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Tomasz Zwęgliński, PhD Eng.
The Main School of Fire Service

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Appraisal of Selected Elements of the Distance learning Method Based on Training of Fire Protection Specialists

Abstract

The paper is dedicated to assessing elements of a technical nature, including multimedia ones, which are generally applied in training and education implemented in the form of distance learning. The objective of the study was to enhance the quality of e-learning by finding out to which elements of the educational course should particular attention be paid to make sure that they meet expectations of their participants. The study was carried out on the basis of two training courses addressed at fire protection specialists organised in the Main School of Fire Service. In the paper use was made of the method of diagnostic survey conducted based on the auditorium questionnaire with the use of the survey questionnaire tool. The obtained data were subjected to a statistical analysis, including the r-Pearson correlation coefficient and the significance of inter-group differences. Based on the drawn conclusions a presumption may be made that if a bigger number of options of a technical nature are offered during the training course, including multimedia ones, this considerably enhances the satisfaction of training participants. Given the obtained results it is crucial to find how to make the training more attractive to its participants, and consequently to convince them to use the offered options as frequently as possible, such as for example an automatic lecturer or the possibility of executing additional tests to verify one's knowledge. This type of activity contributes to meeting expectations of training participants, and also to positive perceiving of the distance education method as one that is highly effective.

Keywords: distance education, distance learning, fire protection, education for security, Internet training, didactics

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Ocena wybranych elementów zdalnej metody nauczania na podstawie szkolenia specjalistów ochrony przeciwpożarowej

Abstrakt

Artykuł poświęcony jest ocenie elementów o charakterze technicznym, w tym multimedialnych, które wykorzystywane są w szkoleniach realizowanych metodą nauczania zdalnego. Celem badań było podniesienie jakości szkoleń e-learningowych poprzez znalezienie odpowiedzi na pytanie, na jakie elementy kursu należy zwrócić szczególną uwagę, aby spełniały one oczekiwania ich uczestników? Badania przeprowadzono w oparciu o dwa szkolenia specjalistów ochrony przeciwpożarowej zrealizowane w Szkole Głównej Służbie Pożarniczej. W pracy posłużono się metodą sondażu diagnostycznego przeprowadzonego techniką ankiety audytoryjnej z wykorzystaniem narzędzia kwestionariusza ankiety. Uzyskane dane poddano analizie statystycznej, w tym korelacji współczynnika r-Pearsona oraz istotności różnic międzygrupowych. Uzyskane wnioski wskazują na fakt, że większa liczba zastosowanych podczas kursu opcji o charakterze technicznym, w tym multimedialnych, pozwala na zwiększenie satysfakcji uczestników kursu. W świetle uzyskanych wyników istotnym staję się problem jak uatrakcyjnić kurs, a tym samym przekonać kursantów do możliwie częstego stosowania dostępnych opcji, takich jak np. automatyczny lektor czy możliwość wykonywania dodatkowych zadań sprawdzających wiedzę. Tego typu aktywność przekłada się na spełnienie oczekiwań uczestników szkolenia, a także na pozytywne postrzeganie metody nauczania zdalnego jako efektywnej metody kształcenia.

Słowa kluczowe: kształcenie zdalne, kształcenie na odległość, ochrona przeciwpożarowa, edukacja dla bezpieczeństwa, szkolenie przez internet, dydaktyka

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Оцінка вибраних елементів дистанційного методу навчання на основі підготовки фахівців з пожежної охорони

Анотація

Стаття присвячена оцінці технічних елементів, зокрема мультимедіальних, що використовуються на навчальних курсах проведених методом дистанційного навчан-

ня. Метою дослідження було покращення якості навчань на тему e-learning шляхом пошуку відповіді на питання, яким елементам курсу слід приділити особливу увагу, щоб вони відповідали очікуванням своїх учасників? Дослідження проводилось на основі двох навчальних курсів для фахівців з протипожежної охорони, проведених у Головній школі пожежної служби у Варшаві. У дослідженні використовується метод діагностичного опитування, проведеного з використанням техніки анкети в аудиторії з використанням інструменту анкети-опитування. Отримані дані проаналізовано статистично, включаючи кореляцію коефіцієнта r-Пірсона та значимість міжгрупових відмінностей. Отримані висновки свідчать про те, що більша кількість технічних варіантів, що використовуються під час курсу, включаючи мультимедійні варіанти, збільшує задоволеність учасників курсу. У світлі отриманих результатів, з'являється важлива проблема, як зробити курс більш привабливим, і тим самим переконати студентів якомога частіше використовувати доступні варіанти, наприклад, автоматичний викладач або можливість виконання додаткових завдань для перевірки знань. Така активність впливає на задоволення очікувань учасників навчання, а також позитивне сприйняття методу дистанційного навчання як ефективного методу навчання.

Ключові слова: дистанційна освіта, дистанційне навчання, протипожежний захист, освіта для безпеки, онлайн-навчання, дидактика

Introduction

The SARS-CoV-2 pandemic, which formally started in Poland on 4th March 2020 following the identification of the first case of an infected person, has disturbed the educational process on all its levels, from elementary schools up to universities, for a period of a few months. All those entities had to undergo a sudden and difficult period that required adaptation of educational methods and techniques to the current epidemic-related conditions. From the viewpoint of hitherto traditional educational practices, which had been commonly used and which appeared to have been used for ever, it turned out that the biggest problem was the necessity of adopting social distancing. In such a situation educational entities faced a serious problem of assuring a continuation of the education process without the necessity of personal contacts of teachers or lecturers with school or university students.

The slow and evolutional process of making the Polish education more flexible by way of adopting elements of distance learning experienced an unbelievable, even evolutional acceleration, which was imposed by epidemiological circumstances. Luckily

the major part of entities already had some sort of experience with the use of distance education, which for years was already being proposed among others by bodies of the European Union under the so-called Bologna process. At that time a premise for those activities was primarily to assure equal access to knowledge. This applies particularly to people who for some reasons, like for example geographical ones (distance from the seat of the attended, economic causes (lack of financial means to live away from the permanent place of residence), difficulty in reconciliation of study with working, but also those that arise from civilizational acceleration (universally experienced lack of time) who could not afford to participate in education delivered in the traditional form. As a consequence certain social groups have experienced exclusion because they had limited access to such goods, as for example education. Conditions of the pandemic have surprisingly and unconditionally proven that those relatively small groups of persons may in practical terms grow to the dimension of the entire population, and may as a consequence become a universal problem [1, pp. 21–50)], which entails adverse consequences, not only for specific groups, but also all participants of the education system, and indirectly the entire state and its citizens.

