

**GEORGE EMIL PALADE UNIVERSITY OF MEDICINE, PHARMACY,
SCIENCE AND TECHNOLOGY OF TÂRGU MUREȘ**

Doctoral dissertation

**Use of virtual reality technology in professional development in disaster
management**

PhD student **EmiliaTurucz**

PhD supervisor **Prof. Dr. Leonard Azamfirei**

There is a rising tendency of disaster numbers globally, yet the number of the people affected by these events tends to decline in the past years, mainly due to the development of action plans, specialized teams and professional training programs in this field. Exposure and experience gain of the intervention personnel is still limited. Field exercises are thought to be the most efficient methods to maintain theoretical knowledge and practical abilities related to disaster management, but there is a limited access to them due to complex organizational issues and high costs. Virtual environment and its innovative forms, under continuous development, represent a field to explore due to the potential in practical applications and simulation exercises in educational context.

The main objectives of this doctoral dissertation were to explore the potential use of virtual reality simulations in professional formation in disaster management, development of simulation prototypes and practical applications in virtual environment in this context, respectively elaboration of implementation, development and exercises directing principles of simulation designed in virtual reality for this educational milieu.

The research protocol of the thesis was developed after the model of educational designed based research and included four major research stages: preliminary research, prototype development, prototype evaluation and testing, respectively results reflection and elaboration of principles of implementation and usage.

The first study of the thesis, entitled “Actual stage of virtual reality application in training processes in disaster management”, represents a systematic literature review with the main objective to corroborate and summarize the results of published studies and experiences in this domain. Another goal was the development of a pool of useful ideas for those who intend to develop virtual reality based training programs.

Virtual reality simulations are as efficient as other training methods used in disaster management formation processes, second to literature data. Technical capabilities of these virtual reality systems allow creation of extremely realistic and interactive environments. Simultaneous joining and interaction of more than one correspondent in the same virtual environment, possibility to run the same scenario as many times as needed, allow training of personnel for specific procedures, communications, collaborations and coordination related non-technical skills until perfection, in a cost-efficient manner.

Simulation exercises in virtual reality offer a lot of flexibility to both trainer and trainees in the process of transposition of theoretical knowledge in practice. Experimenting exceptional disaster events as simulations in virtual reality contributes significantly to development of professional expertise in this domain. In the same time, virtual reality simulations offer a standardized, reproducible testing ambient, with more precise and objective evaluation possibilities of competencies, abilities or long term knowledge retention.

The second study of the thesis, entitled “Experience with Virtual Reality in personnel training program for operationalization of a field hospital” presents the process of elaboration and integration of three virtual reality simulation prototypes developed in context of a training program of a level 3 international modular field hospital personnel.

The first simulation prototype was a design exercise in which the trainees projected virtual modular field hospitals. The other two forms of virtual exercises were developed on the structure of multi-level, multi-strategic, multidisciplinary complex field exercises.

Positive feed-back was obtained from both trainers and trainees for the exercises conducted in virtual reality. The participants adapted swiftly to the new form of training

regarding technical utilization and the combined, virtual and real information flow of the simulation events. Virtual reality proved to be a satisfactory method for practical applications in this field and may be useful in all the steps of personnel training for mobile hospital units.

The third study of the thesis, "Large scale exercises in virtual reality. Prototypes of virtual reality applications in context of large scale field exercises organized by EADRCC – NATO", represents another series of virtual reality exercises developed this time in context of annual NATO organized disaster consequence management field exercises with the main focus on international collaboration and resilience. Three experiments were conducted in this study.

In the first experiment a full digital exercise was organized, based on field exercise algorithm and that proved that virtual reality is ideal for Command Post exercises. During the second experiment we tested the potentials of utilization of virtual reality simulations in the context of real field exercises and during the third experiment we succeeded the integration of virtual simulations in the algorithm of field exercise, amplifying its complexity without additional specific preparations and costs.

Didactic methodology of simulation exercises in virtual environment is based on situational and constructivist learning theories, in which efficient learning is achieved only if the specific context in which it is intended to be used is created. Virtual reality and interactive multimedia offer situational learning opportunities into the classroom educational settings. Furthermore, through interactivity, encourages extension of individual cognitive knowledge towards social one, facilitating cognitive, affective and psychosomatic learning and developing interpersonal collaboration related non-technical abilities. It offers a context for an active learning process that helps the student to find a meaning for the new knowledge, being relevant for his own version of reality, in contrast with conventional teaching which is based on the perspective of the tutor.