SWOT analysis of the usability of augmented and virtual reality in teaching crisis management

SWOT analýza využiteľnosti rozšírenej a virtuálnej reality pri výuke krízového riadenia

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Abstract:

The paper focuses on determining the main possibilities and benefits of using augmented and virtual reality in teaching university students in the field of crisis management. One of the basic problems of future members of crisis staff, who will coordinate the solution of the most extensive events with the most serious impacts, is the inability to try the solution in advance with the possibility of finding the most effective variant. The aim of the paper is to show that with the help of simulations this problem can be eliminated. At the same time, the paper contains a definition of the main obstacles and limitations that accompany the use of simulations.

Keywords: *Simulation, augmented reality, virtual reality, crisis management, crisis staffs*

Abstrakt:

Príspevok sa zameriava na stanovenie hlavných možností a prínosov využitia rozšírenej a virtuálnej reality pri výuke študentov vysokých škôl v odbore krízového riadenia. K základným problémom budúcich členov krízových štábov, ktoré budú koordinovať riešenie tých najrozsiahlejších udalostí s najzávažnejšími dopadmi, je nemožnosť skúsiť si riešenie dopredu s možnosťou hľadania najefektívnejších variánt. Cieľom príspevku je ukázať, že s pomocou simulácií je možné tento problém eliminovať. Zároveň príspevok obsahuje definíciu hlavných prekážok a obmedzení, ktoré využívanie simulácií prevádzajú.

Kľúčové slová: *simulácia, rozšírená realita, virtuálna realita, krízové riadenie, krízové štáby*

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Introduction

A fundamental problem of teaching methods, not only in crisis management, is their inertia. Most educators have developed a certain stereotype during their practice, which they consider optimal and very reluctant to approach fundamental changes. The introduction of new procedures into teaching is thus associated with the entry of new employees in particular. Back in 2000, computers in schools were an exception, often concentrated in the so-called computer classrooms, in which teaching was aimed at mastering the work with the computer and its software. Later, electronic whiteboards (SmartBoards) also began to penetrate into other classrooms, and only recently did tablets appear. The current COVID-19 epidemic, which brings with it the need to reduce contacts and use distance learning, will also contribute to the development of the use of computer support in teaching. Tools for e-learning, video conferencing and various electronic communicators such as Messenger, SKYPE or VIBER come to the fore. The study materials can thus include audio and video recordings, interactive images or databases. Different types of video sequences explaining real processes using models and simulations can also be used to clarify the material covered in distance learning. These materials are then just a step away from augmented reality and the creation of virtual reality (cyber-reality). However, the possibility of quality representation and modeling in the teaching process requires a creative approach of the teacher and adequate user or more advanced knowledge in the operation of computer technology.

To illustrate the internal connections, laws and internal structure in the description of real phenomena, it is often difficult to comprehensively describe all these elements. Schemes and diagrams will always describe only a specific property or relationship and there is no possibility, using traditional teaching methods, to describe more complicated relationships. This possibility is brought only by the development of computer technology and is generally called modeling [4, 6]. The driving force in the field of creating virtual reality is then primarily the gaming industry. This is a huge market which, thanks to high demand and money turnover, has enough capacity to develop new and new processes and continuous improvement. Thanks to this, we now commonly encounter the creation of truly full-fledged 3D reality, not, as was often the case in the past only by modeling the immediate surroundings of objects and more distant objects, along with the background created using only a 2D canvas [5,8]. The problem that development in this area constantly encounters is the necessary computing capacity of the computers on which the simulation takes place and the amount of data stored directly on the computers [7]. While the first computer games - simulations needed hundreds of kilobytes of information, today's games containing 3D reality are in the tens of gigabytes. With the growing need to represent details and model over time in a changing environment, the demands on computing power and capacity will continue to increase [10]. For really high-quality calculations of the course of floods or meteorological phenomena, powerful "supercomputers" are needed today, ie machines with a huge number of computer cores, built as mainframe computers.