Owing to the appearance of the epidemic hazard, underestimated in the risk analysis as at beginning of 2020 they were perceived merely as a hazard of average risk [8][1], educational entities were faced with a challenge of changing over within the shortest time possible and to the biggest extent feasible to distance education. It was obviously implemented via the Internet, because other forms, such as for example sending electronic carriers, such as CDs, via mail is impractical as compared to usage of the Internet. Distance education as a teaching method[2], is currently most frequently implemented in the form of e-learning, with the use of on-line instant messengers. In the pre-pandemic period several Internet training platforms have been created, which still offer diverse educational courses of different substantive levels that cover a wide range of issues, starting with pre-school education[3], up to the level of postgraduate

1 National Crisis Management Plan, update 2020, Part A – where the likelihood ofoccurrence considered as "possible" and effects as "average".

2 A teaching method is defined as an intentionally and systematically applied method of work of a teacher with students, which enables the students to acquire knowledge, but also the acquisition of abilities to apply such knowledge in practice, as well as development of abilities and cognitive interests of the (author's note).

3 *Electronic learning* or *eLearning* is a general term used to define the process of learning executed with the use of a computer. This term is used in a particularly broad context, and for this reason it

studies, and at times also elements of doctoral studies. Such e-learning platforms as Moodle [20] allow considerable possibilities of their usage to post and transmit teaching contents from diverse fields of education. In the pandemic period the number of platforms and instant messengers in use has been considerable extended and developed, which also was an effect of urgent needs in this respect [6].

The above deliberations led to a single general conclusion, and namely – there is no turning back from passing on to e-learning, at least partly, regardless of the subject of such education. Does that infer that the method of distance education could also prove to be successful in education for security or education implemented in the sphere of societal security? And if so, does it fulfil its functions, such as for example effective familiarisation of trainees with new materials, keeping up the acquired knowledge, verification and assessment of the degree to which knowledge has been acquired? Is the chosen teaching method appropriate to the presented contents? Does it allow education pursuant to the new vision of higher education, implemented as a consequence of the Bologna Declaration, which comprises three learning levels, i.e. knowledge, skills and social or professional competencies? In the new social reality a lot of questions arise in a natural way.

Education for security has its characteristics features, in the case of which the form in which knowledge is transmitted is of exceptional importance, especially owing to the fact that primarily this education applies to practical aspects in the use of the acquired competencies, such as ability of evacuation from an endangered building, securing one's place of refuge (e.g. in the event of contamination by chemical means), abilities of suppressing a fire or provision of first medical aid [13, pp. 61–72]. In its presumption training is to a smaller or bigger extent a compilation of theoretical knowledge and practical skills [3, pp. 22–46]. Typical and most frequently used e-learning courses appear to neglect the second of those education elements, which may suggest that

is not determined in an unequivocal way. In many cases it is inherently connected with advanced learning technology – ALT, i.e. technology and methodology applied during transmitting of knowledge via the computer network or other multimedia technologies – definition specified according to Wikipedia: the Free Encyclopedia (http://en.wikipedia.org/wiki/E-learning), *Moodle* (*Modular Object-Oriented Dynamic Learning Environment*) – distance learning environment via ICT networks, available in the Internet browser. The Moodle e-learning platform has been established on the basis of Apache, PHP and MySQL or PostgreSQL. It may be opened in the operating systems of Linux, MS Windows, Mac OS X, NetWare 6. It is a gratuitious software, a so-called open source – source: http://pl.wikipedia.org/wiki/Moodle, [download: 06.09.2020].

they may not be as effective as traditional education methods, especially those in the field of security.

Effective learning, i.e. "effective learning with the use of optimum means, time outlays and relatively small effort" [5] may be assessed by measures of "efficiency and effectiveness" of the transmission of knowledge, in the analysed case via the Internet [16]. The first component is related to transmission of appropriate didactic contents, which allows the achievement of assumed objectives, while the second one concerns the implementation of that process in an appropriate way, i.e. achievement of goals with the use of minimum input. In the present paper the effectiveness of selected educational elements has been based on empirical methods (among others a diagnostic survey, statistical analysis) [4].

The effectiveness of the education process, in particular in the case of knowledge dissemination via the Internet, affects the attractiveness of the form in which didactic contents are transmitted and the relative ease of their gaining, which is connected with the already mentioned efficiency. This plays a particular role because it is one of the guarantees for inspiring interest in educational materials disseminated via the Internet, particularly as regards to persons who are not related with the field of safety in their professional work [15, pp. 52–59].

Effective implementation of the learning process via e-learning education is feasible on the assumption that it would be prepared and conducted in a way sufficiently attractive with regard to the contents and form so that they could be considered as being socially useful [10, p. 231]. The two education courses addressed at specialists in fire protection implemented in the form of distant learning show that the method is indeed effective. This may be proven for example by the fact that only three persons[4] failed the final exam. This in turn indicates that the majority of training participants, i.e. over 99%, have passed the exam, i.e. they acquired competencies during the educational course that meet criteria imposed on fire protection specialists[5]. Naturally not all participants passed with the same grade, which suggests that the quality of

4 Data from the report devised by the Examination Committee needed to execute the final exam for the course of Fire Protection Specialists in the Main School of Fire Service of 6 October and 16 November 2009.

5 In the implementation period of education courses subjected to the analysis applicable was the Regulation of the minister of Interior and Administration of 25 October 2005 on qualificational requirements and training courses for firefighters from fire protection units and persons executing activities in the scope of fire protection.

the final effect may depend on various elements, and one of the main ones is probably the training course as such, including the method and form of its preparation and implementation. From literature we may know that the quality of on-line course may differ and depends on such factors as their adaptation to the specific nature of the subject, but also the target group [2, p. 221]. But does that cover all possibilities of having the process optimised?

As regards the above deliberations, given also the present domination of this form of education, the question is how to deliver e-learning courses to make sure that they meet expectations of their users?

It should be borne in mind that the scientific milieus emphasise the legitimacy of executing studies on pedagogical and technological aspects of the distant learning method [17], and that inclined the author to take up this subject, which is of particular importance for the reality that arises from epidemiological conditions.

The above presumptions enable the determination of the objective of conducted studies, and namely enhancing the usefulness of education implemented with the e-learning method with respect to the development of their effectiveness and attractiveness already at the stage of their preparation, both with respect to planning of teaching contents and the technological dimension. The particularisation and broadening of knowledge related to the quality and effectiveness of education executed via the Internet allows the verification and improvement of didactic tools applied in distance education in such a way that they contribute in the most optimum way to better suitability of this type of education courses.

Experience gained by each of us suggests that ways in which information is presented, perceived as component of knowledge[6], always affects the emotions that we experience. This effect is clearly visible in TV reports, for example during news programmes. Our emotions during acquisition of knowledge are inherently connected with the ability and permanence of their memorisation[7]. This fact allows the presumption that transmitting educational material during the course has to a smaller or bigger extent the same dependence. Consequently it may be assumed that the form of transmitting of educational material, its devising, presentation, evaluation affect

6 Knowledge is an ordered as of information generated by people as a result of their relations with nature or with abstract systems they create.

