sciendo

An innovative conceptual model for education and training on hybrid warfare

Paul TUDORACHE
"Nicolae Bălcescu" Land Forces Academy, Sibiu, Romania
tudorache.paul@armyacademy.ro

Ghiță BÂRSAN
"Nicolae Bălcescu" Land Forces Academy, Sibiu, Romania
gbarsan@armyacademy.ro

Zoltán JOBBÁGY
"Ludovika" University of Public Services, Budapest, Hungary
Jobbagy.Zoltan@uni-nke.hu

Alin CÎRDEI
"Nicolae Bălcescu" Land Forces Academy, Sibiu, Romania
cirdei.alin@armyacademy.ro

Ilie GLIGOREA
"Nicolae Bălcescu" Land Forces Academy, Sibiu, Romania
goreili@armyacademy.ro

Abstract: *This study aims to present an innovative conceptual model of learning, teaching, and training that appears to be applicable to the field of hybrid warfare. It is based on integrating three critical elements such as reference curriculum, teaching methodology, and online support capabilities. By using qualitative research through correlating critical analysis of relevant sources, logical scheme, and cognitive task analysis, each descriptive element is analysed in order to provide an eloquent image of the proposed conceptual model. Also, to gain real feedback on the proposed model as well as on its constitutive elements, the quantitative research using statistical data grouping is performed. The analysis and interpretation of the collected data demonstrate not only a high interest in the designed conceptual model, but also a positive impact at the level of each descriptive element on the academic staff and students from the military and civilian university environment.*

Keywords: HW, CTA, statistical data grouping, HWRC, TSM, MOOC.

Please cite the article as follows: Tudorache, P., Bârsan, G., Jobbágy, Z., Cîrdei, A. and Gligorea I. (2023), "An innovative conceptual model for education and training on hybrid warfare", *Management & Marketing*, Vol. 18, No. 3, pp. 234-250, DOI: 10.2478/mmcks-2023-0013.

Introduction

Lately, the educational strategies have undergone transformations due to continuous changes generated by internal and external factors. From an internal perspective, these transformations reflect on adapting the didactic methodology, assuming the evolution of teaching, learning, and evaluation methods in relation to the educational audiences, while the perspective of external transformations involves the permanent updating of educational contents in relation to the requirements of society's fields.

Within this cliché, there is also the need to identify an optimal didactic formula regarding education and training in the field of hybrid warfare (HW), which requires an innovative interdisciplinary teaching perspective due to the necessity to correlate quite different topics from various fields that ensure the appropriate approach to HW. As is known, HW is an extremely complex concept with implications and conditioning in multiple fields. Moreover, the adaptation of specific methodology also requires the use of the revolutionary capabilities in the form of emerging and disruptive technologies (EDT), where the exploitation of artificial intelligence (AI) becomes a major concern.

On the other hand, the education and training on HW assumes consistent reflections on the specific curriculum, as well as on the online support capabilities. Consequently, in order to educate and train different audiences on HW, it is necessary to adopt a hybrid pedagogy which requires significant reflections both in terms of the theoretical dimension and in terms of the practical-applicative component in the educational field (Anton, 2016). Hybrid pedagogy represents a complex educational approach, which aims to combine traditional training methods and techniques with modern ones and involves the use in an integrative way of in-person learning and online training, using digital tools from the most diverse to be able to offer a learning experience as complete as possible, adapted to the subjects of the educational process. The key to the hybrid pedagogy used to study HW is to encourage students to develop their knowledge and skills of analysis, critical thinking, in an interactive and dynamic environment to be able to grapple with challenges.

Under these circumstances, in November 2021, the project of "Interdisciplinary Education and Training on Hybrid Warfare" was launched, to which 6 institutions contributed: the "Ludovika" University of Public Services (UPS, Hungary); the "Nicolae Bălcescu" Land Forces Academy (LFA, Romania); the University of Turin (UNITO, Italy); the Bar Ilan University (BIU, Israel); the Armed Forces Academy (AFA, Slovakia); and the Centre for the Study of New Security Challenges (CSNSC, UK). The purpose of the project is to provide a conceptual framework for a better understanding of current and future conflicts, highlighting, especially, the HW. Also, the project tries to create a modern tool available to specialists and the general public, interested in understanding the mechanisms of the manifestation of HW, in knowing the implications of using hybrid tactics to achieve political, military, economic, or other objectives, and in the early identification of threats of hybrid nature to be able to try to counteract them.