1. Specifics of crisis management teaching - requirements, limitations, goals

Education in the field of crisis management belongs to the narrowly specialized fields, taught within the European states always at only a few universities. Graduates of these fields are being prepared for work in crisis staffs in public administration, or as crisis managers within companies. In both cases, these are groups of people whose goal is to manage sudden large-scale events that directly threaten the existence or significant damage to the entity or territory. As these are events that can have different causes and therefore different manifestations, the area of crisis management is inherently multidisciplinary. In his work, the crisis manager is forced to calculate not only the material losses arising from the event, but also their social, psychological and economic manifestations [14]. At the same time, during the solution, it must prepare the conditions for a quick renewal or re-establishment of the function of the entity or infrastructure. In practice, two terms are used for these phenomena - domino-effects and synergistic phenomena. In the case of domino effects, it is the mutual relations of individual consequences, where a specific consequence generates other problems in interconnected areas. As an example, some domino effects associated with extreme wind can be mentioned (see Fig. 1). It can be seen from the example that the impacts on the damaged area will be very diverse. At the same time, however, it is necessary to realize that the intensity of impacts on individual sectors will depend on a large number of factors that will be known only when the situation arises [9]. The resulting situation will be completely different in a city with a dense network of roads and a population dependent only on the sale of food in shops, the consequences will be completely different on a village with a single passageway, a single intersection with traffic lights and a population used to shopping once a week and food availability. from own resources. The second phenomenon mentioned above is synergistic bonds. Synergy - interaction, affects phenomena that arise independently of each other, but after their occurrence they interact with each other. A typical example could be torrential rains over a small area the size of a district or even a municipality. These precipitation can cause problems, but if the previous period was rich in rain, the amount of water that flows over the surface will be significantly different than if it was preceded by a dry period and the soil is dry. However, synergistic phenomena can also have a social basis. In the event of a torrential downpour and a cultural or social event organized in parallel, the number of disabled people will be significantly different. And we are not talking about similar complications as the currently solved problem with the COVID-19 epidemic.
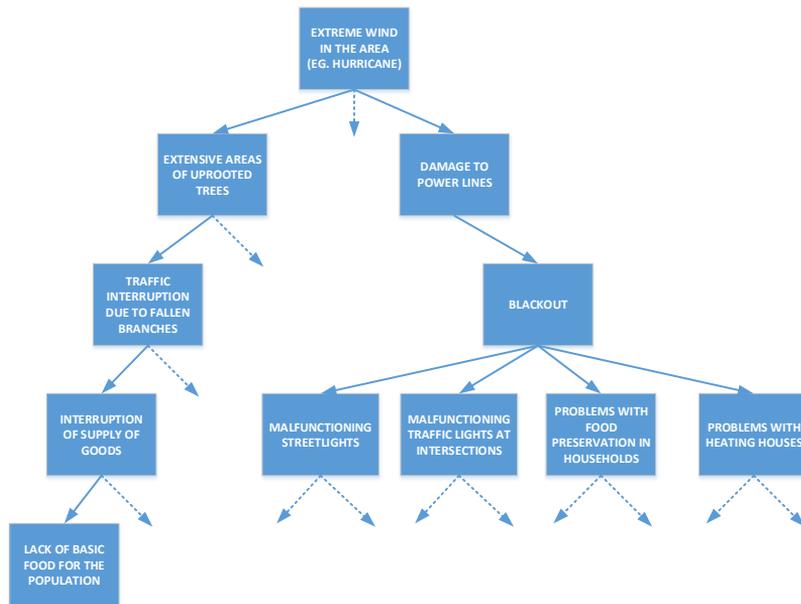
Fig. 1 An example of domino-effects associated with extreme wind.

Source: Author

Crisis management is thus a scientific discipline that requires a general overview and at the same time the ability to respond multidisciplinary to the situation. The real world is infinitely variable, and so with each situation solved, new and new challenges arise, which require new, operational approaches to managing them. One of the ways to help students prepare for crisis management is to use simulations, augmented and virtual reality. However, even this option brings pros and cons.