7 Expert consultation with psychologist C. Dobrodziej – Chief Specialist of the Main Headquarters of the State Fire Service.

the quality of provided education, its efficiency and as a result also its usability. Those dependencies were confirmed by studies [18] conducted in the Main School of Fire Service by proving that a simulation game may give rise to a much higher subjective stress level than other teaching forms (also multimedia ones), and that allows the presumption that such a form is not only more attractive, but also more effective in application. Such a reaction may have a positive dimension, for example mobilisation of a student to intensify efforts at broadening own knowledge and skills or could also cause better concentration and more effective acquisition of information transmitted in the educational materials[8]. The above deliberation are confirmed by results of the above mentioned research work [12], the conclusions of which emphasise that "the utilisation of techniques of digital virtual reality affects the learning process, enhancing the interest of learners, first of all by increasing the number of stimuli that reach the learner and activation of all possible information transmitting channels, as well as enabling active participation".

Another aspect worthy of emphasis in a situation of communication evolution taking place owing to the development of Internet is the fact that this phenomenon sets out directions of present and future development of human communication channels, which is the basic tool in team work. And as it turns out such activities, both at the state level (civilian and military defence modules, international economic organisations), and at the level of an individual citizen, play an ever increasing role in achievement of objectives connected with widely understood security and much more than that. And that is a key to progress, which allows the presumption that continuous discovering and skilful usage of opportunities given by the Internet constitutes one of the bases of continuous, multidimensional and universal social development. If we combine the above deliberations with the issue of significance of education, enhancing its standards and availability and its impact on social and economic progress, but also forming social awareness, a cognitive structure is created, which clearly convinces us as to the significance of the undertaken topic [7].

Consequently given the currently universal and intense ongoing exploration related to the necessity of practical usage of distance education here and now, there is a significant need of more in-depth study of the analysed sphere by way of conducting relevant research.

8 Expert interview with psychologist C. Dobrodziej – Chief Specialist of the Main Headquarters of the State Fire Service.

As regards the analysed studies, the definition of a hypothesis is an attempt at pointing to the anticipated nature of dependencies, relation between phenomena with direct impact on the quality of e-learning education. Hitherto experience, observations, review of reference and studies of institutions delivering distance learning inclines to formulating a theorem that application of a bigger abundance of multimedia technologies [19] in e-learning enhances its effectiveness.

Materials and methods

As of 2009 the Main School of Fire Service has been running a cycle of e-learning trainings for specialists in fire protection that comprise knowledge in the field of fire safety engineering. The educational courses were the subject of our studies in which use was made of the diagnostic survey method [11, p. 79]. This method enables compiling knowledge concerning structural and functional attributes and the dynamics of social phenomena, opinions and view of selected communities, intensification and development directions of given phenomena. In order to solve the research problem use was made of the auditorium survey technique, the questionnaire of which was used as a research tool. The survey was anonymous and comprised primarily observations and opinions of the respondents concerning the preparation and conducting of the educational course, its effectiveness as a whole, but also particular elements of the course, including ICT technologies used in the educational process. Given the cyclical nature of the conducted training course, studies comprised groups that participated in two subsequent editions with identical programme, but with courses shifted in time. The educational course provided knowledge with concurrent use of brief educational videos, as well as materials in the form of didactic texts. It was also technologically broadened with respect to ways of transmitting educational contents, e.g. by verification exercises, option of switching on or off of the lecturer reading the transmitted educational contents, recommendations of additional source materials, visualisations of the contents etc.

For needs of the studies each of the training courses was considered as a separate study group to allow the utilisation of the group comparative method. The study group included two trial groups (participants of different courses), which comprised 168 (course No. 1, trial group) and 287 respondents (course No. 2, control group) respectively (a total of 455[9]) [11, p. 129].

9 Data obtained from report of the examination committees in the Main School of Fire Service.

The studies were primarily focused on the sphere of perceiving, the respondents' assessment of ways of preparation and implementation of the course, but also the suitability of applied IT technologies, and hence comprises analyses of:

- facts (review of given activities executed by the respondents during the educational course, or not executed by them, e.g. filling out self-tests after completion of learning a specific material module) and
- opinions concerning facts (assessments of respondents concerning implementation of the course – their subjective opinion).

The survey form used in our analyses comprised the following questions:

1. What is your opinion of preparation of the e-learning course?
2. To what extent did the course meet your expectations?
3. What is your opinion concerning comprehensibility and legibility of materials with contents for familiarisation during the training course?
4. What is your opinion concerning the Internet forum was ways of communicating with persons delivering the classes?
5. Did you use the "lecturer" option while becoming familiar with the educational material?
6. Did you use any proposed additional books in the period of the course?
7. Did you solve verification exercises as recommended after certain educational modules?
8. Do you think that video presentation of educational material allows its better comprehension?
9. Did you contact lecturers executing the classes with the use of Internet technologies?
10. Do you think that the e-learning educational method allows better familiarisation of the educational contents as compared to the traditional method? (option of respondents' comments).

Responses could be made in a five level scale, and namely:

– questions 1–4: *very well, well, average, poorly, badly;*
– questions 5–9: *always, frequently, sometimes, seldom, never;*
– question 10: *much better, better, the same, worse, much worse.*

To maintain the reliability of studies, the survey form comprised questions that enable the verification of the credibility of provided answers. This verification consisted in rejection of surveys, in which the answers were logically excluding each other. For this purpose use was made of questions Nos. 4 and 9, which ruled out the possibility of the respondent's assessing the quality of communication with the lecturer (to which

question 4 applied) without confirmation of the usage of this form of communication in practice (as stated by the respondent in question 9).

The obtained data (opinions of respondents) have been subjected to statistical analysis, which comprised the calculation of average values for particular questions, frequency of granted responses, their percentage of the whole, and in certain cases execution of tests of statistical significance of differences between groups. The objective of using descriptive statistics was to sum up the set of data and drawing basic conclusions and generalisations.

The process has been divided into three parts. The first one of them is dedicated to calculating the r-Pearson correlation for selected variables (responses given by respondents to particular questions of the survey) and on this basis the indication of dependencies that exist between the selected variables. Analysis of variables with the use of the r-Pearson linear coefficient only allows the presumption of the existence of dependencies between variables, but does not allow the determination of cause and effect relationships [1, p. 96]. In this part of the analysis the correlation coefficient was calculated with the use of Microsoft Excel.

