

Crisis Training Software and User Needs – Research Directions

Monika Magnusson

Interactive Institute and Karlstad
University
Monika.Magnusson@kau.se

Lena-Maria Öberg

Mid Sweden University
Lena-maria.oberg@miun.se

Emergency Management, User Needs.

ABSTRACT

Crisis management training software is gaining researchers' as well as practitioners' interest. In order to truly support organizations it is important that such software responds to actual user needs. The aim of this study is to compare existing initiative described in research with the needs of the users and to identify possible research directions for forthcoming studies. The literature review shows that discussions on users' needs are superficial at best. The software described in research mainly focus on co-located execution of exercises, often in the form of simulations. Furthermore, a "right or wrong" behavior is usually built-in. Empirical data from a web survey indicate that flexibility in time and space during training is a fundamental user need. This is not particularly acknowledged in earlier research. Neither is the users' wish for better support in designing exercises. We propose that system flexibility, modularity and pedagogy for computer based crisis training are urgent issues for future research.

Keywords

Computer Based Training, Crisis Management, Crisis Training Software,

INTRODUCTION

Organizations strive to become prepared to handle different types of crisis, disasters or emergencies. Exercises of different types are often described as important to support the preparedness-process (Berlin and Carlström, 2014; Di Loreto, Mora and Divitini, 2012). Rencrantz et al. (2012) point out that the Swedish way of organizing crisis management in three levels, i.e. national, regional and local levels, has the consequence that no single governmental agency is in command. To prepare for the type of cooperation and coordination that is required in such a system, exercises have to be inter-organizational and frequent. A large number of stakeholders then need to be involved and live exercises become expensive and hard to organize (e.g. Jain and McLean, 2008). Computer based training is suggested to be a resource-efficient way to complement traditional exercises (e.g. Lukosch, van Ruijven and Verbraeck, 2012). Different types of information system (IS) have been developed to support the planning, execution and evaluation of exercises. As for any type of IS, the knowledge about the problems to be solved with the IS is instrumental (Shih-Chieh Hsu, 2012). The aim of this paper is to compare existing initiatives described in research with the needs of the users and identify possible research directions for forthcoming studies in the area of computer based crisis training. Our focus is on users that are responsible for planning and evaluating exercises.

METHOD USED

The method consists of three parts: a literature review, a web survey and an analysis of research directions. The literature review covers articles between 2002 and 2014. The review was performed between October and December 2014. We applied keywords such as crisis, disaster or emergency in combination with exercise or training and collaborative, cross-sector or multi-agency in databases such as Google, Google Scholar, Academic Search Elite, ACM, IEEE Xplore, Science Direct and SCOPUS. Other search terms were ‘need analysis’ or ‘pre-study’ and software, computer, technology, online or gaming. A total of 39 articles were selected for the study. We made an inductive thematic analysis where we searched for patterns regarding the software’s support for different training modes (co-located or distributed), types of exercises, exercise phases etc. In this paper a limited number of findings are presented. The selection is based upon what has been identified as the clearest patterns. Furthermore, we will use the concept ‘crisis training’ to refer to both individual and collaborative training for crisis, disasters or emergencies.

We performed a web survey in spring 2014 as a pilot study of user needs. A link to the web survey was distributed by the crisis and emergency management department at a Swedish county administrative board via e-mail to their network of approximately 40 contingency managers in the region. A letter explaining the purpose was attached. The survey was also distributed to three other county administrative boards for further distribution. No follow-up was made. Finally, we compared the patterns from the literature review with the empirical findings with an aim to identify future research directions for research within the field.

EARLIER RESEARCH

There is an increased interest for computer based crisis training both among researchers and practitioners. MacKinnon and Bacon (2012:3) claim that “It is very likely that over the next 10-20 years we will see a far greater acceptances of virtual technologies to train and prepare for actual physical situations, as the current “digital native” population move into more senior positions, and the technologies prove their worth[...].