2. Theoretical prerequisites for the use of virtual and augmented reality in the teaching of crisis management

As stated in the previous sections, there is very limited experimentation in safety education [12]. Mostly it is not possible at all. For example, it is very problematic to try to evacuate a medical facility where manipulation of patients could cause their health to deteriorate or even cause their death. In the event of a chemical or radiation accident, the situation is even clearer. In both cases, these are mechanisms and effects that cannot be demonstrated in the real world. No one intentionally creates a flood, large-scale fire, or contagion just to demonstrate to students the need for individual content plans, the operation of a crisis management system, or disaster management procedures. The possibility of using simulations is essential for the education of students in the field of accident and disaster management.

Technically, the use of simulations in teaching can take two directions, a purely educational path, or a practical exercise. In the case of purely educational use of simulations, it will be primarily the basis for self-study in the form of interactive models or teaching texts enriched with elements of augmented reality. An example

would be a table, where by reading inside the hidden code by a mobile device (phone, tablet), an animation or an accompanying video would appear, containing an explanation of the data given in the table. Of course, any element in the text can be enriched in this way. The condition is a mobile device - tablet or phone, equipped with a camera and installed software. In the case of safety and crisis management, a concrete example can be the use of, for example, animations highlighting safety-relevant objects on the map, animation of evacuation routes, animation of the course of floods or the spread of hazardous substances from the source. The range of possibilities for use here is wide and is limited only by the imagination of the creators of study materials.

In the case of practical training, the use of augmented and virtual reality offers the possibility of visualization inside buildings, where, for example, augmented reality will highlight important elements with safety implications (evacuation signs, directions of evacuation, smoke spread in a fire), elements ", were supplemented by test questions, or would respond to the adjustment of conditions depending on the course of the exercise (eg students proposed measures for intervention). Similarly, when conducting field exercises, gathering places, flood waves or intervention by IRS units could be displayed. The clear advantage will be the possibility of stopping or interrupting the simulation, retrospective analysis of its course and repetition from the selected moment. This will make it possible to search for and present various solutions, visualize the consequences, estimate the amount of technology needed or identify critical areas.

3. SWOT analysis of the usability of augmented and virtual reality in the teaching of crisis management

SWOT analysis is a method that allows you to compile a matrix of strengths and weaknesses, as well as opportunities and threats and their subsequent evaluation. The advantage of the analysis is that it is possible to look for dependencies among the identifiable items that can be further used for a strategy to address the risks arising from weaknesses and threats [1]. Under the abbreviation SWOT you can imagine an abbreviation that is composed of the first letters of the English names of the factors and represent [2, 13]:

S – Strenghts,
W- Weakness,
O – Opportunities,
T – Threats.

The aim of the SWOT analysis itself is to divide the strengths and weaknesses of the project in order to develop the strengths and improve the strengths of the organization. In this context, it is also necessary to expect the emergence of threats and opportunities. The elaboration of the analysis does not only mean the correct division into individual lists of strengths and weaknesses, opportunities and threats, it is also necessary to see other connections. Opportunities can easily turn into threats and vice versa. This also applies to strengths and weaknesses, it always depends on a certain point of view [3].

The process does not end with the implementation of the SWOT analysis. The result of the analysis should be the subject of an understanding of the situation and the specification of an appropriate strategy.

As part of the experts discussion, a list of internal and external factors influencing the benefits and negatives of the introduction of simulations using augmented and vitral reality was created. The generated data were then critically evaluated, repetitive data removed and similar merged. The result is presented in Tab. 1.

Tab. 1 Augmented reality in crisis management teaching - SWOT analysis

	S	**W**
Internal origin (organization attributes)	• Possibility of simulation before the real situation arises • Ability to create psychological pressure • Possibility to search for alternative solutions • Existing workplaces at the FSE (CESIT) • Making teaching more attractive - interest of students • Upgrading qualifications • Possibility of implementing international exercises • Possibility of distance learning and simulation • Involvement of participants with minimal knowledge and experts from practice. • Possibility to stop and step the simulation process, repeat selected situations • Diversification of participant roles.	• The need for internal experts (screenwriters) • The need for investment to create and maintain technical equipment and standards • The need to collect detailed information about events and their solutions - non-public documents, GDPR restrictions • Limited theory in the field of CM • Narrow specialization - insufficient number of students • Language limitations, barriers during international exercises • The need for an IT expert and an external consultant for start-up and simulation • Time consuming scenario building. • Limited theory of the use of VR / AR in education • Challenging space conditions and technical infrastructure
	O	**T**
External origin (organization attributes)	• High variability and diversity of events and their impacts • Experts in practice with experience from recent years • Use of significant events and experiences in recent years (floods, pandemics, hurricanes, flash floods, epizootics, terrorism) • "Politically" interesting topic - social demand • Objectively increasing number of events with large negative impacts • Increasing availability of IT support tools	• Reluctance from practice to cooperate • Non-existent regulation unifying the work of crisis staffs • Different structure of work organization across the republic • Limited number of schools in the Czech Republic and abroad with the necessary focus • Different legal framework in each country • Different organizational structure in each country • Insufficient data connection.