Results obtained from the surveys were subjected to calculations implemented with the use of the Pearson linear correlation coefficient indicating the existence or non-existence of the statistical dependence, its direction and intensity, between the analysed responses. This coefficient is calculated in the following way [9]:

$$r_{yx} = \frac{\sum_{i=1}^{n}[((x_i - \overline{x})]\big)\big(y_i - \overline{y}\big)}{n\, S(x)S(y)}$$

where:
r_{yx} – coefficient of linear correlation,
x_i – i^{th} x value,
y_i – i^{th} y value,
$\overline{x}$ – average value of x,
$\overline{y}$ – average value of y,
n – number of observations
S(X), S(y) – standard deviations, x and y respectively.

The coefficient assumes values within the range of <-1, 1>. It is assumed that if the absolute value of the coefficient (regardless of the character that defines the direction of the dependence) remains within the specified range, the dependence between responses:

– 0.0 – 0.2 – does not occur or is very weak,
– 0.2 – 0.4 – is weak
– 0.4 – 0.6 – is moderate
– 0.6 – 0.8 – is strong
– 0.8 – 1.0 – is very strong.

The inference process was implemented according to the below schema:

1) processing of results of frequency of provided responses in the trial group,
2) calculation of the correlation coefficient for the trial group,
3) processing of results pertaining to the frequency of provided responses in the control group,
4) calculation of the correlation coefficient for the control group,
5) comparison of results obtained in both groups with respect to the frequency of granted responses and values of the Pearson correlation coefficients (measurement of relation intensity),
6) rejection or confirmation of the results obtained in the trial group by making a comparison with the result recorded in the control group.

The second part of the study was dedicated to the statistical analysis executed with the use of SPSS Statistica. It consisted in analysing qualitative data expressed by respondents. The analysis concerned indications of respondents with respect to the below features of the training course:

1) lack of possibility of printing educational materials,
2) lack of practical classes (e.g. in a laboratory),
3) lack of personal contact with the lecturers.

After identification in the comments for needs of statistical needs, the data have been codified at a nominal scale based on a negative or positive indication, i.e.:

- the given feature of the educational course was considered a drawback of the course,
- comment provided by the respondent did not mention inconveniences related to the analysed feature of course organisation.

The codification only concerned those questionnaires in which the respondent provided some written comment. Forms with no comment filled out were considered as lack of data.

The data were analysed for the entire trial group, but also in a division into subgroups according to the criterion of profession declared by course participant (pursuant to the principle: "expert" – profession associated with the sphere of security, such as for example a soldier, a firefighter, a physician or "layman" – non-associated

profession, such as teacher in secondary school, trade representative, etc.). The paper only presents significant statistical results.

The third part of the task comprised the execution of statistical significance tests for selected data (responses given in questionnaires – dependent variable) in a division into a group of "experts" and "laymen" (independent variable).

Results

Correlations

This paper presents only those results, which were proven both in the trial group and in the control group.

Results obtained by a comparison of questions concerning usage by respondents of the option of automatic lecturer[10] with their opinion concerning the usability of presenting educational material in a video version was presented in table 1.

Table 1. Using the option of automatic lecturer in relation to the opinion concerning comprehension of video material

	Did you use the "lecturer" option while becoming familiar with the educational material?		**Do you think that video presentation of educational material allows its better comprehension?**	
response on scale	**trial (n=163)**	**control (n=272)**	**trial (n=162)**	**control (n=271)**
always	41 / 25.15%	54 / 19.85%	92 / 56.79%	147 / 54.24%
frequently	39 / 23.93%	81 / 29.78%	51 / 31.48%	87 / 32.10%
sometimes	38 / 23.31%	71 / 26.10%	16 / 9.88%	33 / 12.12%
seldom	28 / 17.18%	37 / 13.60%	3 / 1.85%	3 / 1.11%
never	17 / 10.43%	29 / 10.66%	0 / 0%	1 / 0.37%

Source: own study

10 The educational course gave the participants the choice from among two options of becoming familiar with the material: option 1 – presentation of educational material as a text without its being read by an automatic lecturer, option 2 – presentation of educational material as a text combined with its reading out loud by the automatic lecturer.

For the above values the Pearson correlation coefficient equals to **0.746**, which proves a strong positive dependence between responses given by respondents to those questions. In the control group the correlation coefficient equalled to **0.496**, which proves merely a moderate dependence between features, and not as in the study performed for the trial group, which were characterised by strong dependence. Nevertheless in such a case it is worthwhile to at least speak of the trend of co-dependence of responses for the posed questions.

Table 2 presents results of a comparison of questions pertaining to the frequency of using a lecturer during the education courses and the respondent's opinion concerning his/her assessment of distance education method as compared to the traditional method.

Table 2. Usage of the option of the automatic lecturer as compared to the opinion concerning an assessment of e-learning as a teaching method

Did you use the "lecturer" option while becoming familiar with the educational material?			**Do you think that the e-learning educational method allows better familiarisation of the educational contents as compared to the traditional method?**		
response on scale	**trial group (n=163)**	**control group (n=272)**	**response on scale**	**trial group (n=163)**	**control group (n=269)**
always	41 / 25.15%	54 / 19.85%	much better	27 / 16.56%	21 / 7.81%
frequently	39 / 23. 93%	81 / 29.78%	better	33 / 20.25%	60 / 22.30%
sometimes	38 / 23.31%	71 / 26.10%	the same	59 / 36.20%	118 / 43.87%
seldom	28 / 17.18%	37 / 13.60%	worse	39 / 23.92%	64 / 23.79%
never	17 / 10.43%	29 / 10.66%	much worse	5 / 3.07%	6 / 2.23%

Source: own study

For the above mentioned values the Pearson correlation coefficient equals to **0.634**, which proves their strong positive dependence. Similarly as in the preceding case the control group has confirmed a dependence between responses, yet once again at the level of moderate dependence (close o strong dependence, which equals to > 0.6) according to the correlation coefficient, which equals to **0.594**. Attention is drawn

to the fact that results of the control group are very similar to the coefficient value obtained in studies for the trial group (0.634).

Table 3 and Table 4 compare opinions of the respondents concerning the usage of educational video as a technique of transmitting knowledge that allows better comprehension of the presented material during the course with opinions concerning the quality of course preparation and the extent to which it meets expectations of the trainees.

Table 3. Opinion concerning the comprehension of video material in relation to the assessment of educational course in the distance method

Do you think that video presentation of educational material allows its better comprehension?			**State your assessment of the preparation of educational course in the form of e-learning?**		
response on scale	**trial group (n=162)**	**control group (n=271)**	**response on scale**	**trial group (n=1624)**	**control group (n=281)**
always	92 / 56.79%	147 / 54.24%	very well	91 / 55.49%	122 / 43.42%
frequently	51 / 31.48%	87 / 32.10%	well	68 / 41.46%	142 / 50.53%
sometimes	16 / 9.88%	33 / 12.12%	average	5 / 3.05%	0 / 0%
seldom	3 / 1.85%	3 / 1.11%	not too well	0 / 0%	16 / 5.69%
never	0 / 0%	1 / 0.37%	poorly	0 / 0%	1 / 0.36%

Source: own study

For the above mentioned values the Pearson correlation coefficient amounts to **0.742**, which proves their strong positive dependence. The correlation coefficient for the control group equalled to **0.903**, which proves a very strong positive dependence of the response. The result confirms the mutual dependence proven in the trial group.