Consequently, this research aims at designing a conceptual model for educating and training from an HW perspective. The research objectives proposed in the study are: identifying the particularities of the hybrid warfare reference curriculum (HWRC); defining the characteristics of the teaching and simulation methodology (TSM); designing supported online capabilities (*Massive Open Online Course – MOOC*) specific to HW didactic approach; getting the initial feedback for the proposed conceptual model as well as for its constitutive elements.

Considering the deep novelty of the topic addressed, as well as the reflection on the key questions that have emerged during the transnational project meetings (TPM) of the previously mentioned research project (What should the HWRC design look like?, What particularities should the TSM of HW have?, What kind of innovative technical capabilities could be used to stimulate education and training on HW?) the formulation of required research questions used the quantitative method. All these, as well as the need to identify a first imprint regarding the impact of the possibility of education and training on HW, constituted the basis for the formulation of research questions, as follows: (1) Do education and training on HW require a diverse curriculum to enable a comprehensive approach to it?; (2) Does the effectiveness of education and training on HW depend on the development and applicability of suitable interdisciplinary TSM and innovative MOOC capabilities?; (3) What is the initial impact generated by the proposed conceptual model for education and training of HW on the educational audiences?.

Literature review

The analysis of the specialised literature highlights the lack of conclusive studies that deal with the problem of education and training in the field of HW, since this is a niche field, which attracted the attention of researchers who wanted to understand its manifestation mechanisms and the implications for the security environment, but it did not arouse the same interest in the development of a teaching methodology adapted to the study of this complex phenomenon with multiple ramifications. The ones that stand out have a generic imprint and aim at the field of adapting the pedagogy and teaching methodology to current demands.

Among the studies carried out to understand the concept of HW and the need to develop adapted ways of teaching, we can mention "Hybrid Pedagogies for Hybrid War" (Anton, 2016), which portrays the imperatives of educational and training processes from the perspective of approaching the HW. The emphasis is on introducing neuroscience in studying HW and promoting innovative thinking, mental agility, and enhanced cognitive skills to boost pedagogical practices. Central conclusion of the study is that new types of hybrid threats and new forms of confrontation that exceed the conventional dimension and take place in all environments and use a wide range of means, both conventional and especially hybrid in nature, offer multiple possibilities for transforming and adapting education and military training by using modern methods and means, adapted to the new realities, which are based on hybrid pedagogical strategies, and which should put education in the foreground, emphasise specialised education, before attention is focused on specialised training correlated with predictable, conventional circumstances, and context.

Rao (2019) proposes an innovative educational approach, blended learning, which focuses on an effective combination of traditional in-person teaching-learning activities in classrooms and laboratories, with advanced distance learning and other didactic activities conducted online by teachers, instructors, students and other subjects of the educational process. This study is also representative for understanding the need for developing a hybrid teaching methodology because it describes some of the most likely advantages in using blended teaching/learning: enhancing effectiveness, working freely with new concepts, providing simultaneous independent and collaborative learning, exploiting new technologies and creating virtual learning environment, etc.

Other authors, such as Klimova and Kacetl (2014), analyse the characteristics of the hybrid teaching methodology and identify the main reasons and principles for using the hybrid pedagogy.

On the other hand, Vassileva and Zwilling (2018) promotes action-based interactive methods, such as simulation, facilitating the acquisition of critical knowledge/skills and the operationalisation of theoretical foundations in the framework of HW. In addition to this, the pedagogical practices should focus not only on general mindset, but also on using intercultural reconciliation and promoting relational skills. Moreover, understanding HW requires approaches that are material and cognitive in fashion, and for this reason, simulation-based learning could be a very effective method to fulfil designated learning objectives. Last, but not least, Vassileva and Zwilling's research is representative because it introduces the quantum skills (seeing, knowing, thinking, feeling, acting, trusting, and being) as critical ingredients for specific pedagogical practices, which are the basis of the proposed conceptual model (*SIM4thWarfare*) to support trainees in gaining critical experience in dealing with HW.