We found that earlier studies mainly concern the design of existing or proposed software for crisis training (e.g. Greitzer, Kuchar, and Huston, 2007; Reuter, Pipek and Müller, 2009a; Tecuci, Boicu, Hajduk, Marcu, Barbulescu, Boicu and Le, 2007; van de Ven, Stubbe and Hrehovcsik, 2013; Vold and Wenstad 2013) while there are few examples of regular use, more extensive evaluations or for that matter, literature reports on pre studies or needs analysis preparing for the software development.

Pottebaum, Marterer and Schneider (2014) describe that this type of software can be used for the planning, control, observation, and analysis of the exercise and to support debriefing or to create learning material. We have also found some examples in the research of software that support the planning process (Cesta et al., 2014; Reuter et al., 2009a; Vold and Wenstad, 2013), the preparation or learning processes before an exercise (Coppari, Di Pasquale, Goretti, Papa, Papa, Paoli, Pizza and Severino, 2008) or the debriefing (Waller, Lei and Pratten, 2014). Our literature review, however, shows that most of the research focuses on systems used *during* an exercise.

Furthermore, while Rankin, Field, Wong, Eriksson, Lundberg and Rooney (2011) present interesting thoughts about flexible components to support improvisation, our review shows that formalized software, where the exercises include an idea of what is a proper behavior and what is not, predominate (e.g. Cesta, Cortellessa and De Benedictis, 2014; Oulhaci, Tranvouez, Espinasse, and Fournier, 2013). The unpredictable nature of a crisis makes it important also to practice on problems that do not have a pre-defined right or wrong behavior. Another pattern is that most systems seem to be built for trainees that are geographically co-located although a few examples of tools for distributed usage are also presented (Asproth, Borglund and Öberg, 2013; Bacon, Windall and MacKinnon, 2011).

Another pattern seems to be that the research so far has focused on different types of simulation exercises (e.g. Ahmad, Balet, Boin, Brivio, Ganovelli, Gobbetti, Himmelstein, Pintore, De la Rivière and Schaap, 2012; Jain and McLean, 2008). This is supported by Araz, Jehn, Lant and Fowler (2012) who conclude that research on IS support for other types of exercises is missing. They present a tool to support table-top exercises and suggest a tool that could support digital maps and video clips. Similarly, Asproth et al. (2013) describe (web based) software

that can be used to support distributed table-top exercises. However, the questions of how a “traditional” method for crisis training could be supported by crisis training software, as well as if and how new training methods could be developed through the use of crisis training software, generally seem to be underdeveloped areas in research.

Also, descriptions of methods used in gathering user requirements and developing the software are rare. Lukosch et al. (2012) however, describe a design process for participatory design of simulation software and Lundberg, Granlund and Fredäng, (2012) present a method for the co-design of scenarios. There are also studies in our literature review that discuss desirable subsystems (Jain and McLean, 2008), systems functionality (Reuter, Pipek and Müller, 2009b), fundamental roles, general design principles and specifications for IS (Turoff, Chummer, Van de Valle and Yao, 2004) and the use of workshops and group discussions in IS development (Reuter et al., 2009a). Although overall, there are few explicit reports on pre-studies or needs analysis executed before the development of software. It is thus not clear from our literature review which (generic) user needs these systems were developed to meet. Ahmad et al. (2012:3) state that: “[...] the research makes painfully clear that IT/software engineers and crisis scholars do not communicate, i.e. they are clearly unfamiliar with each other’s work and key findings of that work. This leads to IT products that crisis managers do not need; it also means that crisis managers are not familiar with the technological possibilities available to them”.