Table 4. Opinion concerning comprehension of video material in relation to the trainees' satisfaction with the provided education

Do you think that video presentation of educational material allows its better comprehension?			**Does the educational course meet your expectations?**		
response on scale	**trial group (n=162)**	**control group (n=271)**	**response on scale**	**trial group (n=162)**	**control group (n=277)**
always	92 / 56.79%	147 / 54.24%	very well	84 / 51.85%	107 / 38.63%
frequently	51 / 31.48%	87 / 32.10%	well	70 / 43.21%	142 / 51.26%

Table 4. – ctd.

Do you think that video presentation of educational material allows its better comprehension?			Does the educational course meet your expectations?		
response on scale	**trial group (n=162)**	**control group (n=271)**	**response on scale**	**trial group (n=162)**	**control group (n=277)**
sometimes	16 / 9.88%	33 / 12.12%	average	7 / 4.32%	0 / 0%
seldom	3 / 1.85%	3 / 1.11%	not too well	0 / 0%	26 / 9.39%
never	0 / 0%	1 / 0.37%	poorly	1 / 0.62%	2 / 0.72%

Source: own study

For the above values the Pearson correlation coefficient equals to **0.754**, which proves their strong positive dependence. The control group has confirmed a strong and even a very strong dependence between granted responses. The correlation coefficient equalled to **0.885**. Consequently the control group has confirmed the rule proven in the trial group.

Table 5 and table 6 specify responses pertaining to making use by the trainees of the option of supplementing reading materials and the respondent's opinion concerning his assessment of distance education method as compared to the traditional method.

Table 5. Opinion concerning an assessment of e-learning as a teaching method as compared to the frequency of usage of verifying exercises during the educational course

Did you solve verifying exercises as recommended after certain educational modules?			Do you think that the e-learning educational method allows better comprehension of the educational materials as compared to the traditional method?		
response on scale	**trial group (n=162)**	**control group (n=270)**	**response on scale**	**trial group (n=163)**	**control group (n=269)**
always	30 / 18.40%	47 / 17.41%	much better	27 / 16.56%	21 / 7.81%
frequently	42 / 25.77%	80 / 29.63%	better	33 / 20.25%	60 / 22.30%
sometimes	61 / 37.42%	89 / 32.96%	the same	59 / 36.20%	118 / 43.87%

Table 5. – ctd.

Did you solve verifying exercises as recommended after certain educational modules?			Do you think that the e-learning educational method allows better comprehension of the educational materials as compared to the traditional method?		
response on scale	**trial group (n=162)**	**control group (n=270)**	**response on scale**	**trial group (n=163)**	**control group (n=269)**
seldom	17 / 10.43%	34 / 12.59%	worse	39 / 23.92%	64 / 23.79%
never	13 / 7.98%	20 / 7.41%	much worse	5 / 3.07%	6 / 2.23%

Source: own study

For the above values the Pearson correlation coefficient equals to **0.790**, which proves their strong positive dependence (almost a very strong one). The control group has confirmed a strong dependence proven for the trial group. This time the result was **0.785** of the correlation coefficient, i.e. at a level quite similar to the trial group.

Table 6. Opinion concerning the evaluation of e-learning as a didactic method as compared to the frequency of using additional reading material during the educational course

Did you use any proposed additional reading materials in the period of the course?			Do you think that the e-learning educational method allows better comprehension of the educational materials as compared to the traditional method?		
response on scale	**trial group (n=164)**	**control group (n=273)**	**response on scale**	**trial group (n=163)**	**control group (n=269)**
always	8 / 4.88%	9 / 3.30%	much better	27 / 16.56%	21 / 7.81%
frequently	38 / 23.78%	60 / 21.98%	better	33 / 20.25%	60 / 22.30%
sometimes	70 / 42.68%	108 / 39.56%	the same	59 / 36.20%	118 / 43.87%
seldom	33 / 20.12%	72 / 26.37%	worse	39 / 23.92%	64 / 23.79%
never	15 / 9.15%	24 / 8.79%	much worse	5 / 3.07%	6 / 2.23%

Source: own study

In this case the trial group has proven a very strong dependence at the level of the correlation coefficient of **0.853**. The control group also confirmed the result at the level of a very strong dependence, i.e. **0.959**.

Frequency

Almost 44% of trainees who have provided their comments in the survey (36 respondents of 82) considered the lack of possibility of making printouts as a drawback of the course (Table 7). This aspect has proven to be the most frequently names shortage of the course in opinions of the respondents.

Table 7. Lack of possibility of making a printout as a feature of the course

Lack of the possibility of printing	Frequency	Percentage of respondents who posted their comments	Percentage of all respondents	Cumulated percentage (%)
Considered as drawback of course	36	43.9	24.2	24.2
Comment was provided without reference to feature	46	56.1	30.9	55.0
No comment provided	67	0	45.0	100.0
Total (n)	149	100.0	100.0	

Source: own study

An analysis was executed of the comments with respect to lack of possibility of printing training materials also in a breakdown into groups of "experts" and "laymen" (Table 8).

Table 8. No possibility of printing as a feature of the educational course in a breakdown into the group of "experts" and "laymen"

Lack of the possibility of printing	Frequency (expert/ layman)	Percentage (%) of respondents as compared to all trainees who have provided their comments (expert/ layman)	Percentage (%) of respondents as compared to all trainees (expert/ layman)	Cumulated percentage (%) (expert/ layman)
Considered as drawback of course	14/22	33.3/55.0	18.9/29.3	18.9/29.3

Table 8. – ctd.

Lack of the possibility of printing	Frequency (expert/ layman)	Percentage (%) of respondents as compared to all trainees who have provided their comments (expert/ layman)	Percentage (%) of respondents as compared to all trainees (expert/ layman)	Cumulated percentage (%) (expert/ layman)
Comment was provided without reference to feature	28/18	66.7/45.0	37.8/24.0	56.8/53.3
No comment provided	32/35	n/a	43.2/46.7	100.0/100.0
Total (n)	74/75	100.0/100.0	100.0/100.0	

Source: own study

Six of 82 respondents providing their comments in the questionnaire considered the lack of practical classes as a disadvantage of the course (Table 9). This comes up to 4% of the entire group (those who have attached comments and those who have not provided any comments).