An effective way to conduct distance education and to provide useful tools to those interested in broadening the horizon of knowledge and accumulating new knowledge in the HW field is the use of online teaching-learning platforms. In this sense, the tool called MOOC, which allows a large number of learners to access learning resources made available by teachers, was developed and successfully used. Lan and Hew (2020) perform an analysis on using the MOOC as an educational alternative in teaching and learning. While investigating the involvement of students in the MOOC, the research concludes that their motivations are behavioural, emotional, and cognitive, and even though many students use the MOOC to fulfil primary and additional learning needs, not all of them manage to complete the MOOCs to the end. The need to develop a platform for conducting MOOCs, but also the analysis of the influence of traditional learning models on the creation of specific MOOC processes were also studied by Kopp and Lackner (2014), who also created a checklist and a useful framework to support administrators, developers, and teachers involved in the development and operationalisation of MOOCs. They analysed classical learning theories in relation to MOOCs and provided the benchmarks of their own model for making a functional platform for MOOCs.

To increase the efficiency of the training process, modern technology can be used and the advantages offered by AI can be exploited in the process of analyzing and understanding the concept of HW. In this sense, Thiele (2020) addresses the benefits of using AI in various fields, including the educational one. Among the many highlighted contributions in the field of education and training, the most conclusive are: personalised educational process, based on the real needs of the training beneficiaries; coherent and objective assessment, conducting realistic, challenging exercises and simulations, adapted to real and current situations; combining classical methods with the use of virtual reality and other modern training technologies; the use of simulation of complex situations, based on realistic training scenarios and anticipating future developments in the field of interest, but also anticipating future technologies and innovative ways of using them.

These researches serve as starting points in designing the conceptual model of educating and training on HW, which must focus on training military and civilian personnel to meet the threats and challenges specific to HW. It should be mentioned that this conceptual model is not generally valid and applicable in this form in all countries and in all

particular situations, due to national specificity and the regional or local context, but it represents the starting point for the development of a consistent and realistic training strategy in the HW field.

Research methodology

Considering the exploratory and absolutely new nature of the problem addressed, the study used a research methodology comprising a mixture of qualitative and quantitative methods that integrated critical analysis of relevant sources, cognitive task analysis (CTA), logical scheme, and statistical grouping. If the first two methods were applied to answer to the first two research questions, the last ones, logical scheme and statistical grouping, contributed to the analysis of the last research question. As it is depicted in table 1, for answering to the research questions, each method had a significant contribution, and they were used in a correlated fashion.

Table 1. The contribution of research methods to answering to the research questions and expected outcomes

Research methods / Research questions	Critical analysis of relevant sources	Logical scheme	CTA	Statistical grouping
(1) Do education and training on HW require a diverse curriculum to enable a comprehensive approach to it?	x		x	
(2) Does the effectiveness of education and training on HW depend on the development and applicability of suitable interdisciplinary TSM and innovative MOOC capabilities?	x		x	
(3) What is the initial impact generated by the proposed conceptual model for education and training of HW on the educational audiences?		x		x
Expected corresponding outcomes	HWRC design; TSM, MOOC particularities	Conceptual model of educating & training on HW	HWRC design; TSM, MOOC particularities	Initial feedback from educational audiences

Source: authors' own research.

Also, some of the research methods had some secondary contributions. For example, the design of the conceptual model of education and training in HW, although it was largely based on applying the logical scheme, it was secondary supported by performing CTA during TPMs.

Regarding CTA, this should be understood as the process which consists of the analysis and dissection of expert knowledge and expertise of some subject tasks and their

adaptation to the real needs of the training and education process based on a specific educational model (Grunwald et al., 2004). Furthermore, CTA contributes to understanding how people think, solve problems, and make decisions and typically proceeds in several steps, such as identifying the cognitive task, describing the task, dissecting the task into substeps or component parts, observing and evaluating performance, and interpreting the results. This information might be used in various fields, and in this study was applied during TPMs carried out during the progress of the aforementioned research project and it was based on critical observations and constructive discussions with different subject matter experts (SME) in the field of education and HW. Information collected during CTA was related to the following questions:

- What minimum elements should coagulate the qualitative model for educating and training on HW?
- What are the HWRC eligible domains?
- What topics should be included for lecture and seminar activities?
- What didactic methods are suitable for teaching/learning the HW?
- What could be some examples of simulating specific HW hypothetical scenarios?
- What minimum elements should be included in the MOOC design?
- How can MOOC facilities be exploited?
- How could AI capabilities be integrated within the proposed qualitative model?
- How the elements of qualitative model could be validated?
- In what form can the proposed conceptual model be implemented?