EMPIRICAL DATA

The web survey included questions about the respondent’s role, work assignments and frequency of exercises in the organization as well as questions regarding attitudes towards IT based crisis training and questions about the respondent’s suggestions for using IT in crisis training. A total number of 41 answers were collected. Of the 41 respondents, 46 % were employed in the municipal sector, 17 % in a county administrative board, 10 % in a county council, 10 % in governmental agencies, 12 % in the private sector and 5 % in “other”. Three out of four respondents were responsible for determining goals and purposes of the exercises and/or to ensure that the experiences of the exercises were implemented

in their organizations. Two out of three were responsible for planning the exercises and/or were participating in them. Approximately one of two respondents was responsible for leading the execution, observing, documenting or evaluating the exercises.

Almost half of the respondents (47.5 %) claimed that their organizations execute exercises several times a year and almost as many (45 %) carry out approximately one exercise a year. The rest (7.5 %) declared that exercises are performed “seldom or never” in their organizations. The most popular type of exercise used was table-top (90 %), followed by simulation with counter-acting (72.5 %). Field exercises and other practical exercises were used by 37.5 %.

Strengths in current crisis training practice

The open-ended questions regarding what, if anything, the major strengths in the organization’s current crisis training practice were resulted in 32 answers. Twelve of these concerned increased capability. The respondents mentioned that exercises develop the ability to act, bring experience, keep the knowledge up to date and clarify their own role and that of others. Several respondents claimed that the networking, discussing and getting to know one another were important strengths. Other strengths were a strong interest and engagement in the organizations and that areas that need to be improved were discovered. Yet another strength was that the exercises create awareness and stimulate reflection.

Problems in current crisis training practice

We also asked an open-ended question regarding what, if anything was perceived as problematic. The by far most common opinion expressed in the 36 answers was time for practice. Almost every second answer concerned ‘time issues’ of some sort. It could be the lack of sufficient budgeted time or time for actual planning (planner) and execution (trainees). Some also mentioned that the current exercises are time-demanding to plan and execute. In addition, ‘economy’ or resources available for training was also mentioned as problematic. Consequently, another problem stated was that exercises are performed too seldom and with too few members of the organizations. However, the second most common problem area

was how to design good exercises. Almost every third respondent mentioned problems connected to exercise design, for example, how to construct realistic yet simplified scenarios, how to activate all trainees or how to know what the trainees needed to practice or what they already were good at respectively. Furthermore, employee turnover was also seen as problematic.

Attitudes towards IT based crisis training

Overall, the respondents had very positive attitudes towards complementing traditional crisis training with IT based training. 55 % stated that this idea was very good. 40 % thought it was good and 5 % not so good. No one stated that it was a bad idea.

Comments were also made to the effect that exercises could take place more often as well as independently of time and space if IT were used. One respondent mentioned the great geographical distances between the trainees and how IT based training might mitigate these. One respondent stated that IT based training may be a resource efficient alternative. Another respondent, however, expressed a word of warning against seeing IT based training as a replacement of “real” exercises. Other comments were that IT based training alone will not solve the problem of little time for training and that personal collaboration and practical tasks reinforce the learning.

Ideas for IT based crisis training

The question “Do you have any suggestions regarding how to use crisis training on computer, tablet or mobile phone as a complement to traditional crisis training?” yielded a broad range of suggestions from 25 respondents. A common suggestion was to use IT as a tool to create flexibility in time and space, thus enabling training at work or at home at optional hours. In line with this, there was the suggestion to practice more often in shorter sessions.

Another idea was that a crisis situation can be either concentrated or “stretched out” in time. Several also mentioned the ability to generate scenarios that could be custom-made for a specific unit or a specific type of crisis. E-learning was another

area that was seen as suitable for IT based training. Furthermore, the opportunity to prepare for a joint exercise in which individuals can train their own roles was suggested and so were tests to estimate the trainees’ knowledge and the possibility to repeat an exercise.

Quite a few proposed that IT based tools should be used to practice collaboration between organizations. Some also pointed out that existing crisis management technology should be used also in training. Others saw the possibility to use rich multimedia material in the scenarios. Game-based training with counter-acting was another suggestion. Among the training areas that were mentioned as suitable for IT based training were communication exercises, handling and prioritizing resources, and situational awareness.

