

ICT TOOLS IN CBRN TROOPS' EDUCATION AND TRAINING

Paweł MACIEJEWSKI*

*Training Centre, War Studies University in Warsaw
e-mail: p.maciejewski@akademia.mil.pl

Received on 26th July; accepted after revision in October 2016

Copyright © 2017 by Zeszyty Naukowe WSOWL



Summary:

The aim of the article is to prove that Information and Communication Technologies (ICTs) can serve as viable didactic tools in the CBRN troops' education and training. The analysis of selected case studies reveals that specific competences can be trained with the support of social media, e-learning platforms, virtual worlds, mobile technologies or even augmented reality technologies. The unique qualities of these tools, such as an easy access to the training content, interactivity, or possibility of simulating different scenarios allow for designing a training process tailored both for larger groups and an individual.

Keywords:

ICT, CBRN education and training, didactic tools, virtual worlds, augmented reality, social media, e-learning platforms

INTRODUCTION

Nowadays, in the information era¹, the Information and Communication Technologies (ICTs)² are recognized as catalysts for social, economic, cultural, or even educational changes. Distinctive features of this era include an extensive use of the Internet, social media applications (e.g. YouTube, Facebook, Twitter) as well as sending, retrieving,

¹ American Heritage® Dictionary of the English Language defines the information era as *the period beginning around 1970 and noted for the abundant publication, consumption, and manipulation, especially by computer and computer networks*. American Heritage® Dictionary of the English Language, Fifth Edition. Copyright © 2011 by Houghton Mifflin Harcourt Publishing Company. Published by Houghton Mifflin Harcourt Publishing Company. [online]. [available: 15.01.16]: Available on the Internet: <http://www.thefreedictionary.com/Information+era>.

² Information Communication Technologies (ICT) will refer to the computer and Internet connections to handle and communicate information for educational purposes. The ICTs are often described in terms of emerging technologies, which are claimed to be developed within next five to ten years.

receiving, archiving information anytime and anywhere. According to data presented by Eurostat, as of the beginning of 2014, just over three quarters (78 %) of all individuals in the EU-28, aged between 16 and 74 years, used the Internet (at least once within three months prior to the survey date)³. This data proves the significance of general changes in the manner of communicating between people and the fact that they concern all social groups. As ICTs influence the way of handling and exchanging information, they play a salient role in almost every field of human activity, among others, in education and training. Teachers start using state-of-art solutions that combine virtual and real worlds. Although this “blend” is challenging – it requires a proper preparation, knowledge about technology, it gives teachers and learners more possibilities: the training content can be stored virtually and easily reached by any number of learners (depending on the imposed conditions). Different educational experiments and practices lead to intensive discussions on new paradigms related to educational technology, consequently affecting educational philosophies, approaches, theories and methods of teaching. This view is reflected in M. Gawlik-Kobylińska's book, titled in Polish: *Nowe technologie w edukacji dla bezpieczeństwa. Paradygmat społeczeństwa informacyjnego i jego przyszłość (Emerging Technologies in Education for Safety and Security. The Information Society Paradigm and Its Future)*. The author explains the way in which emerging technologies affect development of contemporary teaching and learning⁴. It must be noted that one of the most significant changes in education and training concerns a very well known concept of distance learning⁵, which presently goes through its *renaissance*. Due to its growing popularity a significant number of authors pay attention to the development of this method. For instance, B. Misnevs, N. Fila, A. Dunjashkins and E. Abasheva explain the functioning of a contemporary distance learning academic model, which can be followed by various universities to maintain a proper level of effective organization⁶. On the whole, the application of ICTs in education and training, the emergence of new approaches, systems, models, implementation of new organizational solutions has one prevailing goal: to increase the effectiveness of contemporary teaching and learning. *Keeping up with the pace* of technologies and the issue how to understand a *digital native* learner are the key factors, which affect this goal.

³ [online]. [available: 15.01.16]. Available on the Internet: http://ec.europa.eu/eurostat/statistics-explained/index.php/Information_society_statistics_-_households_and_individuals.

⁴ M. Gawlik-Kobylińska, *Nowe technologie w Edukacji dla bezpieczeństwa. Paradygmat społeczeństwa informacyjnego*. Rozpisani.pl, 2016.

⁵ The California Distance Learning Project (CDLP) defines distance learning as follows. *Distance Learning (DL) is an instructional delivery system that connects learners with educational resources. DL provides educational access to learners not enrolled in educational institutions and can augment the learning opportunities of current students. The implementation of DL is a process that uses available resources and will evolve to incorporate emerging technologies*. California Distance Learning Project website, [online]. [available: 15.01.16]. Available on the Internet: <http://www.cdlonline.org/index.cfm?fuseaction=whatis&pg=2>.

⁶ B. Misnevs, N. Fila, A. Dunjashkins, E. Abasheva, *Simulation model of distance learning planning and implementation on the basis of ECTS credits*. Proceedings of the 35th International Convention, MI-PRO 2012. 2012, pp. 1215 - 1219.

Apart from this general aspect, the development of ICTs brings inevitable challenges in military education and training, especially in the Polish CBRN troops. In this specific area, taking protective measures in situations where chemical, biological, radiological, nuclear (CBRN) warfare (including terrorism) hazards may be present, becomes a crucial competence. It involves skills related to CBRN passive protection, contamination avoidance, and CBRN mitigation. The contemporary training of those skills will require the application of carefully selected state-of-the-art solutions which will enhance the realization of scenarios related CBRN incidents, will present states, processes and the possibilities of seamless lessons-learned process. Therefore, this kind of education and training demand both special attention and treatment. Undoubtedly, it requires a deeper consideration, intensive discussions, and paying attention to the most contemporary practices, approaches, and research. It is vital to stress that the present-day knowledge on CBRN should be obtained from subject matter experts (SMEs), e.g. from experts on tropical medicine⁷ or ecology⁸. The character of the CBRN troops' education and training and the highlighted context triggered author's interest in the question on how ICT tools can support the aforementioned processes.