Also, the feedback on the proposed conceptual model was obtained through the analyses of statistical grouping based on data obtained by applying an online questionnaire (Google Forms) during the multiplier event conducted on 9th May 2023. Data analysis was performed using Microsoft Excel 365, where functions for data sorting, statistical analysis, and graph generation were used. Furthermore, additional graphics were developed using CorelDraw.

Within the research project, the multiplier event is the main method used to promote the project's results (elements of the conceptual model). The validation criteria for the multiplier event consisted of at least 40 in-person participants and at least 100 online participants from the military and civilian academic environment (students and staff).

On the other hand, in order to allow the multiplier event's objectives to be met and to meet the minimum number of participants, purposive sampling that involves deliberately selecting specific individuals or elements from the population based on certain criteria relevant to the research questions (Campbell et al., 2020) was used as sampling methodology. Thus, individuals who are considered key informants or have specific characteristics of interest were chosen such as: English speakers at an above average level, having previous knowledge of the HW field, being interested in acquiring new knowledge, and training skills to analyse the implications of HW on different areas of social life. The nonprobability method of subjective selection was used to select the individuals who participated in the multiplier event and to whom the questionnaire was administered due to the fact that the participants had to meet the criteria mentioned above.

The subject population that met the required criteria was 215. Although an attempt was made to carry out quasi-exhaustive research by applying the questionnaire to the entire population, it was completed by 149 respondents, which maintains a confidence level

of 95%, but with 4.6% margin of error. Even if most researches require a confidence level of 95% and a margin of error of 3%, this method is usually used on much larger populations.

The multiplier event was attended by SMEs, academic staff, and students from civilian and military national and international universities, including 85 in-person and 130 online ("Nicolae Bălcescu" Land Forces Academy website, 2023). Out of the 215 participants, 149 answered the feedback questionnaire, representing 69.3%.

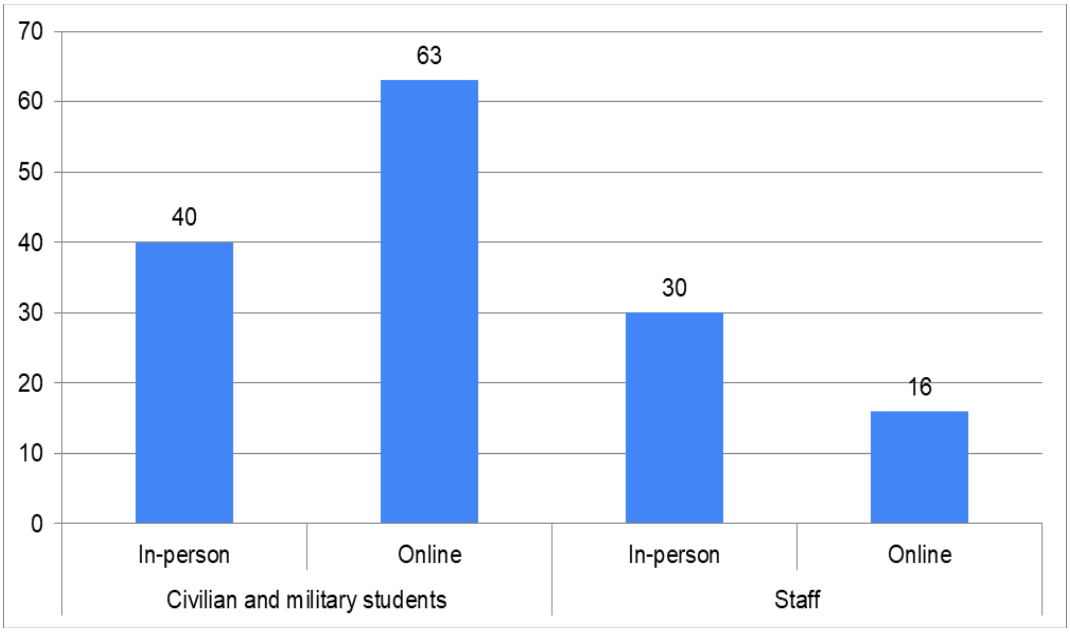

Figure 1. The nature of respondents to the feedback questionnaire
Source: authors' own research; data collected during multiplier event (https://bit.ly/43yLS5x).