RESEARCH DIRECTIONS

Although the empirical data in this study have some limitations in terms of sampling, number of respondents, survey distribution, follow-up and the fact that we have only studied software described in research, there are still some interesting findings for future research directions. This study indicates that a major need for IT based training is to reduce the effects of the limited time for training in organizations as well as the geographical distances between trainees. This means that IT based training should enable distributed and asynchronous training to offer flexibility in time and space. At the same time the importance of personal collaboration is emphasized by the respondents. More research is thus needed on how to increase flexibility in time and space while not losing the collaborative and trust-building character of training.

The request for shorter but more frequent training sessions also suggests that more research is needed regarding how to decompose, present, distribute and execute an exercise in smaller modules. The literature review shows that few studies focus on, for example, table-top exercise, which is a form of training that could easily be distributed and also divided into smaller modules. Turoff et al. (2004) have suggested a framework that includes design principles that could support the design and development of flexible and dynamic response systems where training component could be one part.

Another request from the respondents is that tests to establish training needs (or effects) should be built into IT based training. Also, it should be possible to “re-run” an exercise to repeat it. Additionally, software solutions could offer different training or knowledge levels. The pedagogical aspect of IT based training and training methods for IT based training is thus another instrumental research direction. Finally, forthcoming studies should preferably investigate whether the lack of studies on actual usage of computer-based crisis training software indicates low adoption and if so, if the existing software fails to meet user needs or is too expensive for the public sector.

REFERENCES

1. Ahmad, A. Balet, O., Boin, A., Brivio, P., Ganovelli, F., Gobetti, E., Himmelstein, J., Pintore, G., De la Rivière, J.B. and Schaap, M. (2012) Interactive Simulation Technology for Crisis Management and Training: The INDIGO Project, *Proceedings of the 9th International ISCRAM Conference*, Vancouver Canada, April 2012.
2. Araz, O.M., Jehn, M., Lant, T. and Fowler, J.W. (2012) A New Method of Exercising Pandemic Preparedness Through an Interactive Simulation and Visualization, *Journal of Medical Systems*, 36, 1475–1483.
3. Asproth A., Borglund E.M., Öberg L-M. (2013) Exercises for crisis management training in intra-organizational settings, *Proceedings of the 10th International ISCRAM Conference – Baden-Baden, Germany, May 2013* T. Comes, F. Fiedrich, S. Fortier, J. Geldermann and L. Yang, eds.
4. Bacon, L., Windall, G. and MacKinnon, L. (2011) The development of a rich multimedia training environment for crisis management: using emotional affect to enhance learning, *Research in Learning Technology* 19, 1, Proceedings of the 2011 ALT Conference.
5. Berlin, J.M. and Carlström, E.D. (2014) Collaboration Exercises: What Do They Contribute? – A Study of Learning and Usefulness, *Journal of Contingencies and Crisis Management (in press)*.
6. Borglund, E.A.M. and Öberg, L-M. (2014) Creation of an exercise scenario: A collaborative design effort, In *ISCRAM 2014 Conference Proceedings - 11th International Conference on Information Systems for Crisis Response and Management*, 488–492.
7. Cesta A., Cortellessa G. and De Benedictis, R. (2014) Training for crisis decision making – An approach based on plan adaption, *Knowledge-Based Systems*, 58, 98-112.
8. Coppari, S., Di Pasquale, G., Goretti, A., Papa, F., Papa, S., Paoli, G., Pizza, A. G. and Severino, M. (2008) The TRIPOD e-learning Platform for the Training of Earthquake Safety Assessment, *AIP Conference Proceedings*, 7/8/2008, 1020, 1, 1916-1925.
9. Di Lorento, I., Mora, S. and Divitini, M. (2012) Collaborative serious games for crisis management: an overview, *IEEE 21st International WETICE*.
10. Greitzer, F.L., Kuchar, O.A. and Huston, K. (2007) Cognitive science implications for enhancing training effectiveness in a serious gaming context, *J. Educ. Resour. Comput.*, 7, 3.
11. Jain, S. and McLean, C.R. (2008) Components of an Incident Management Simulation and Gaming Framework and Related Developments, *SIMULATION*, January, 84, 1,3-25.
12. Lukosch, H., van Ruijven, T. and Verbraeck, A. (2012) The participatory design of a simulation training game, *WSC '12: Proceedings of the Winter Simulation Conference*.
13. Lundberg, J., Granlund, R. and Fredäng, A. (2012) Scenario play workshops – Co-design of emergency response scenarios for information technology design in collaboration with emergency response personnel, *Proceedings of the 9th International ISCRAM Conference, Vancouver, Canada, April 2012*.
14. MacKinnon, L. and Bacon, L. (2012) Developing realistic crisis management training, *Proceedings of the 9th International ISCRAM Conference, Vancouver Canada*.