The article will focus on the use of ICT tools in acquiring and achieving specific competences in the field of the CBRN defense. The presented issues will concern teaching outcomes connected with CBRN defense education and training, present-day pedagogies which can be applied in this kind of education and training and, finally, didactic tools (social media, e-learning platforms, virtual worlds, mobile technologies and augmented reality technologies).

1. CBRN TROOPS' TRAINING OUTCOMES – OVERVIEW

The CBRN troops' training outcomes (knowledge and skills to be acquired) were identified through the analysis of the following NATO documents: *The Allied Joint Doctrine For Chemical, Biological, Radiological and Nuclear Defense - AJP-3.8(2012)* and *The International CBRN Training Curriculum (2013)*. The first AJP-3.8 document describes military capabilities developed according to alliance troops requirements. These military capabilities could be employed in reinforcement of or in addition to insufficient or non-existing civilian capabilities in case of CBRN incidents⁹. The second document is a part of *The Non-Binding Guidelines and Minimum Standards for CBRN First Responders (NBG/ MS)* developed by NATO Civil Protection Group. It helps to establish a common framework for international response to CBRN incidents and to enhance interoperability and cooperation of international response teams¹⁰.

⁷ Cf. K. Korzeniewski, The epidemiological situation in Iraq, „Przegląd Epidemiologiczny” 2006, No 60(4).

⁸ Cf. A. Sobianowska-Turek, W. Szczepaniak, M. Zabłocka-Malicka, *Electrochemical evaluation of manganese reducers - recovery of Mn from Zn-Mn and Zn-C battery waste*, Journal of Power Sources. 2014, vol. 270, p. 668-67.

⁹ Allied Joint Doctrine For Chemical, Biological, Radiological, And Nuclear Defence - AJP-3.8 Edition, Version 1, NATO Standardization Agency (NSA), March 2012, p.15.

¹⁰ Project on Minimum Standards and Non-Binding Guidelines for First Responders Regarding Planning, Training, Procedure and Equipment for Chemical, Biological, Radiological and Nuclear (CBRN) Inci-

According to the analysis of the above-mentioned documents, the training outcomes include: understanding fundamentals of CBRN defense (basic concepts, aim, principles), force protection, CBRN threats and hazards; gaining knowledge on characteristics and effects of chemical and biological agents, radiological material, nuclear weapons, as well as characteristics and effects of toxic industrial materials. Moreover, participants of the training gain knowledge on components of CBRN defense, they gain skills on how to detect, identify, monitor CBRN agents; how to warn and report about CBRN incidents as well as to assess the risk and protect troops individually and collectively. Additionally, they acquire the knowledge on the areas such as: pre-hazard precautions, the issues related to hazard control recognition, decontamination, medical countermeasures and pre-treatments, medical support in CBRN environments. Training outcomes also include raising the awareness in the scope of regulations on when and how the military can assist civilian authorities, skills on how to operate during pre-incident activities, during incident occurrence and post-incident activities. Interestingly, there is also an emphasis put on social skills in the scope of CBRN management (command considerations for planning and conduct of CBRN defense, operational and CBRN defense priorities, extension of CBRN defense and CBRN Consequence Management - CM, Joint Staff Responsibilities for CBRN Defence)¹¹.

The NATO document *The International CBRN Training Curriculum* highlights that CBRN training should be adaptable and flexible to accommodate different emergency management structures within the nations; used by nations to complement and support national CBRN training programs as required; modular and focused on key functions of the immediate or short-term elements of the response - these modules can then be used in various combinations to meet the specific training needs of the nations; dynamic and incorporated into best practice and lessons learned from real incidents¹². The recommendations can be incorporated into domestic curricula and executed with the help of suitable teaching forms and methods.

2. CONTEMPORARY PEDAGOGICAL APPROACHES APPLICABLE FOR CBRN TRAINING

The information era affects people's everyday lives, their work and a way of entertainment. The use of ICTs by individuals or larger groups builds the information society. Its main feature is an unconstrained access to information and the development of telecommunication infrastructure. As it was previously stated, education and training in the information society are affected by overwhelming use of ICT tools. On the one

dents. *The International CBRN Training Curriculum*, NATO Civil Emergency Planning Civil Protection Group, 2013, p. 3, [online]. [available: 15.01.16]. Available on the Internet: <http://www.nato.int/issues/cep/CBRN-Curriculum-August2013-EN.pdf>.

¹¹ *Allied Joint Doctrine For Chemical, Biological, Radiological, And Nuclear Defence - AJP-3.8 Edition, Version 1*, NATO Standardization Agency (NSA), March 2012.

¹² Project on Minimum Standards and Non-Binding Guidelines for First Responders Regarding Planning, Training, Procedure and Equipment for Chemical, Biological, Radiological and Nuclear (CBRN) Incidents. *The International CBRN Training Curriculum*, NATO Civil Emergency Planning Civil Protection Group, 2013, p. 4, [online]. [available: 15.01.16]. Available on the Internet: <http://www.nato.int/issues/cep/CBRN-Curriculum-August2013-EN.pdf>.

hand, they create a new learning environment, but on the other – they create requirements that must be fulfilled by teachers/trainers (knowledge and skills on how to use the ICT didactic tools). Supporting education with emerging technologies affects today's pedagogy. Nowadays, it is possible to distinguish between traditional pedagogy and pedagogy applicable for the information society. According to J. Voogt (2003) the distinction concerns four aspects of learning: activity, collaboration, integration and evaluation (table 1)¹³.