Figure 1 shows the nature of respondents, where it can be seen that 70 of them took part in-person (46.98%), while 79 participated online (53.02%). Also, it can be noticed that 103 were civilian and military students (69.12%), while 46 were academic staff (30.88%).

Designing the conceptual model

Considering the highlighted preliminary aspects, and performing logical scheme supported by CTA (What minimum elements should coagulate the qualitative model for educating and training on HW?), it can be concluded that the design of the conceptual model must incorporate three specific elements as: HWRC, TSM, and MOOC capabilities (Figure 2).

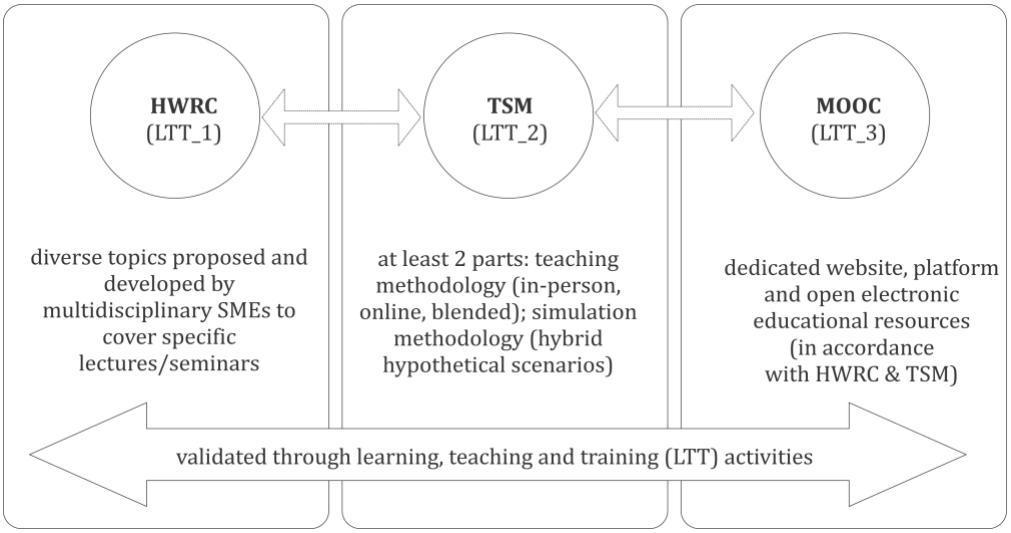

Figure 2. The conceptual model of educating and training on HW

Source: authors' own research.

The innovative character of the proposed model is given not only by the specific of the constituent elements, but especially by their correlation, respectively, by its validation method. Also, the possibility of using AI capabilities is another ingredient that significantly contributes to its innovation. On the other hand, all these design elements are interrelated, the possibility of their use depending to a large extent on the nature of the educational audiences (location, level of education, level of specific knowledge, etc.) and most likely learning objectives. On the other hand, the conceptual model in Figure 2 offers solutions both for physical, online (synchronous or asynchronous), hybrid or blended didactic activities. Regardless of the didactic formula, the simulation of different HW hypothetical scenarios, as well as the timely exploitation of MOOC resources, can facilitate the development of critical knowledge and skills necessary to understand and manage the HW contexts.

Hybrid warfare reference curriculum

The first element of the conceptual model is the HWRC. The design of the HWRC transcends the traditional ways because, accepting the idea that HW is a complex concept involving the use of diverse combinations of tactics and strategies, both conventional and nonconventional, in an effort to gain advantage in conflicts and military operations and the use of various instruments of power to exploit an actor's vulnerabilities across the full spectrum of society's functions and achieving synergistic, lasting and powerful effects through their interaction (MCDC, 2017), it becomes an extremely complex phenomenon that involves actors, strategies, ways and means from different fields.

For this reason, and considering the principle that HW involves a comprehensive, multidimensional approach to all the power tools that an entity or civil and military capabilities have at their disposal, and it focuses on wide variety of objectives (Rațiu & Tudorache, 2021), HWRC assumes an extremely diversified topics, which fall at least in the social, political, economic, military, information, and infrastructure spheres. More specifically, they should cover fundamental aspects of the current security environment and the hybrid dimension of current economic, military, and political confrontations, conducted

in all physical and virtual environments and across the entire spectrum of confrontation, such as: the definition of HW, global megatrends, ideologies, and motivations, specific environments, cyber security, dedicated strategies used in HW, or risk analysis.