	• Increasing the employability of students in the labor market. • Low number of students and effective cooperation. • Project calls.	• Reluctance of users to work with new technologies. • Overwhelmed by courses and spreads of topics. • Replanning and opacity of planning documentation as a starting supporting material. • Confusing system of competencies.

Source: Author

The general data obtained in this way needed to be further specified and their levels of severity determined. This is presented in the following chapter.

4. Evaluation of SWOT analysis

For the self-evaluation and adoption of conclusions, it is necessary to assign priorities to individual aspects in each category. The Paired comparison method, sometimes called the Binary method, is used to determine priorities or levels of relative severity. The basis of this method originated in the 18th century, but it was not until the 20th century that its methodological basis and basic theoretical method were created by the American psychologist Louis Leon Thurstone (1887-1955). He used this method to investigate and compare social phenomena, such as serious crimes or the tendency to gamble. It is a method of multicriteria analysis, in which all pairs of objects from a certain list are compared. From the list items, pairs are gradually selected, for which a mutual assessment of importance is carried out. The results are written into a preference matrix and then evaluated. The advantage is the ability to obtain an independent evaluation, the disadvantages include a high number of combinations and the time required for evaluation.

In the case of evaluating the strengths of the process of introducing augmented and virtual reality in crisis management teaching, the most significant strength of the existence of the CESIT Faculty Simulation Center at the Faculty of Safety Engineering of the Technical University of Ostrava. This workplace was directly created for the introduction of virtual and augmented reality into teaching. It has state-of-the-art technological equipment and, thanks to its belonging to academic workplaces, also a close connection with new scientific trends. This workplace already has experience in preparing simulation exercises in the form of management models. Consistent with their practical experience, the second most important positive in the evaluation of strengths was the possibility of interrupting, stopping and stepping through the individual phases of the exercise. From the point of view of the teaching process, this is a significant benefit. By interrupting the exercise with the possibility to reconnect at a given moment, it brings the opportunity not only to record the student's mistake, but also to explain its nature, or the opportunity to find a better solution. An important strength of the introduction of simulations into teaching is also the fact that this step makes teaching significantly more attractive and thanks to that the student's interest in the issue will increase. As previously described, in the field of safety it is not possible to teach in real situations, their analysis is usable only in theoretical teaching, what the use of simulations and models in teaching is to solve the situation and find optimal solutions in the virtual world, ie without the emergence of real damage. Here it is

necessary to highlight the possibility of repeating the solution, which has a huge benefit for practitioners. They encounter relatively large events relatively rarely and the possibility of restoring their skills and knowledge in the form of practical simulation exercises is very beneficial, including the opportunity to try solutions from various professional positions within the staff. Rather, the possibility of implementing international exercises and simulating stress during the exercise appears to be an additional benefit after the evaluation. Nevertheless, one of the strengths of international exercise is. Through them, it is possible to gain a new perspective on working in crisis staffs and also the ability to communicate in a professional foreign language. It is known from practice that this is often a major problem for university students. Their language skills increase them from year to year and thanks to that they get the idea that communication in a foreign language (mainly in English) is not a problem. However, a professional solution requires specific terms that are not included in the general language. It is also worth mentioning today, especially the current possibility of carrying out crisis exercises when it is impossible to meet in one room. The COVID-19 pandemic has shown that even these situations are real. However, the work of the team in such conditions requires a number of new approaches and in general it is still a very unresolved area.