Table 1. Overview of Traditional Pedagogy versus Information Society Pedagogy

Aspect	Traditional pedagogy	Emerging pedagogy applicable for the information society
Active learning	Activities prescribed by teacher	Activities determined by learners
	Whole class instruction	Small group
	Little variation activities	Many different activities
	Pace determined by the program	Pace determined by learners
Collaborative learning	Individual	Working in teams
	Homogenous groups	Heterogeneous groups
	Every one for him/herself	Supporting each other
Integrative learning	No link between theory and practice	Integrating theory and practice
	Separate subjects	Integration between subjects
	Discipline based	Thematic
	Individual teachers	Teams of teachers
Evaluative leaning	Traditional pedagogy	Emerging pedagogy for the information society

Source: own elaboration

The presented pedagogies can be treated as two different contexts for performing teaching activities. The contemporary pedagogy focuses on active learners who work in small groups and are tasked with multifarious exercises (to maintain a proper level of concentration and external motivation). Also, their activities can be individualized and the instructions are mostly designed for small groups. Unlike in the traditional pedagogy, students work in teams, they support each other during practical exercises

¹³ J. Voogt, *Consequences of ICT for aims, contents, processes, and environments of learning*. In J. van den Akker, W. Kuiper & U. Hameyer (Eds.), *Curriculum landscapes and trends*. Kluwer Academic Publishers, Dordrecht 2003, p. 222.

(building social skills) and work with different thematic instructors. Subjects are no longer separated.

It must be added that modern pedagogy focuses also on learner's cognitive skills, which are stimulated with the use of ICT tools. Especially designed educational activities are based on behaviorists' approach (response and reaction), connectivist approach (learning is a process of connecting specialized nodes or information source) and constructivism (knowledge cannot be transmitted because it is a construct of the mind and learners have an active role in building the understanding so as to make sense of the world)¹⁴. The choice of an approach or approaches depends on a teacher/instructor, a trained group and conditions under which the training is performed.

3. ICT TOOLS IN THE CBRN TRAINING

In the era of information the process of the CBRN education and training involves different ICT tools such as: social media, e-learning platforms, virtual worlds, mobile technologies as well as augmented reality technologies. However, their use needs standardization. In military context, the Advanced Distributed Learning (ADL) Initiative is the institution, which deals with standardization of the teaching processes. It was established in 1997 as a part of the U.S. Department of Defense and it aims, among others, to support lifelong learning through the use of learning technology. The Initiative develops and implements new technologies for educational purposes and fulfills its mission by collaboration with government, industry and academia. Regarding the international cooperation, the ADL Initiative recognizes the network of ADL Partnership Labs around the world¹⁵. Bearing in mind the issue of standardization of military education and training, the application of ICT tools requires deliberation and caution.

3.1. Social media

At the eLearning Guild's DevLearn 2010 Conference it was stated that the ADL recognizes the need to enable social learning, mobile learning, augmented reality and forms we don't even know about yet¹⁶. Furthermore, with reference to social media the more we share and comment, the more we learn (...).The intent is to spur innovation in learning technology, especially in the area of community-oriented technology¹⁷. The development of community-based technology is possible thanks to the use of online technologies (the Internet and mobile-based tools) which enable people to share opinions, insights, experiences and perspectives with each other. Social learning takes place within the online communities; it happens during discussions through social portals (such as Twitter, WhatsApp, and similar Web 2.0 applications). D. McConnell explains that working with social media allows for learners' participation in a learning

¹⁴ C. M. Klinger, *Behaviourism, cognitivism, constructivism, or connectivism? Tackling mathematics anxiety with 'isms' for a digital age*. [online]. [available: 12.01.16]. Available on the Internet: <http://www.almonline.net/images/ALM/proceedings/alm16/Articles/15klinger.pdf>.

¹⁵ [online]. [available: 12.01.16]. Available on the Internet: <http://adlnet.gov/>.

¹⁶ [online]. [available: 12.01.16]. Available on the Internet: <http://www.learningsolutionsmag.com/articles/581/breaking-news-adl-initiative-to-focus-on-design-amp-community-oriented-technology>.

¹⁷ Ibid.

community; they share resources, knowledge, experience and responsibility through reciprocal collaborative learning¹⁸, which is an educational approach to teaching and learning, that motivates groups of learners working together to solve a problem, complete a task or create a product¹⁹. Moreover, learners can create training content. As a result, the boundaries between experts or teachers and learners become blurred. According to M. L. O’Sullivan and G. Samarawickrema, Web 2.0 technologies can be employed effectively to create rich learning environments, are entirely collaborative and depend on users to read-write-edit-publish through an iterative process²⁰. Regarding CBRN training – social media can be used for tasks that involve collaboration and instant exchange of information (e.g. field exercise during which mobile apps can be used for giving and receiving instructions or alerts). Sharing the knowledge by world’s leading states institutions dealing with the CBRN incidents would constitute further example of the social media application. The knowledge would be conveyed and shared among members of a closed group.

3.2. E-learning platforms

The ability to reuse instructional components in multiple applications and environments, regardless of the tools used to create them is an important factor that should be taken into account during training preparation²¹. This means that content can be reused in different applications. To maintain reusability as well as interoperability and durability, the ADL Initiative developed the SCORM (Sharable Content Object Reference Model), which is a collection of standards and specifications for web-based electronic educational technology²². It assures communication between e-learning platforms (Learning Management System – LMS). ILIAS²³ and Moodle belong to the most popular educational platforms²⁴. They include teaching modules and means of syn-

¹⁸ D. McConnell, *E-learning groups and communities*. Milton Keynes, Open University Press, 2006, p. 6.