Moreover, the HWRC should be developed so as to include topics suitable for lecture and seminar activities. These topics, for either lecture or seminars, could be compulsory or elective. If the topics above are suitable for lectures, because are generic in fashion, for seminars the topics should be much more specific and practical and should involve a more intensive interaction between teachers and learners and allow the latter to contribute to a greater degree in customising the content to be learnt, based on their own concerns and interests. Some examples of possible topics for seminar activities could be: role of proxies, weapons of mass destruction (WMD), biosecurity risks, dedicated courses of action (COA), homefront resilience, case studies and so forth. Also, regardless of the diversity of the topics for the lecture and seminar activities, they should be correlated, so that those addressed in the seminars are able to particularise some aspects highlighted during the lectures.

On these considerations, and responding to the requirements of correlating the critical analysis of relevant sources and CTA (What are the HWRC eligible domains?, What topics should be included for lecture and seminar activities?) it can be considered that the answer to the first research question of the study as 'Do education and training in HW require a diverse curriculum to enable a comprehensive approach to it?', is identified.

Teaching simulation methodology

Another critical element of the conceptual model is the TSM. As depicted in Figure 2, this should include at least an extensive methodology for professors and trainers that should cover various ways of teaching (in-person, online, hybrid, blended) as well as another extensive methodology of simulating HW hypothetical scenarios. They can represent two separate manuals, or they can be compressed into a single manual that includes two different sections. In the situation where it is necessary to create a multinational imprint of the methodology, then it is indicated to apply a questionnaire to identify didactic needs from each national partner.

Also, another characteristic of the TSM is to have innovative elements to ensure a better understanding of the HWRC topics. Some didactic methods than could be used are: problem posing/solving, formative assessment, adaptive/collaborative learning, team working, peer evaluation, gamification and serious game, etc. Because gamification enables the use of elements specific to selected video game in non-video game environments and systems to diversify and improve the user experience, increase their performance and make the whole activity more attractive and interactive (Deterding et al., 2011) and serious games are used as innovative ways to facilitate interaction and learning, they should be promoted in particular because it facilitates the operationalization of key concepts and the development of critical skills.

Related to the simulation methodology, it should also include hypothetical scenarios that are facilitated by using integrated and distributed simulation. Some examples of HW scenarios could be special military operations including conventional and unconventional elements, threat of damp overflow with HW elements, leakage of hazardous material with HW elements, etc.

Regardless of the methodology, teaching, or simulation, they should include specific case studies, as well as some examples of good practices from how to teach HW topics to

different training audiences, with a different background and different objectives regarding the outcomes of the educational process in which they participate.

All these aspects, and especially the answers to the key questions of CTA (What didactic methods are suitable for teaching/learning the HW?, What could be some examples of simulating specific HW hypothetical scenarios?) contribute to the answer to the second research question.

Massive open online course

As we are concerned about the MOOC, it can be considered an online course open to all interested persons, from any country or geographic region, structured around learning objectives and learning outcomes in a specific area of interest or curriculum area and usually taking place during a longer or shorter but predetermined period of time, on an online dedicated platform that enables interaction between professors and students, provides materials and recommendations for individual study, and provides tools for self-evaluation of the course and for the formal evaluation of the achievement of objectives (European Commission, 2014).

MOOCs offer advantages such as global accessibility, flexibility and the opportunity to learn from experts in the field of HW. However, for MOOCs to be effective, it is important to support and facilitate interaction and feedback between participants to ensure a complete and satisfying learning experience and can be used in several directions such as continuous learning, supporting university education by providing additional teaching tools, distance education, but also professional training of specialists in different fields.

Based on these aspects and from the discussions conducted during TPM's working groups, it can be inferred that the MOOC should allow teaching in a modern video format, be openly accessible in terms of learning content with courses in a true online format, and make online testing possible. On the other hand, the MOOC design should include: developing dedicated website (administrator and user manuals are required), HW adapted topics, teams, syllabus, dedicated platform (could be Moodle or Canvas), and specific technical support. Moreover, to convert learning objectives, and HWRC/TSM into suitable electronic educational resources, it must be established a template of the platform's content, introductions of the courses, brief short videos, pictures, and bios, etc. In this way, the MOOC will enhance both massive online learning and classes with blended learning methods. Furthermore, according to learning objectives and educational audiences, the MOOC could be used in different ways to support in-person, online self-placed/online in group, hybrid or blended teaching/learning.