Table 9. Lack of possibility of printing as a feature of the educational course

Lack of practical classes	Frequency	Percentage of respondents who have provided their comments	Percentage of all respondents	Cumulated percentage (%)
Considered as drawback of course	6	7.3	4.0	4.0
Comment was provided without reference to feature	76	92.7	51.0	55.0
No comment provided	67	0	45.0	100.0
Total (n)	149	100.0	100.0	

Source: own study

If a breakdown is made into a group of "experts" and "laymen" it turns out that this feature was suffered more by the "experts", although the difference was insignificant (Table 10). It may be assumed that each tenth person in the group of "experts" and each twentieth trainee in the group of "laymen" from those who have shared their opinion in the part concerning own comment have identified the lack of practical classes as a deficiency.

Table 10. Lack of possibilities of printouts as a feature of the educational course in a breakdown into a group of "experts" and "laymen"

Lack of practical classes	Frequency (expert/ layman)	Percentage of respondents who have provided their comments (expert/ layman)	Percentage (%) of respondents in relation to all trainees (expert/ layman)	Cumulated percentage (%) (expert/ layman)
Considered as drawback of course	4/2	9.5/5.0	5.4/2.7	5.4/2.7
Comment was provided without reference to feature	38/38	90.5/95.0	51.4/50.7	56.8/53.3
No comment provided	32/35	n/d	43.2/46.7	100.0/100.0
Total (n)	74/75	100.0/100.0	100.0/100.0	

Source: own study

Similarly as shown above, also in cases when there was no possibility of personal consultation with the lecturer during the educational course (face-to-face meetings), the respondents did not consider this fact as a defect (Table 11). Only nine of 82 respondents perceived this as a shortcoming. Despite providing written annotation as to the course, 73 respondents did not suggest that they had experienced in any way the absence of consultations with the lecturer or a need of having such consultations. As compared to all survey participants, the group of persons who pointed out the lack of personal consultations equalled to 6%, which allows the presumption that more or less each twentieth trainee pointed to the analysed aspect as a negative element of the educational course in the course evaluation.

Table 11. Lack of personal consultation with the lecturers as trait of the educational course

Lack of personal consultations with the lecturers	Frequency	Percentage of respondents who have given their comments	Percentage of all respondents	Cumulated percentage
Considered as drawback of course	9	10.9	6.0	6.0
Comment was provided without reference to feature	73	89.1	49.0	55.0
No comment provided	67	0	45.0	100.0
Total (n)	149	100.0	100.0	

Source: own study

Differences of the mean

Results of tests of the significance of differences conducted in the trial group as compared to the use of an option consisting of the possibility of making use of additional reading material (n=148) and the Internet forum (n=128) are presented by table 12.

Additional reading material was more frequently used by trainees who already had certain knowledge and experience arising from hitherto work in institutions handling security (qualified as "experts" on the basis of independent variables in the survey) than the so-called "laymen" (trainees who have to date worked on different posts than those directly connected with security). The first group has on average used additional reading materials more than "frequently" (mean of 3.10), while "laymen" less than "frequently", i.e. with a mean of 2.81. The U Mann-Whitney Test has proven a statistical significance at the level of $p < 0.1$, which allows a presumption that a trend of the observed nature does exist.

The Internet forum as a form of communication has been analysed using the t-Student test for independent trials given groups of equal number subject to comparisons. The dependent variable, i.e. as assessment of the Internet forum was verified in both groups from the viewpoint of normality of distribution and the preservation and homogeneity of the variance. The Internet forum was perceived as a better solution

by persons categorised to the group of "laymen" (at the level of average of 4.27 – i.e. better than "well") than "experts" (slightly below the value "well", average result of 3.97). Differences in the obtained mean values are not significant, yet they have been confirmed as statistically significant at the level of $p < 0.05$ of the statistical significance of differences between groups. Consequently they may be assumed as real, referring to a wider population.

Table 12. Frequency of usage of additional reading materials and evaluation of the Internet forum of "experts" and "laymen"

Average	Frequency of usage of supplementing materials (U Mann-Whitney test)	Internet forum assessment (t-Student test)
"experts"	3.10; n = 73	3.97; n =64
"laymen"	2.81; n = 75	4.27; n = 64
significance of differences; level of statistical confidence	P <0.1; 90%	P = 0.05; 95%

Source: own study

Discussion and conclusions

Correlations

Table 13 presents collective results of strong correlations ($0.6 < x < 0.8$), and in some cases very strong ($x > 0.8$) or moderate ($0.4 < x < 0.6$) correlations between answers given by respondents to the posed questions. Only those results were presented, which were characterised at least by a strong dependence in the trial group, which was confirmed at the minimum moderate level of dependence in the control group.

Strong correlation dependencies between responses indicate that persons who have more frequently used technological options during the educational course, such as for example the automatic lecturer, automatically recommended exercises and proposed additional reading materials, had a better opinion of video materials presented during the courses, and also considered the e-learning method as one that allows better comprehension of the transmitted learning material than a traditional course. On the

other hand, persons who used the available options more seldom, had a worse opinion of the video material, and also of e-learning as compared to the traditional material. The obtained results enable the formulation of the following conclusions:

1) a way should be found to encourage the trainees to use the available technical options, because an increase in frequency of their use enhances satisfaction and conviction of the effectiveness of a course provided in the e-leaning form. One may also presuppose that available options during a course are prepared at a qualitative level that is satisfactory to all their users, because intensified frequency of usage improves the conviction of the effectiveness of distance learning method;
2) trainees should be encouraged to use the automatic lecturer if on the e-learning platform training videos are available. Results suggest that persons who use the lecturer option more frequently were convinced that they were able to comprehend the educational contents much better in the form of an educational video.

Table 13. Specification of significant correlations between selected elements of e-learning education

Frequency of usage of available options during the course	Group	Video presentation of educational material allows its easier comprehension	E-learning allows better comprehension of the educational material than the traditional learning method
Automatic lecturer	trial group	0.746	0.634
	control group	0.496	0.594
Verifying exercises	trial group	no significant correlation ascertained	0.790
	control group	due to lack of correlation in the trial group it has not been tested in the control group	0.785
Additional reading material	trial group	no significant correlation ascertained	0.853
	control group	due to lack of correlation in the trial group it has not been tested in the control group	0.959

Source: own study

Strong and very strong correlations presented in table 14 suggest that trainees found an educational video as a good education form, have equally well evaluated e-learning as such. They also expressed the opinion that the educational course met their expectations. On the other hand, respondents who had a worse opinion of the video material as an educational form were convinced that e-learning and the course as such fail to meet their expectations. At this point it should be noted that in a trial group comprising 162 persons there was only one person convinced that the course has absolutely failed to meet his expectations, and in the control group there were two such persons in 277 trainees.