¹⁹ M. D. Laal, M. Laal, *Collaborative learning: what is it?* Procedia - Social and Behavioral Sciences 31, 2012, p. 491.

²⁰ M.L. O’Sullivan, G Samarawickrema, *Changing learning and teaching relationships in the educational technology landscape*. In Hello! Where are you in the landscape of educational technology? Proceedings ascilite Melbourne 2008, p. 713. [online]. [available: 15.01.16]. Available on the Internet: <http://www.ascilite.org.au/conferences/melbourne08/procs/osullivan-poster.pdf>.

²¹ [online]. [available: 12.01.16]. Available on the Internet: <http://adlnet.gov/adl-research/scorm/>.

²² To learn outside of a Learning Management System (LMS) and a web browser, the ADL Initiative developed the Experience API (xAPI) specification. *In addition, it is capable of tracking informal learning, social learning, and real world experiences. Example learning activities that can be tracked include reading an article, watching a training video, participating in a virtual world with augmented reality or simulation, using a mobile application, or having a conversation with a mentor.* [online]. [available: 12.01.16]. Available on the Internet: <http://adlnet.gov/adl-research/performance-tracking-analysis/experience-api/>.

²³ ILIAS - *Integriertes Lern-, Informations- und Arbeitskooperations-System* (German word for "Integrated Learning, Information and Work Cooperation System") is an open source web-based learning management system (LMS). It supports learning content management (including SCORM 2004 compliance) and tools for collaboration, communication, evaluation and assessment.

²⁴ Moodle - Modular Object-Oriented Dynamic Learning Environment - is an open source web-based learning management system (LMS).

chronous and asynchronous communication tools such as forums, chats and e-mails; they have possibility to launch websites or MS Office Word and Adobe Acrobat files. The ILIAS platform, an open source of Learning Management System, can be described not only as a multipurpose tool that can be used as a flexible course player or authoring tool but also as a communication and collaboration platform²⁵. In Poland, it is popular among military institutions²⁶. Moodle, another open LMS source, can be defined as a free web application for educators and it was probably one of the most popular free LMSs on the market in 2015. It has constantly been upgraded and developed²⁷. From CBRN training perspective, the platforms have a wide range of inbuilt functions that allow for designing e-learning or b-learning (hybrid, which combines the face-to-face classroom practice with e-learning solutions) courses. The training can take the individual or team form. The example of the training delivered by an e-learning platform (TRAMS) comes from the Johns Hopkins Bloomberg School of Public Health. The course *Introduction To Weapons of Mass Destruction* consists of three parts: Part 1: *Introduction to Chemical Terrorism Preparedness*, Part 2: *Introduction to Bioterrorism Preparedness*, Part 3: *Introduction to Radiological Terrorism Preparedness*. It can stand as a self-directed course or a course, which supplements a stationary training. Figure 1 presents the course's sample screen.

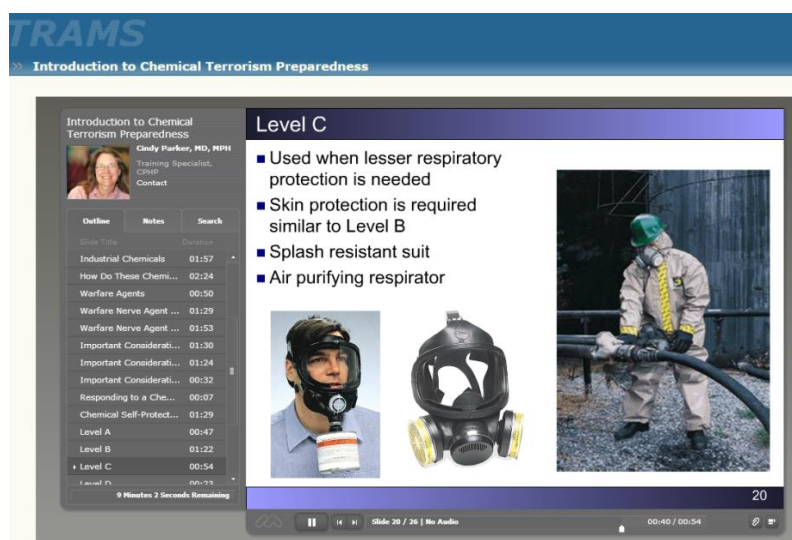


Fig. 1. Introduction to Chemical Terrorism Preparation course

Source: [online]. [available: 16.01.16]. Available on the Internet: <http://trams.jhsph.edu/trams/index.cfm?event=training.playSection§ionID=499> (after being logged)

²⁵ [online]. [available: 11.01.16]. Available on the Internet: <http://www.academyofmine.com/12-best-free-learning-management-systems-lms/>.

²⁶ K. Trochowska, M. Gawlik-Kobylińska, *Information and communication technologies in intercultural competence training for the purpose of Ministry of National Defence. Introduction to cultural awareness course*. *Zeszyty Naukowe/Wyższa Szkoła Oficerska Wojsk Lądowych im. gen. T. Kościuszki*, (2)/2015, pp. 84, 89, 91.

²⁷ [online]. [available: 11.01.16]. Available on the Internet: <http://www.academyofmine.com/12-best-free-learning-management-systems-lms/>.