Tab. 2 SWOT analysis - evaluation of strengths

PAIRED COMPARSION METHOD S Evaluation of strengths		Simulation before the real situation	Psychological stress during negotiations	The possibility of finding alternative solutions	Existing workplace at VSB-TUO	Possibility to make teaching more attractive	Improving students' qualifications	Possibility of organizing international exercises	Possibility of distance learning and simulations	Usability for laymen and experts	Possibility to stop, repeat and step the scenario	Possibility to try different roles	Score	Relevance
	Simulation before the real situation	X	1	1	0	0	0	1	1	1	0	1	6	4
	Psychological stress during negotiations	0	X	0	0	0	0	0	0	0	0	0	0	11
	The possibility of finding alternative solutions	0	1	X	0	0	0	1	1	1	0	1	5	5
1	Existing workplace at VSB-TUO	1	1	1	X	1	1	1	1	1	1	1	10	1
	Possibility to make teaching more attractive	1	1	1	0	X	1	1	1	1	0	1	8	3
	Improving students' qualifications	1	1	1	0	0	X	1	0	0	0	0	4	8
	Possibility of organizing	0	1	0	0	0	0	X	0	1	0	0	2	9

international exercises							✕						
Possibility of distance learning and simulations	0	1	0	0	0	1	1	✕	1	0	0	*4*	**7**
Usability for laymen and experts	0	1	0	0	0	1	0	0	✕	0	0	*2*	**10**
Possibility to stop, repeat and step the scenario	1	1	1	0	1	1	1	1	1	✕	1	*9*	**2**
Possibility to try different roles	0	1	0	0	0	1	1	1	1	0	✕	*5*	**6**
	4	*10*	*5*	*0*	*2*	*6*	*8*	*6*	*8*	*1*			

Source: Author

In the case of the evaluation of weaknesses, the most significant internal shortcoming appears to be the insufficient theoretical basis on the area of crisis management. The problem here is the connection of theoretical procedures with the existing legal framework and organizational structure of crisis management entities. In practice, this means that it is necessary to gradually switch to the conditions in the Czech Republic abroad existing theoretical basis. Due to the fact that there is no specific theory, it is also problematic to evaluate individual variants of solutions and find the optimal variant. Another significant shortcoming is the long-term need to invest in maintaining the technological level. As stated above, at the Faculty of Safety Engineering, Technical University of Ostrava, there is a top CESIT workplace. Even in the case of this new workplace, it will be necessary to ensure a continuous supply of financial resources for further development and maintenance of the entire workplace. Currently, the use of virtual glasses in teaching is developing here. However, this is an extremely time-consuming and professionally demanding matter, which requires considerable financial costs for the acquisition of equipment. This workplace already has a network of external collaborators from the ranks of firefighters, paramedics, police officers and other experts from practice. Therefore, an otherwise very significant weakness in the need for external experts is addressed in this case.

Creating one scenario for an exercise of the order of 4 hours, together with the necessary materials and scenario, requires approximately 3 months of work. In the case of virtual reality, this time is even longer. Time consuming is one of the major problems in implementing virtual and augmented reality in practice and can be expected to gradually become a basic limiting factor along with available financial resources. Time consuming is also closely linked to the need for very detailed information. When creating scenarios, it is best to start from events that have occurred in the past. Unfortunately, the documentation for dealing with these situations is often incomplete or unavailable for various reasons. The missing documentation must then be replaced by the experts of the scenario with expert estimates, which further prolongs the creation of the scenario.

During all exercises, there are situations that are professionally debatable. There is no theoretical solution for them. This is not a natural consequence of a solution that

cannot be eliminated. For these cases, the exercise must be attended by an expert in the role of consultant. Based on his experience, decisions are then made about the correctness of the solution. Without these people, the exercise scenario would inevitably collapse.

The last of the important aspects that threaten the successful introduction of simulations into teaching practice are the spatial requirements. Despite the fact that we are creating virtual reality, real classrooms and laboratories are needed. The inability to obtain sufficient space for implementation is often a limiting factor for the use of simulations in practice.

