

1. Shorter foundational training courses for students and training in shared methodologies.
2. Internships and projects aimed at strengthening crisis management competencies.
3. Improved communication between actors through shared systems and language.

Generally, in the groups, we observed that much of the discussion were centred around the need to develop shared frameworks and tools for Nordic collaboration in crisis management. That the TTCM project should focus on coordination, structure, and effective execution of both synchronous (live) and asynchronous (learning path) exercises to facilitate effective training, and that there should be a learning objective related to how to use shared emergency response systems to reduce damage and quickly restore normality after crises.

LEARNING PATH AND EXERCISE EXECUTION

The research team also tried to sort and analyse the input based on which points were related to the LMS learning

path/system design, and which were more related to the execution of the exercise. We saw that the challenges, ideas and general discussion in the workshop centred around two similar, but different aspects of exercise design and execution, and that the LMS should be divided into a preparatory training part, as well as an execution/exercise part.

For the **learning path**, the discussion centred around how to prepare participants and provide a common shared knowledge, skills and understanding of how to conduct exercises, in other words a standardised and user-friendly course with training materials on how to do exercises. For this, the participants found it important to have a shared methodology describing procedures and roles, and language/terminology for collaboration. The training should include a module on relevant support tools for situational awareness, digital whiteboards using Zoom, Miro or other easy to learn collaboration tools. There should also be instructions for how roles should be played out, the decision-making process and how to follow up and evaluate tabletop exercises, as well as a module on the responsibility of the strategic, tactical and operational levels. Stakeholder understanding was another suggestion, which means learning how to map the collaboration and communication patterns of different stakeholders, and how to use this insight to work towards better communication between stakeholder groups.

For **execution of tabletop exercises**, applying the training from the course, the participants identified the following as essential success criteria: The use of digital tools to create a shared situational awareness, enabling real-time sharing of information. Implementation of the roles and hierarchies learned during training, and to assess and evaluate the decision-making structures during and after exercises. Being able to tailor exercises to different levels (strategic, tactical and operational), evaluating the effectiveness of shared terminology and AI-assisted translation tools and scenarios, and to do a thorough evaluation post-exercise, following established protocols. Table 2 below summarizes these findings.

Table 2: Summary of workshop input for the LMS, from the ideation workshop

Course on how to do exercises – LMS part 1	**Execution of exercises - LMS part 2**
Purpose: Prepare participants with the necessary knowledge, skills, and shared understanding before the tabletop exercise.	**Purpose:** Apply the training from the LMS in a practical, simulated crisis scenario to train collaboration and decision-making.
Shared methodology and language for collaboration: • Training in standardized terminology, procedures, and roles for crisis management. • Focus on reducing language barriers by establishing a common understanding and using AI-based translation.	**Shared situational awareness:** • Use of digital tools to share information and update situational pictures in real time. • Focus on collaboration and coordination between participants.
Support tools for situational awareness: • Training in the use of digital tools and templates for documentation and information sharing.	**Clear structures for roles and decision-making processes:** • Implementation of the roles and hierarchies learned during training. • Testing decision-making structures in a simulated context.
Exercise structuring: • Instructions and guidelines on how roles, decision-making processes, and follow-up should be conducted in a tabletop exercise. • Preparation to address various levels (strategic, tactical, operational).	**Adaptation to different levels:** • Testing exercises tailored to strategic, tactical, and operational levels.
Stakeholder understanding: • Mapping and training on how different actors and stakeholders collaborate and communicate during crises.	**Communication and collaboration:** • Testing communication flow, including the use of shared terminology and translation tools.
Standardized training materials: • Development of learning paths to ensure all participants receive the same foundational training, focusing on short and effective modules.	**Follow-up and evaluation:** • Documentation of the exercise and evaluation of what worked, with a focus on learning outcomes and areas for improvement.

CONCLUSION AND FUTURE WORK

The workshop provided valuable insights into the challenges and opportunities associated with digital tabletop exercises for crisis management and resulted in good input for the design phase of the TTCM project. Participants emphasized the need for a shared methodology, standardized training, and effective tools for situational awareness and decision-making. By aligning on shared challenges and collaboratively developing potential solutions, the workshop succeeded in identifying key areas for improvement in crisis management training and execution. Notably, the integration of learning paths in an LMS, combined with live tabletop exercises, emerged as a robust approach to enhance collaboration, communication, and preparedness across different levels and stakeholders. The main findings are summarised in table 2 above.

The results highlight the importance of participatory design in developing crisis management exercises. The dynamic between participants from different sectors, different age groups and with existing experience of exercises ranging from none to experienced led to very good discussions both in plenary sessions and in the group work on day 2. Students who were new to the concept of crisis management exercises raised several interesting points that the more experienced participants could elaborate on and start discussing solutions to. Limitations of the study include the small number of participants, health-sector skew, and limited time due to project constraints to conduct a full stakeholder mapping.