Table 14. Assessment of video material as a form of education as compared to the opinion concerning e-learning and meeting expectations of the trainee

Correlation coefficient	Group	Assessment of e-learning as educational method	Meeting respondent's expectations by the educational course
Assessment of educational video as a form of education	trial group	0.742	0.754
	control group	0.903	0.885

Source: own study

This confirms the presumption that distance learning should be prepared attractively enough from the viewpoint of visual message to encourage trainees to use the available multimedia options, such as for example an educational video. Furthermore, a conclusion may be made that the bigger the number of such options, the bigger the chance of meeting the trainees' expectations, and to improve their opinion concerning e-learning as a teaching method.

This proves that persons who use multimedia tools during the educational course (automatic lecturer, instructional video), who declare their frequent use, have a better opinion of e-learning as an educational method and declare that the course has met their expectations. The possibility of listening to educational material, as well as unconstrained access to self-testing exercises and additional materials that assure full freedom of the trainee's self-education exert a positive effect on the quality of the educational course. On the basis of the presented results and conclusions it may be presumed that as the distance learning method becomes more popular, as is happening

now owing to the epidemiological situation, the positive attitude to this method will improve and it is likely to be perceived as effective educational methods that meets all expectations.

Frequency

The conducted analysis has shown that educational courses should assure access to educational materials, such as printouts or other forms (e.g. CD, PDF) that could be used by the trainee beyond the time of using the Internet educational platform. This is particularly applicable to groups of beginners. The trainees emphasised the lack of possibility of making use of educational materials beyond the time when they use the computer, which would have been possible if they could print out teaching materials. The obtained results suggest that the possibility that the possibility of printing educational materials should be an inherent element of education implemented by the method of distance learning. Almost 50% of the respondents have expressed opinions that the lack of such option during training is an evident disadvantage. Consequently training courses should take into account access to training materials also in paper version to enhance the attractiveness and effectiveness of teaching. It has been found that this element was perceived much more frequently as a deficiency by persons who owing to their hitherto profession may be considered as inexperienced ("laymen") in the sphere of issues connected with security. And as a consequence this is of particular importance for the participants who until taking up the course were not associated with subjects of the course. It seems that if a group benefitting from e-learning education has a certain level of knowledge concerning the subject of training (e.g. one that arises from the fulfilled functions, executed profession), they require fewer educational materials as hard copy (printout) than the group that faces the subject of the course for the very first time.

The potential lack of practical classes during distance education has also been defined as an element which could be perceived as a shortcoming of a course implemented in this way. Persons categorised to the group of "experts" were more afflicted by this feature than persons whose hitherto profession pointed to their lack of experience in the subjects comprised by the course. This may prove the fact that organisers should be required to assure practical classes during the course if the group does not comprise beginners. For such a group a substitute comprising an instructional video presented during the training course may prove to be insufficient to meet their expectations as to the course.

The results have also shown that personal consultations (i.e. a traditional meeting) with the lecturers are a desired, albeit not absolutely necessary element of education. Each tenth trainee pointed to the lack of this option as a drawback of the course in his/her opinion expressed as free comment. The major part of respondents did not consider personal contact with the lecturer as indispensable, particularly in the context of using other forms of contact, such as for example e-mail, forum or an Internet chat with the lecturers. And as an effect the possibility of personal consultation of a trainee with the lecturer is most probably an advantage of the course, nevertheless in the event of the analysed group it did not prove to be a determinant element for the positive or negative opinions regarding the course by its participants.

Differences of the mean

As regards multimedia technologies used during education courses addressed at fire protection specialists it should be stated that their usage did not differ considerably in their effectiveness in relation to the adopted breakdown of the trial based on the criterion of the profession into "experts" and "laymen". It turns out that additional reading materials were used more frequently by trainees who already had a certain knowledge and experience arising from hitherto work in institutions specialised in security (qualified as "experts" according to the form heads) than the so-called "laymen" (trainees who up to now have been working on different posts than those related to security). This may be due to the fact that persons with a profession related to the subject of the course have better orientation in the topic and know exactly what they want to achieve as learning outcome after completion of the course. Their expectations and needs of their professions are better defined, and for this reason they find it easier to define and determine the subject of their particular interest during implementation of the course programme.

The issue of a better assessment of the Internet forum as a communication tool by the "laymen" group may arise from the fact that it is an open, "uncensored" form of exchange of knowledge and opinions. The forum was used first of all by course participants, and not the lecturers, which enabled trainees with less experience and smaller knowledge to exchanger their views and doubts freely, without being exposed to the possibility of being perceived as a person with a low level of knowledge. This is a typically psychological factor, which shows that in the event of lack of certainty of one's knowledge, which may be assumed for the group of "laymen", we tend to prefer

less formal tools for exchange of views, in which persons with comparable knowledge may participate.

During the conducted studies the author looked for an answer to the research problem – how to implement distance learning courses to guarantee that they meet expectations of their users? The response to that question was supposed to assist organisers of this type of educational courses. A hypothesis was formulated that the usage of a bigger amount of multimedia technologies in e-learning helps it enhance its effectiveness. The presented results allow their positive verification and finding confirmation that it is really so. Consequently a bigger number of multimedia functions contribute to perceiving the educational course as more professional and meeting expectations of the trainees. However, at this point it should be emphasised that a key role appears to be played by effective will of trainees to using the available multimedia options, because the persons that used them had a better opinion of distance learning as an educational method. It is also important that the available options of a technical nature be adapted to the profile of the trainee group, because beginners in the course would have slightly different expectations than those substantively advanced, for example with regard to possibilities of making printouts of transmitted contents, applied communication tools (e.g. less formal Internet forum), or direct contact with the persons delivering the courses, as well as physical participation in the part connected with practical skills. All those elements should be applied in organisation of distance learning, because, as has been proven in the studies, their more frequent usage during the educational course contributes to better satisfaction of the trainees, which becomes transposed on positive perceiving by them of this form of education. Such an attitude of distance learning participants is a prerequisite to be able to consider any education via the Internet.

References:

[1] Bedyńska S., Brzezicka A., *Statystyczny drogowskaz – Praktyczny poradnik analizy danych w naukach społecznych na przykładach z psychologii*, Wydawnictwo Szkoły Wyższej Psychologii Społecznej "Academica", Warsaw 2007.

[2] Chmielewski A., Wodecki A., *Pomiar efektywności systemu e-learningowego w szkolnictwie wyższym*, Polski Uniwersytet Wirtualny, Uniwersytet Marii Curie-Skłodowskiej w Lublinie, [in:] *Rozwój e-edukacji w ekonomicznym szkolnictwie wyższym*, (ed.) M. Dąbrowski and M. Zając, Katowice 2004.