Tab. 3 SWOT analysis - evaluation of weaknesses

PAIRED COMPARSION METHOD W Evaluation of weaknesses	The need for internal experts	The need for investment	The need for detailed information	Insufficient theoretical basis	Highly specialized field	Insufficient language skills	The need for a professional and IT consultant	Time consuming scenario building	Limited theory for the use of VR / AR in teaching	Challenging spatial and technical requirements	Score	Relevance
The need for internal experts	✕	0	1	1	0	1	1	1	0	1	6	**3**
The need for investment	1	✕	1	0	1	1	1	1	1	1	8	**2**
The need for detailed information	0	0	✕	0	0	1	1	1	0	1	4	**6**
Insufficient theoretical Basis	0	1	1	✕	1	1	1	1	1	1	8	**1**
Highly specialized field	1	0	1	0	✕	0	0	0	1	1	4	**7**
Insufficient language Skills	0	0	0	0	1	✕	0	0	1	1	3	**8**
The need for a professional and IT consultant	0	0	0	0	1	1	✕	0	1	1	4	**5**
Time consuming scenario building	0	0	0	0	1	1	1	✕	1	1	5	**4**
Limited theory for the use of VR / AR in teaching	1	0	1	0	0	0	0	0	✕	0	2	**9**
Challenging spatial and technical requirements	0	0	0	0	0	0	0	0	1	✕	1	**10**
	3	1	5	1	5	6	5	4	7	8		

Source: Author

Using simulations also brings many opportunities. One of the most important is the opportunity to participate in solving new project challenges. These are published at both national and European level. The ongoing COVID-19 pandemic highlights the need for crisis preparedness and thus generates increased societal demand for the number and quality of university graduates in the field of crisis management. Unfortunately, society and its political representatives always focus only on current issues. Their interest appears in the waves. In the case of safety, we can register a wave of interest coming after the floods in 1997 and 2002, after Hurricane Kiril and Herward, flash floods in Moravia or the current wave of interest in crisis management due to the ongoing COVID-19 pandemic. Despite these periods, the field of crisis management remains a narrowly focused field with a small number of students. From the point of view of opportunities, it is important to be able to pay more attention to individual students and their knowledge, in contrast to the fields, with huge numbers of students. Thanks to a better education, students will find employment in the labor market faster.

The general willingness of practitioners and their employers to participate in teaching can also be seen as a great opportunity. In the case of leading lectures or participating in exercises in the role of experts, these people have no problem relaxing, and the lecture activity is also perceived very positively. Practitioners also have, thanks to a number of events from recent years, practical experience that can complement theoretical teaching.

Also in terms of the availability of the necessary technologies, the situation in the field of simulation tools is developing significantly. The field of education is a very interesting space for a large number of companies to offer their products.

Tab. 4 SWOT analysis - evaluation of opportunities

PAIRED COMPARSION METHOD O Evaluation of opportunities	High variability and diversity of events and their impacts	Existing experts in practice with experience	Possibility to use experience from recent events	Social demand	Objectively increasing number of negative events	Increasing availability of IT support tools	Increasing the employability of students in the labor market	Low number of students and the individual approach	New grant calls	Score	Relevance
1 High variability and diversity of events and their impacts	✕	0	0	0	0	0	0	0	0	0	**9**
Existing experts in practice with experience	1	✕	1	0	1	1	0	0	0	4	**5**
Possibility to use experience from recent events	1	0	✕	0	1	1	0	0	0	3	**6**

	1	2	3	4	5	6	7	8	9		
Social demand	1	1	1	✕	1	1	1	1	0	7	**2**
Objectively increasing number of negative events	1	0	0	0	✕	0	0	0	0	1	**8**
Increasing availability of IT support tools	1	0	0	0	1	✕	0	1	0	3	**7**
Increasing the employability of students in the labor market	1	1	1	0	1	1	✕	0	0	5	**4**
Low number of students and the possibility of an individual approach	1	1	1	0	1	0	1	✕	0	5	**3**
New grant calls	1	1	1	1	1	1	1	1	✕	8	**1**
	8	4	4	1	7	5	3	3	0		