It can be noticed that the contents of the platform is intuitive and multimedia are well composed in the training content. The course can be conducted online anytime and anywhere, without any time constraints and costs. Moreover, it can be interspersed with social media communicators, which make the learning more engaging. However, it must be stressed that teachers/trainers need to apply clear rules of communication between all members of educational process²⁸. It makes the learning and teaching processes more effective and smooth.

3.3 Virtual worlds

Apart from social media and e-learning platforms, the training can be conducted in any virtual world (VW), often called the 3D Virtual Learning Environment (VLE), which creates a *landscape* for conducting educational activities. Since the exchange of information and communication is increasingly exercised online, such systems have become a part of the essential educational infrastructure in various higher education establishments²⁹. The most popular VLEs are as follows:

- *Second Life* (<http://www.secondlife.com>);
- *OpenSim* (<http://www.opensimulator.org>);
- *There* (<http://www.there.com/>);
- *Olive* (<http://www.saic.com/products/simulation/olive/>).

A VW platform is a “student-centered virtual learning platform” because it supports and diversifies the opportunities for learners to choose the content individually while designing the learning environment³⁰. These VLEs are perceived as a multi-user virtual environment (MUVE) that are defined as such environments which possess *the potential to generate a sense of presence among peer learners via their avatars in a 3-D environment through real-time interactions that may facilitate relationship-building, learners’ engagement and motivation*³¹.

The training of CBRN troops also can be conducted in such an environment, e.g. virtual presentation of elements, molecular structures, the effects of acid rain, toxic waste, management, decision making, etc. The example of the content presentation (molecular structures) comes from Texas University SL Island (Fig. 2).

²⁸ M. Gawlik-Kobylińska. *Komunikacja w nauczaniu zdalnym na przykładzie platformy LMS ILIAS*. Zeszyty Naukowe/Wyższa Szkoła Oficerska Wojsk Lądowych im. gen. T. Kościuszki, 4/2014, p. 5-14.

²⁹ P. Traffor, Y. Shiota, *An Introduction to Virtual Learning Enviroment*. [online]. [available: 09.03.16]. Available on the Internet: http://www.gakushuin.ac.jp/univ/eco/gakkai/pdf_files/keizai_ronsyuu/contents/contents2006/4803/4803paul/4803paul.pdf.

³⁰ T. Coffman, M. B. Klinger, *Utilizing Virtual Worlds in Education: The Implications for Practice*. International Journal of Social Sciences, Volume 2 Number 1, 2008, pp. 29-33.

³¹ P. Edirisingha, M. Nie, M. Pluciennik, R. Young, *Socialisation for learning at a distance in a 3-D multi-user virtual environment*. British Journal of Educational Technology Vol 40 No 3, 2009, pp. 458–479.



Fig. 2. 3D presentation of Content in VLE

Source: [online]. [available: 16.01.16]. Available on the Internet:
<http://maps.secondlife.com/secondlife/12th%20Man/46/64/751>.

Recording the action that is performed on the screen is another form of the use of 3D VLE. This kind of videos is called *machinima*. It is a new form of filmmaking, which utilizes 3D videogame engine technology to create animated films within virtual environments³². In such videos the stage is provided by computer generated imagery, therefore its production is perceived as highly cost-effective. Machinima, as a form of demonstration, can be used for the needs of CBRN training as well - it can be easily disseminated to learners and teachers as video-podcasts (or vodcasts). M. Gawlik-Kobylińska suggests that machinima can be perceived both as a supporting material (typical visual aid and video) and as a task (a task-based approach) by which learners acquire, develop and reinforce specific skills³³. It may be implied that the process of video production boosts concentration and memorization of particular tasks (e.g. CBRN crisis management).

3.4. Mobile technologies

Mobile learning and performance support applications (apps) gain popularity in training of CBRN troops. The introduction of HTML5, "Moment of Need" mobile support, Big Data Applications, responsive design, wearable accessories, geolocation are among main features that trigger new ideas for learning activities, which will be designed and realized with the use of mobile devices. Unlike Flash, HTML5 is perceived as accessible on all platforms, devices and browsers, simultaneously it is faster and more versatile. The "Moment of Need" mobile support provides resources for better performance

³² A. Morozov, *Machinima Learning: Prospects for Teaching and Learning Digital Literacy Skills through Virtual Filmmaking* [in:] J. Luca & E. Weippl (Eds.), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2008*. Chesapeake, VA: AACE, pp. 5898-5907.

³³ M. Gawlik-Kobylińska, *Machinima as a Teaching Tool in Linguistic Education*, *EDULEARN15 Proceedings*, 2015, p. 6853.

(e.g. instructions for trainers) and the Big Data Application enables the opportunity to examine learners' preferences and improve their overall mobile training strategy. Responsive design allows for automatic adjustment of the training content to the size of a screen. Wearable accessories such as Google Glass, Oculus Rift, Apple Watch and Android Wear are becoming both more popular and affordable. Finally, geolocation – a trainer can design location-based online content³⁴. PEARLS and JKO (Joint Knowledge Online)/Advanced Distributed Learning (ADL) Mobile constitute samples of mobile apps. PEARLS is capable of monitoring a user's GPS, interests, expertise, schedule, media preferences and daily routines. It uses this information to suggest learning content and persuades the learner to read that content based on their personal preferences and goals, time and location constraints and level of expertise in the form of Smart Lists and Smart Alerts³⁵. JKO app provides CBRN courses, e.g. *Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives Advanced Learning Education (CBRNE - ALERT) Course*³⁶ - the hybrid course designed to better prepare responders for incidents involving weapons of mass destruction, *Emergency Prepared Response Course (EPRC) - Clinician Short Course* – focuses on the issues on how to manage casualties during an all-hazards incident including those emanating from chemical, biological, radiological, nuclear or high-yield explosives (CBRNE) sources³⁷. Needless to say, designing courses in mobile apps requires the special micro-learning approach, which provides learning content in small chunks of knowledge.