FUTURE WORK

To build on the outcomes of the workshop, the project will focus on the following in coming months:

1. **Develop the LMS** – using the input from the ideation workshop and from the previous literature review and curriculum workshop. The LMS should include interactive learning paths that prepare participants for live tabletop exercises, ensuring that all users, regardless of their background, are equipped with a shared understanding of methodologies, tools, and roles.
2. **Validate the LMS through testing** – we plan to conduct two workshop/test sessions with students and practitioners. These sessions will be evaluated using The Collaboration, Learning and Utility (CLU) Scale, which is a validated survey tool especially designed to measure collaboration exercise participant`s perceived levels of collaboration, learning and utility.
3. **Explore the integration of AI tools** – Investigate the potential of AI tools for translation, decision-support and scenario generation.

At the time of writing, we have six different student groups who are working on different parts of the LMS. We envision a three-layered system. The top level is the "TTCM portal for crisis management exercises", which will function as knowledge resource for Nordic crisis management. In the portal, there will be a knowledge database, which summarizes different training methods, pedagogical methods, evaluation techniques, and other data collected by the team over the years. Finally, the actual LMS is the third layer, where we plan to set up preparatory courses on how to conduct exercises, and a module for doing tabletop exercises, which hopefully will include an AI-module for scenario generation.

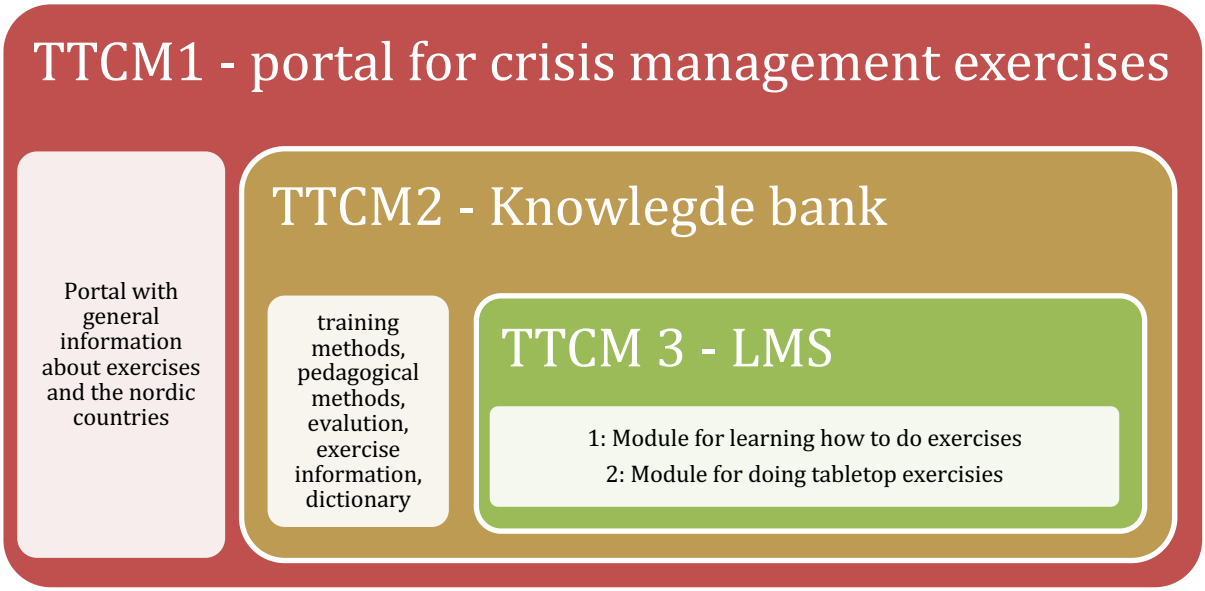

Figure 3: Future plans for the LMS.

While not part of the TTCM project, other potential future research areas include exploring different models of

stakeholder collaboration, such as how different actors can collaborate effectively. There are existing frameworks and models for this that could be adapted to the Nordic countries and the crisis management context. Another interesting future research area is to examine how the LMS can be further modularized and made flexible enough that it could be applied for various kinds of exercises, in different contexts. Finally, if AI is implemented as suggested by our participants, there is a need to examine AI risks and ethical issues, such as translation accuracy, bias, accountability, privacy, and need for human oversight.

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Use of AI: Perplexity AI was used for generating ideas for the paper structure and input for the theoretical approach. The first part of the abstract is AI generated using the paper as input and a prompt to summarize the content and write an abstract.