Source: Author

The last area evaluated is threats. The biggest obstacle to the effective introduction of simulations into teaching appears to be the inconsistent crisis management system within the Czech Republic. Within the state, there is a structure of advisory bodies for the area of crisis management - the security council of municipalities with extended powers, regions and the state, which, after its establishment, will turn into a system of executive bodies - crisis staffs. Crisis staffs are created by expanding the security boards with additional members and a working group. However, this is a fundamental problem. While in the case of security councils the structure and members are defined by a government regulation, in the case of crisis staffs this is not the case. Across the country, we can meet with a number of models of the internal organization of crisis staffs with a very diverse number of people. In practice, this makes it impossible to ask for help, for example, a neighboring region, because a member of the crisis staff of one region will not be able to work in another system. What is a problem in practice is a fundamental limit for education. This should be universal, which is not possible in this case. In the case of simulations, the organizers must always choose one of the models and prepare for the exercise. Unfortunately, the graduates will then find themselves in a situation where the learned theory will not agree with the practice in the region. Which, in conjunction with a confusing competency system, can be a major problem.

As stated in the introduction of this paper, the problem of the whole education system is its inertia. Thus, the reluctance of users to work with new technologies can be limiting for the introduction of simulations and all innovations into teaching.

Not only the language barrier described above is limiting for the organization of inter-university and international exercises, but also the fact that very few universities teach in the field of crisis management. Finding a suitable partner for organizing a simulation exercise is so complicated, despite the different structure of bodies and competencies in the field of crisis management and different ways of organizing work in crisis staffs.

Last but not least, the risk of market overcrowding through training offers. This is not primarily training in crisis management. The problem needs to be seen comprehensively. Schools compete to offer new disciplines and specializations and often try to offer different combinations of existing disciplines and specializations. This can cause a defensive reaction in students in the form of a lack of interest in participating in additional courses and trainings.

Tab. 5 SWOT analysis - evaluation of assessment

AIRED COMPARSION METHOD — T — Threat assessment	Reluctance experts from practice to cooperation	Lack of legal framework for the work of crisis staffs	Different structure of work organization across the republic	A limited number of schools with the necessary focus	Different legal framework for CM in each country	Different organizational structure of CR in each country	Insufficient data connection	Reluctance of users to work with new technologies	Overwhelm the market by offering courses and spreading topics	Too complicated planning documents	Too complicated system of competences	Score	Relevance
Reluctance experts from practice to cooperation	✕	0	1	1	1	1	1	0	0	0	0	5	5
Lack of legal framework for the work of crisis staffs	1	✕	1	1	1	1	1	1	1	1	1	10	1
Different structure of work organization across the republic	0	0	✕	1	1	1	1	0	0	1	0	5	6
A limited number of schools with the necessary focus	0	0	0	✕	1	1	1	0	1	1	0	5	7
Different legal framework for CM in each country	0	0	0	0	✕	0	0	0	0	0	0	0	11
Different organizational structure of CM in each country	0	0	0	0	1	✕	1	0	0	1	0	3	9
Insufficient data connection	0	0	0	0	1	0	✕	0	0	0	0	1	10
Reluctance of users to work with new technologies	1	0	1	1	1	1	1	✕	1	1	1	9	2
Overwhelm the market by offering courses and spreading topics	1	0	1	0	1	1	1	0	✕	0	0	5	4
Too complicated planning documents	1	0	0	0	1	0	1	0	1	✕	0	4	8

Too complicated system of competences	1	0	1	1	1	1	1	0	1	1	✕	8	3
	5	0	5	5	10	7	9	1	5	6	2		

Source: Author

Conclusion

The use of virtual and augmented reality and simulations in general is a very modern trend in education. It can reduce teaching costs due to the transition to the virtual world and also offers the opportunity to perform exercises that are not possible in the real world. However, it is also necessary to respect the limitations and threats posed by the outside world, which can fail when trying to introduce these new methods into teaching [11]. The aim of this paper was to evaluate the pros and cons associated with the use of simulations in teaching in the field of crisis management and coping with large-scale events with negative impacts. Despite all efforts, it will be a gradual process, due to the financial demands, the need for specialized staff and especially the need to change the conservative approach to teaching. However, this modern trend can no longer be stopped, which is why I will encounter virtual and extended realization more and more often.

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