3.5. Augmented reality technologies

Augmented reality is defined as an enhanced image or environment that can be viewed on a screen or other display, produced by overlaying computer-generated images, sounds, or other data in a real-world environment³⁸. Those technologies create unlimited solutions that can be applied during the training of CBRN troops. For example it would be possible to implement oculus rift and workstations – combine them with VR or what is recently more popular – implement Holographic Reality (HR). This advanced technological solution enables possibility of creation collaborative 3D experiences through an interactive display. The innovative tools create fully immersive environment, which is “safer” for a learner and generate lower costs (reduce physical injuries) than a stationary training. The latest and the most sophisticated holographic technology project called LEIA 3D (Fig. 3) constitutes the example of the above-mentioned applications. According to MIT Technology Review *‘there has been very little innovation in the basic physics for making 3-D images since the early 20th*

³⁴ 6 Mobile Learning Trends For 2016. [online]. [available: 15.01.16]. Available on the Internet: <http://elearningindustry.com/6-mobile-learning-trends-for-2016>.

³⁵ [online]. [available: 15.01.16]. Available on the Internet: <http://adlnet.gov/perls/>

³⁶ Training & Exercise Support Anytime, Anywhere. Joint Knowledge Online. November 2014. [online]. [available: 15.01.16]. Available on the Internet: <http://jko.jten.mil/references/jkoCourseCatalog.pdf>, p. 76.

³⁷ Ibid., p. 88.

³⁸ augmented-reality. Dictionary.com. Collins English Dictionary - Complete & Unabridged 10th Edition. HarperCollins Publishers.[online]. [available: 15.01.16]. Available on the Internet: <http://dictionary.reference.com/browse/augmented-reality>.

century. This new display is transforming a technology that's been around for 100 years³⁹.



Fig. 3. Innovative holographic technology - LEIA 3D

Source: [online]. [available: 15.01.16]. Available on the Internet: <http://edition.cnn.com/videos/tv/2015/11/23/make-create-innovate-communication-holograms-leia.cnn>.

The future of CBRN troops' training may involve such novelties as holographic technology. Creation of almost real training conditions may be useful for gaining knowledge and skills in the field of hazard control, decontamination, medical countermeasures and pre-treatments, medical support in CBRN environments, skills on how to operate during pre-incident activities, during-incident actions and post-incident actions. The entire training requires psychomotor activities, the whole body is engaged and a learner operates within artificially created conditions.

CONCLUSIONS

The article focuses on the use of ICTs in education and training of the CBRN troops. By giving different examples, it proves that ICT tools can serve as practical teaching mechanisms, which help students to visualize dangerous incidents, simulate different scenarios, support content dissemination and are motivating and engaging for learners. The described pedagogical approaches and the scope of the tools' applications raise a question on the general standards concerning the implementation of ICTs in this kind of education and training. In the military environment such standards are provided by ADL Initiative. As far as the universal character of ADL solutions is concerned, it seems that any process of designing the CBRN training in a combined form should incorporate the recommendations and standards developed by the Initiative. However, those standards when perceived as a kind of innovation must be compliant

³⁹ [online]. [available: 15.01.16]. Available on the Internet: <https://www.leia3d.com/the-technology/>.

with the organizational and systemic solutions⁴⁰. The initial step of the ICT didactic tools integration into CBRN troops' training would require identification of potential efforts and barriers, especially in the area of policy, planning, infrastructure, learning content and language as well as capacity building and financing. Further implementation of ICTs in the didactic process and preparation of VLE requires a significant number of efforts, which is perceived as a considerable challenge for organizations. As F. Mikre stresses, ICT-enhanced education requires clearly stated objectives, mobilization of resources and political commitment of the concerned bodies⁴¹. Therefore, it needs deliberate efforts and close cooperation between decision-makers (strategic level) as well as between subject matter experts, instructional designers, project managers, e-teachers and administrators (operational level). Regarding the engagement of resources, V. L. Tinio suggests that *potential sources of money and resources (...)* can be *grants, public subsidies, fund-raising events, in kind support from volunteers, community support, revenues earned from core business, and revenues earned from ancillary activities*⁴². Most innovations are brought to life due to such possibilities. Additionally, other challenges are worth mentioning, especially those which concern teachers and learners. From a teacher perspective it is indispensable to possess knowledge on contemporary pedagogical issues and to have computer skills. Learners should also be prepared to use such technology in order not to be inhibited by technical barriers (skills gap). However, regarding all assets of ICT enhanced training, it can be stated that such solutions facilitate different modalities, make the training more attractive and motivating.

The ICTs provide various opportunities both for learners and teachers. The training can take the individual or group form, however, it depends on the specifics of the subject taught, the group of participants, the conditions offered by the organizer of the course and the competence possessed by the individual providing the course.

The presented issues can be a starting point for further discussions and research on the use of state-of-art didactic solutions in CBRN training and education.

REFERENCES

1. American Heritage® *Dictionary of the English Language*, Fifth Edition. Copyright © 2011 by Houghton Mifflin Harcourt Publishing Company. Published by Houghton Mifflin Harcourt Publishing Company. [online]. [available: 15.01.16]. Available on the Internet: <http://www.thefreedictionary.com/Information+era>.