REFERENCES

Alexander, D. (2003). Towards the development of standards in emergency management training and education. Disaster Prevention and Management, 12(2), 113–123. https://doi.org/10.1108/09653560310474223

Berlin, J. M., & Carlström, E. D. (2014). Collaboration Exercises—The Lack of Collaborative Benefits. International Journal of Disaster Risk Science, 5(3), 192–205. https://doi.org/10.1007/S13753-014-0025-2/TABLES/3

Berlin, J. M., & Carlström, E. D. (2015). Learning and Usefulness of Collaboration Exercises: A Study of the Three Level Collaboration (3LC) Exercises between the Police, Ambulance, and Rescue Services. International Journal of Mass Emergencies & Disasters, 33(3), 429–467. https://doi.org/10.1177/028072701503300307

Bødker, S., Dindler, C., Iversen, O. S., & Smith, R. C. (2022). What Is Participatory Design? 5–13. https://doi.org/10.1007/978-3-031-02235-7_2

Duea, S. R., Zimmerman, E. B., Vaughn, L. M., Dias, S., & Harris, J. (2022). A Guide to Selecting Participatory Research Methods Based on Project and Partnership Goals. Journal of Participatory Research Methods, 3(1), 2022. https://doi.org/10.35844/001C.32605

Fan, C., Zhang, C., Yahja, A., & Mostafavi, A. (2021). Disaster City Digital Twin: A vision for integrating artificial and human intelligence for disaster management. International Journal of Information Management, 56, 102049. https://doi.org/10.1016/J.IJINFOMGT.2019.102049

Hevner, A. R. (2007). A Three Cycle View of Design Science Research. Scandinavian Journal of Information Systems, 19(2), 87–92.

Hevner, A. R., March, S. T., Jinsoo, P., & Ram, S. (2004). DESIGN SCIENCE IN INFORMATION SYSTEMS RESEARCH. MIS Quarterly, 28(1), 75–105. http://www.jstor.org/stable/25148625?seq=1#page_scan_tab_contents

Hofer, S. I., Nistor, N., & Scheibenzuber, C. (2021). Online teaching and learning in higher education: Lessons learned in crisis situations. Computers in Human Behavior, 121, 106789. https://doi.org/10.1016/J.CHB.2021.106789

Khorram-Manesh, A. (2023). Global transition, global risks, and the UN's sustainable development goals – A call for peace, justice, and political stability. Global Transitions, 5, 90–97. https://doi.org/10.1016/J.GLT.2023.06.002

Marion Lara Tan, Anna Brown, Kristin Stock, Julia S. Becker, Christine Kenney, Emily Lambie, Alicia Cui, & Raj Prasanna. (2024). Balancing human needs with technology'1—a design-led approach for exploring an earthquake early warning system in Aotearoa New Zealand. In Saskia M. van Manen, Claudine Jaenichen, Klaus Kremer, Tingyi S. Lin, & Rodrigo Ramírez (Eds.), Design for Emergency Management (8). Routledge. https://doi.org/10.4324/9781003306771-9

Norwegian Official Report. (2012). Rapport fra 22. Juli-kommisjonen [Report from the July 22 Commission].

Pan, D., & Rajwani, K. (2021). Implementation of simulation training during the COVID-19 pandemic: A new york hospital experience. Simulation in Healthcare, 16(1), 46–51. https://doi.org/10.1097/SIH.0000000000000535

Rautiainen, I. (2022). Practices of promoting and progressing multinational collaborative work : interaction in UN military observer training [University of Oulu]. In Discourse and Conflict: Analysing Text and Talk of Conflict, Hate and Peace-building. https://doi.org/10.1007/978-3-030-76485-2_14

Reynante, B., Dow, S. P., & Mahyar, N. (2021). A framework for open civic design: Integrating public participation, crowdsourcing, and design thinking. Digital Government: Research and Practice, 2(4), 31:1-31:22. https://doi.org/10.1145/3487607

Schliwa, G. (2019). Smart Cities by Design? Interrogating Design Thinking for Citizen Participation. In C. Paolo, D. F. Cesare, & K. Rob (Eds.), The Right to the Smart City (pp. 151–164). Emerald Publishing Limited. https://doi.org/10.1108/978-1-78769-139-120191011

Seo, W., Li, J., Zhang, Z., Zheng, C., Singh, H., Pasupathy, K., Mahajan, P., & Park, S. Y. (2025). Designing Health Care Provider–Centered Emergency Department Interventions: Participatory Design Study. JMIR Formative Research, 9,

e68891. https://doi.org/10.2196/68891

Sørensen, J. L., Carlström, E. D., Torgersen, G. E., Christiansen, A. M., Kim, T. E., Wahlstrøm, S., & Magnussen, L. I. (2019). The Organizer Dilemma: Outcomes from a Collaboration Exercise. International Journal of Disaster Risk Science, 10(2), 261–269. https://doi.org/10.1007/S13753-019-0220-2/TABLES/2

Sørensen, J. L., Carlström, E., Nilsen, L. R., Sandberg, L., Johannessen, M. R., Berntzen, L., & Khorram-Manesh, A. (2025). TeleTraining in Crisis Management-A Literature Review. Proceedings EGOV-CeDEM-EPart Conference. CEUR-WS Vol. 4127.

Sultan, M. A. S., Khorram-Manesh, A., Carlström, E., Berlin, J., & Sørensen, J. L. (2021). Impact of Virtual Disaster Collaboration Exercises on Disaster Leadership at Hospitals in Saudi Arabia. International Journal of Disaster Risk Science, 12(6), 879–889. https://doi.org/10.1007/S13753-021-00376-0/TABLES/6

The White House & Executive Office of the President. (2006). Federal Response to Hurricane Katrina: Lessons Learned.