[3] Czupryński A., *Kształtowanie bezpiecznego* środowiska *przez polskie uczelnie*, [in:] *Racjonalizacja zarządzania jednolitymi formacjami umundurowanymi odpowiedzialnymi za bezpieczeństwo wewnętrzne, Vol. V*, [ed.] B. Wiśniewski, P. Lubiewski, T. Zwęgliński, Main School of Fire Service, Warsaw 2020.
[4] Foks-Ryznar A., Ryzenko J., Trzebińska K., Tymińska J., Wrzosek E., Zwęgliński T., *Trial as a pragmatic and systematic approach for assessing new solutions in crisis management and rescue operations*, Society of Photo-Optical Instrumentation Engineers (SPIE) Digital Library, Conference Proceedings Volume 11176, Photonics Applications in Astronomy, Communications, Industry, and High-Energy Physics Experiments 2019; 111763T (2019).
[5] https://witalni.pl/pojecie/efektywna-nauka/, [download: 07.09.2020].
[6] http://pl.wikipedia.org/wiki/, [download: 07.09.2020].
[7] Conclusions of the Council and of representatives of governments of Member States assembled in the Council with respect to the role of developing skills and competencies in implementation of the Lizbon Strategy objectives, OJ EU C 292, 24/11/2005 P. 0003–0004.
[8] National Crisis Management Plan, update 2020, Part A.
[9] Maszorek-Szymal A., *Podstawy statystyki dla studentów i nauczycieli*, Impuls Oficyna Wydawnicza, Kraków 2007.
[10] Mische J.M., Wodecki A., Stanisławska A.K., *E-nauczanie – pragmatyka projektu i jakość nauczania,* Polish Virtual University, Maria Curie-Skłodowska University in Lublin, *Rozwój e-edukacji w ekonomicznym szkolnictwie wyższym*, (ed.) M. Dąbrowski, M. Zając, Katowice 2004.
[11] Pilch T., Bauman T., *Zasady badań pedagogicznych – strategie ilościowe i jakościowe*, Wydawnictwo Akademickie "Żak", Warsaw 2001.
[12] Smolarkiewicz M., Raport końcowy z realizacji pracy naukowo-badawczej statutowej pt. *Analiza i weryfikacja scenariuszy zdarzeń na poziomie interwencyjnym z wykorzystaniem technik cyfrowej rzeczywistości wirtualnej* (KBN S/E-422/18/2006/2008).
[13] Socha R., *Podstawowe problemy ochrony ludności – aspekt teoretyczny,* [in:] *Ochrona przeciwpożarowa a bezpieczeństwo państwa*, (ed.) J. Zboina, B. Wiśniewski, Wydawnictwo CNBOP-PIB, Józefów 2014.
[14] Ziobro J., Lubiewski P., *Podstawowe problemy powszechności zagrożeń dla ludzi i* środowiska, [in:] *Racjonalizacja zarządzania jednolitymi formacjami umundurowanymi odpowiedzialnymi za bezpieczeństwo wewnętrzne, Vol. III*, (ed.) B. Wiśniewski, Main School of Fire Service, Warsaw 2020.

[15] Zwęgliński T., *Distance learning – comparison of two forms of knowledge transfer – research results*, [in:] *Provocari si strategii in ordinea si siguranta publica*, (ed.) M. Badescu, V. Stoica, Academia de Politie, Bucarest 2014.
[16] Zwęgliński T., *Effectiveness of E-Learning in Safety and Security. Community Awareness Raising and Resilience Building,* [in:] *Security and Law* (ed.) B. Wiśniewski, G. Sander, P. Kobes, Verlag Dr. Kovac GMBH Fachverlag fur Wissenschftliche Literatur, Hamburg 2017.
[17] *Prometeus Report Open Consultation Process – Pedagogical and Organisational Issues, 27.09.2001*.
[18] Statute research of the Main School of Fire Service in Warsaw "*Analiza i weryfikacja scenariuszy zdarzeń na poziomie interwencyjnym z wykorzystaniem technik cyfrowej rzeczywistości wirtualnej" (Analysis and verification of incident scenarios at the interventional level with the use of digital techniques of virtual reality)*, No. KBN S/E-422/18/2006/2008 – Research head Marcin Smolarkiewicz.
[19] http://en.wikipedia.org/wiki/Multimedia, [download: 07.09.2020].
[20] http://pl.wikipedia.org/wiki/Metody_nauczania, [download: 07.09.2020].

Tomasz Zweglinski – PhD in Security Sciences, Master of Fire Engineering, professional fire officer (Col.) and specialist in civil protection and crisis management. PhD graduated from the National Defence Academy in Warsaw (Poland). Fire engineering and crisis management studied at the Main School of Fire Service accordingly at the Fire Safety Engineering Faculty and the Civil Safety Engineering Faculty. Occupational safety expert graduated from the Warsaw Technical University and the Central Institute for Labour Protection – National Research Institute in Poland. High level coordination expert of the European Union Civil Protection Mechanism and disaster environmental expert of the Joint Environmental Unit UNEP/OCHA. EU CBRN Security Manager graduated from international post-graduate study in 2018, financed from the EU Internal Security Fund (DG HOME). National and international research, development and capacity building projects manager (incl. EU research programmes, the Polish Official Development Assistance funding, etc.). Table-top and field civil protection exercises manager, trainer and evaluator.
ORCID 0000-0003-2652-8068

Tomasz Zwęgliński – doktor nauk o bezpieczeństwie, magister inżynierii pożarnictwa, oficer pożarnictwa oraz specjalista ds. ochrony ludności i zarządzania kryzysowego. Pracownik akademicki w Szkole Głównej Służby Pożarniczej. Stopień naukowy doktora uzyskał w Akademii Obrony Narodowej w Warszawie. Studiował w Szkole Głównej Służby Pożarniczej na Wydziale Inżynierii Bezpieczeństwa Pożarowego i Wydziale Inżynierii Bezpieczeństwa Cywilnego. Ekspert ds. bezpieczeństwa pracy, studiów podyplomowych realizowanych przez Politechnikę Warszawską i Centralny Instytut Ochrony Pracy – Państwowy Instytut Badawczy. Ekspert Unijnego Mechanizmu Ochrony Ludności oraz Połączonego Centrum UNEP/OCHA ONZ ds. ochrony środowiska w przypadku wystąpienia katastrof. EU CBRN Security Manager, absolwent międzynarodowych studiów podyplomowych (2018 r.) finansowanych w ramach Funduszu Bezpieczeństwa Wewnętrznego UE (DGHOME). Krajowy i międzynarodowy menedżer projektów badawczych i rozwojowych (w tym finansowanych z programów badawczych UE, MNiSW, programu Polska Pomoc, itp.). Organizator i współorganizator krajowych i międzynarodowych ćwiczeń sztabowych i pełnoskalowych z zakresu zarządzania kryzysowego i ochrony ludności, w tym jako trener i ewaluator.