⁴⁰ M. Gawlik-Kobylińska. Przedsiębiorczość akademicka na przykładzie Uniwersytetu Harvarda. Transfer doświadczeń dla kreowania bezpieczeństwa. *Bezpieczeństwo i Technika Pożarnicza*, 44(4)/2016.

⁴¹ F. Mikre, *The roles of information communication technologies in education: Review article with emphasis to the computer and Internet*. *Ethiopian Journal of Education and Sciences*, 6(2), 2011, p. 123.

⁴² V. L. Tinio, *ICT in Education: UN Development Programme (2002)*. Retrieved via: www.eprmers.org [In:] F. Mikre, *The roles of information communication technologies in education: Review article with emphasis to the computer and Internet*. *Ethiopian Journal of Education and Sciences*, 6 (2), 2011, p. 123.

2. Allied Joint Doctrine For Chemical, Biological, Radiological, And Nuclear Defence - AJP-3.8 Edition, Version 1, NATO Standardization Agency (NSA), March 2012.
3. California Distance Learning Project website, [online]. [available: 15.01.16]. Available on the Internet: <http://www.cdlponline.org/.cfm?fuseaction=whatis&pg=2>.
4. Coffman T., Klinger M. B., *Utilizing Virtual Worlds in Education: The Implications for Practice*. International Journal of Social Sciences, Volume 2 Number 1, 2008.
5. Edirisingha P. Nie M., Pluciennik M., Young R., *Socialisation for learning at a distance in a 3-D multi-user virtual environment*. British Journal of Educational Technology Vol 40 No 3, 2009.
6. Gawlik-Kobylińska M., *Przedsiębiorczość akademicka na przykładzie Uniwersytetu Harvarda. Transfer doświadczeń dla kreowania bezpieczeństwa*. Bezpieczeństwo i Technika Pożarnicza, 44(4), 2016.
7. Gawlik-Kobylińska M., *Nowe technologie w Edukacji dla bezpieczeństwa. Paradygmat społeczeństwa infomacyjnego*. Rozpisani.pl, 2016.
8. Gawlik-Kobylińska M., *Machinima as a Teaching Tool in Linguistic Education*, EDULEARN15 Proceedings, 2015.
9. Gawlik-Kobylińska M., *Komunikacja w nauczaniu zdalnym na przykładzie platformy LMS ILIAS*. Zeszyty Naukowe/Wyższa Szkoła Oficerska Wojsk Lądowych im. gen. T. Kościuszki, 4/2014.
10. Klinger C. M., Behaviourism, cognitivism, constructivism, or connectivism? Tackling mathematics anxiety with 'isms' for a digital age. [online]. [available: 12.01.16]. Available on the Internet: <http://www.almonline.net/images/ALM/proceedings/alm16/Articles/15klinger.pdf>.
11. Korzeniewski K., *The epidemiological situation in Iraq*, „Przegląd Epidemiologiczny” 2006, nr 60(4).
12. Korzeniewski K., Nitsch-Osuch A., Konarski M., Guzek A., Prokop E., Zieniuk K., *Prevalence of acute respiratory tract diseases among soldiers deployed for military operations in Iraq and Afghanistan*, “Advances in Experimental Medicine and Biology” 2013, Vol. 788.
13. Korzeniewski K., *Health hazards in areas of military operations conducted in different climatic and sanitary conditions*, “International Maritime Health” 2011, t. 63(1).
14. Laal M. D., Laal M., *Collaborative learning: what is it?* Procedia - Social and Behavioral Sciences 31, 2012.
15. McConnell D., *E-learning groups and communities*. Milton Keynes, Open University Press, 2006.
16. Mikre F. *The roles of information communication technologies in education: Review article with emphasis to the computer and Internet*. Ethiopian Journal of Education and Sciences, 6 (2), 2011.

17. Misnevs B., Fila N., Dunjashkins A., Abasheva E., *Simulation model of distance learning planning and implementation on the basis of ECTS credits*. Proceedings of the 35th International Convention, MIPRO 2012. 2012.
18. Morozov A., *Machinima Learning: Prospects for Teaching and Learning Digital Literacy Skills through Virtual Filmmaking* [in:] J. Luca & E. Weippl (Eds.), Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2008. Chesapeake, VA: AACE.
19. O'Sullivan M.L., Samarawickrema G., *Changing learning and teaching relationships in the educational technology landscape* [in:] Hello! Where are you in the landscape of educational technology? Proceedings ascilite Melbourne 2008, p. 713. [online]. [available: 15.01.16]. Available on the Internet: <http://www.ascilite.org.au/conferences/melbourne08/procs/osullivan-poster.pdf>.
20. Project on Minimum Standards and Non-Binding Guidelines for First Responders Regarding Planning, Training, Procedure and Equipment for Chemical, Biological, Radiological and Nuclear (CBRN) Incidents. The International CBRN Training Curriculum, NATO Civil Emergency Planning Civil Protection Group, 2013 [online]. [available: 15.01.16]. Available on the Internet: <http://www.nato.int/issues/cep/CBRN-Curriculum-August2013-EN.pdf>.
21. Sobianowska-Turek A., Wasiewska S., Wierzbicka W., *Przerób zużytych baterii litowo-jonowych (Li-jon) w Polsce*, Przemysł Chemiczny. 2016, t. 95, nr 9, s. 1815-1821
22. Sobianowska-Turek A., Szczepaniak W., Maciejewski P., Gawlik-Kobylińska M., *Recovery of zinc and manganese, and other metals (Fe, Cu, Ni, Co, Cd, Cr, Na, K) from Zn-MnO₂ and Zn-C waste batteries : hydroxyl and carbonate co-precipitation from solution after reducing acidic leaching with use of oxalic acid*, Journal of Power Sources. 2016, vol. 325, s. 220-228.
23. Sobianowska-Turek A., Ulewicz M., Grudniewska K., *Ion flotation and solvent sublation of zinc(II) and manganese(II) in the presence of proton-ionizable lariat ethers*, Physicochemical Problems of Mineral Processing. 2016, vol. 52, no. 2, p. 1048-1060.
24. Sobianowska-Turek A., Szczepaniak W., Grudniewska K. L, Maciejewski P., *Ługowanie wodą jonów K, Na, Mn i Zn z odpadowego materiału baterijnego*, Przemysł Chemiczny. 2015, t. 94, nr 5, s. 702-705.
25. Sobianowska-Turek A., Szczepaniak W., Zabłocka-Malicka M., *Electrochemical evaluation of manganese reducers - recovery of Mn from Zn-Mn and Zn-C battery waste*, Journal of Power Sources. 2014, vol. 270, s. 668-674.
26. Sobianowska-Turek A., Szczepaniak W., Marcinkowski T., Zabłocka-Malicka M., *Odzysk Mn i Zn z odpadowego materiału baterijnego w warunkach kwaśnego ługowania redukcyjnego*, Przemysł Chemiczny. 2013, t. 92, nr 2, s. 248-254.
27. Tinio V. L., ICT in Education: UN Development Programme (2002). Retrieved via: www.eprmers.org [In:] F. Mikre, The roles of information communication