15. Oulhaci, M.A., Tranvouez, E., Espinasse, B. and Fournier, S. (2013) Serious Game for Crisis Management: A Multi-agents Integration Architecture, *In 2013 IEEE 22nd International Workshop on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE)*.
16. Pottebaum, J., Marterer, R. and Schneider, S. (2014) Taxonomy of IT support for training emergency response & management, *Proceedings of the 11th International ISCRAM Conference, University Park, Pennsylvania, USA, May 2014*.
17. Rankin, R., Field, J., Wong, W., Eriksson, H., Lundberg, J. and Rooney, C. (2011) Scenario Design For Training Systems In Crisis Management: Training Resilience Capabilities, *Proceedings of the fourth Resilience Engineering Symposium June 8-10, 2011 Sophia Antipolis, France*.
18. Rencrantz C., Karlsson N., Olsson R. (2012) A concept for inter-organizational crisis management exercises, *Proceedings of the 9th International ISCRAM Conference, Vancouver Canada, April 2012*.
19. Reuter, C., Pipek, V. and Müller, C. (2009a) Avoiding crisis in communication: a computer-supported training approach for emergency management, *International Journal of Emergency Management*, 6,3/4,356-368.
20. Reuter, C., Pipek, V. and Müller, C. (2009b) Computer Supported Collaborative Training in Crisis Communication Management, *Proceedings of the 6th International ISCRAM Conference, Gothenburg, May 2009*.
21. Shih-Chieh Hsu, J., Lin, T-C., Zheng, G-T. and Hung, Y-W. (2012) Users as knowledge co-producers in the information development project, *International Journal of Project Management*, 30, 27-36.
22. Tecuci, G., Boicu, M., Hajduk, T., Marcu, D., Barbulescu, M., Boicu, C. and Le, V. (2007). A tool for training and assistance in emergency response planning, *Hawaii International Conference on System Sciences (HICSS) January 3-6*.
23. Turoff, M., Chumer, M., Van de Valle, B. and Yao, X. (2004) The design of a dynamic emergency response management information systems (DERMIS), *The Journal of Information Technology Theory and Application (JITTA)*, 5, 4, 1-35.
24. van de Ven, J.G.M., Stubbe, H. and Hrehovcsik, M. (2013).Gaming for policy makers: It's serious!, *Games and Learning Alliance Conference 2013 (GaLA 2013)*.
25. Vold, T. and Wenstad, M. (2013) Sustainable training for crisis - technology supported training for organizations, *The 45th ESReDA Seminar on Dynamic Learning from Incidents and Accidents, Bridging the Gap between Safety Recommendations and Learning, 23-24 October 2013, Porto – Portugal*.
26. Waller M., J., Lei, Z., Pratten, R. (2014) Focusing on Teams in Crisis Management Education: An Integration and Simulation-Based Approach, *Academy of Management Learning & Education*, 13, 2208-221.
- 27.