- technologies in education: Review article with emphasis to the computer and Internet. *Ethiopian Journal of Education and Sciences*, 6 (2), 2011.
28. Traffor P., Shirota Y., An Introduction to Virtual Learning Enviroment. [online]. [available: 09.03.16]. Available on the Internet: http://www.gakushuin.ac.jp/univ/eco/gakkai/pdf_files/keizai_ronsyuu/contents/contents2006/4803/4803paul/4803paul.pdf.
 29. Trochowska K., Gawlik-Kobylińska M., *Information and communication technologies in intercultural competence training for the purpose of Ministry of National Defence. Introduction to cultural awareness course. Zeszyty Naukowe/Wyższa Szkoła Oficerska Wojsk Lądowych im. gen. T. Kościuszki*, (2)/2015.
 30. Voogt, J. *Consequences of ICT for aims, contents, processes, and environments of learning*. In: J. van den Akker, W. Kuiper & U. Hameyer (Eds.), *Curriculum landscapes and trends*. Kluwer Academic Publishers, Dordrecht 2003.
 31. [online]. [available: 12.01.16]. Available on the Internet: <http://adlnet.gov/adl-research/scorm/>.
 32. [online]. [available: 12.01.16]. Available on the Internet: <http://adlnet.gov/adl-research/performance-tracking-analysis/experience-api/>.
 33. [online]. [available: 11.01.16]. Available on the Internet: <http://www.academyofmine.com/12-best-free-learning-management-systems-lms/>.
 34. [online]. [available: 12.01.16]. Available on the Internet: <http://adlnet.gov/>.
 35. [online]. [available: 12.01.16]. Available on the Internet: <http://www.learning-solutionsmag.com/articles/581/breaking-news-adl-initiative-to-focus-on-design-and-community-oriented-technology>.
 36. [online]. [available: 16.01.16]. Available on the Internet: <http://trams.jhsph.edu/trams/index.cfm?event=training.playSection§ionID=499> (after being logged).
 37. [online]. [available: 16.01.16]. Available on the Internet: <http://maps.secondlife.com/secondlife/12th%20Man/46/64/751>.
 38. [online]. [available: 15.01.16]. Available on the Internet: <http://adlnet.gov/perls/>
 39. [online]. [available: 15.01.16]. Available on the Internet: <https://www.leia3d.com/the-technology/>.
 40. [online]. [available: 15.01.16]. Available on the Internet: http://ec.europa.eu/eurostat/statistics-explained/index.php/Information_society_statistics_-_households_and_individuals.
 41. [online]. [available: 15.01.16]. Available on the Internet: <http://edition.cnn.com/videos/tv/2015/11/23/make-create-innovate-communication-holograms-leia.cnn>.

42. augmented-reality. Dictionary.com. Collins English Dictionary - Complete & Unabridged 10th Edition. HarperCollins Publishers. [online]. [available: 15.01.16]. Available on the Internet: <http://dictionary.reference.com/browse/augmented-reality>.
43. Training & Exercise Support Anytime, Anywhere. Joint Knowledge Online. November 2014. [online]. [available: 15.01.16]. Available on the Internet: <http://jko.jten.mil/references/jkoCourseCatalog.pdf>.
44. 6 Mobile Learning Trends For 2016. [online]. [available: 15.01.16]. Available on the Internet: <http://elearningindustry.com/6-mobile-learning-trends-for-2016>.

BIOGRAPHICAL NOTE

Paweł MACIEJEWSKI - Lt. Col. Ph.D. Eng., senior lecturer at the CBRN Defence Training Centre at the War Studies University in Warsaw. He is interested in the emerging technologies in the field of CBRN education and training.

HOW TO CITE THIS PAPER

Maciejewski P., (2017) –ICT tools in CBRN troops' education and training. *Zeszyty Naukowe Wyższa Szkoła Oficerska Wojsk Lądowych im. gen. Tadeusza Kościuszki Journal of Science of the gen. Tadeusz Kosciuszko Military Academy of Land Forces*, 49 (4), p. 121-137, DOI: 10.5604/01.3001.0010.7223



This work is licensed under the Creative Commons Attribution International License (CC BY).
<http://creativecommons.org/licenses/by/4.0/>