Correlating this information with those highlighted in the previous section (teaching simulation methodology), and exploiting the same research methods as critical analysis of relevant sources and CTA (What minimum elements should be included in the MOOC design?, How can MOOC facilities be exploited?), it can be considered that the answer to the research question of 'Does the effectiveness of education and training on HW depend on the development and applicability of suitable interdisciplinary TSM and innovative MOOC capabilities?' is also identified.

Requirements for validation and implementation

For feasibility purposes, the elements of the model should be validated through LTT activities carried out during specific TPMs. As can be seen in logical scheme (Figure 2), there are two variants of validating model's elements:

- Using one LTT for each model's element – in this variant it is possible to focus much better on obtaining realistic feedback on the piloted element; it is more time-consuming;
- Using two LTTs for all three model's elements – in this variant, the HWRC and the teaching methodology should be piloted using one LTT, while the simulation methodology and the MOOC should be piloted using another LTT; it allows for much faster validation, but may present some limitations on some of the piloted elements.

Also, the model's elements should be permanently promoted in the form of scientific papers, but also through multiplier events that should aim to generate debates and have the inputs of stakeholders. Last, but not least, this conceptual model could be implemented as a compulsory or elective course (Hybrid Warfare) in the postgraduate, master or bachelor's suitable university programs.

Feedback on designed conceptual model

In order to gain initial feedback, the described model (Figure 2) was presented during the multiplier event carried out on 9th May 2023 at the "Nicolae Bălcescu" Land Forces Academy.

Using statistical grouping, the feedback for the educational opportunity that could be triggered by implementing the model, as well as for its specific design elements is portrayed in Figure 3.

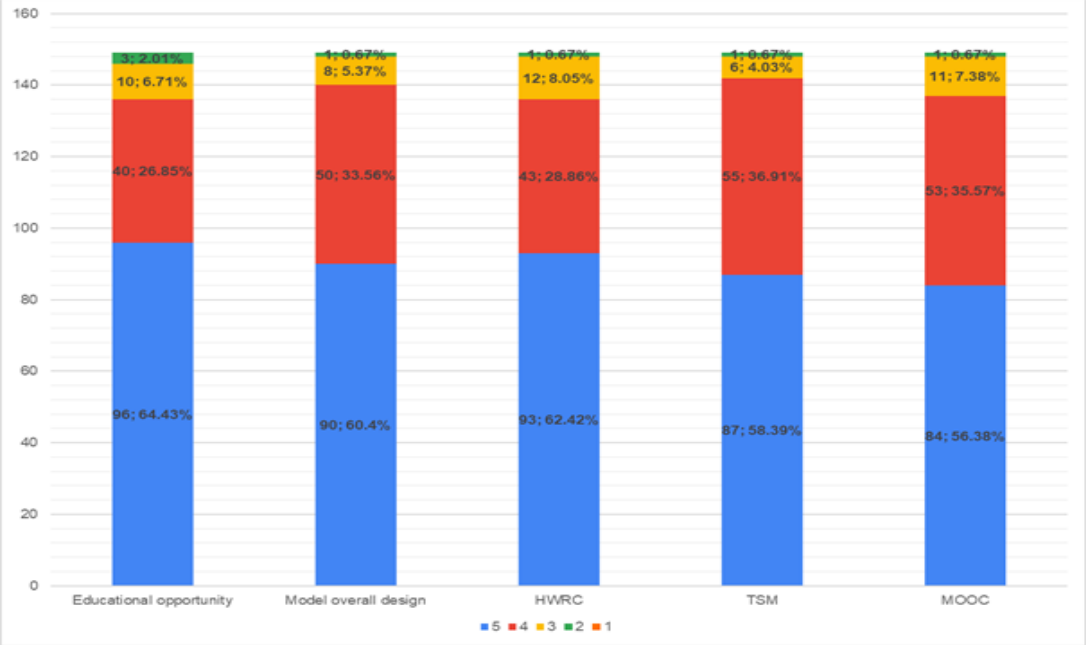

Figure 3. The feedback for designed conceptual model and current educational needs

Source: authors' own research; data collected during multiplier event (https://bit.ly/43yLS5x).

To measure the feedback of the respondents, a scale from 1 (lowest feedback) to 5 (highest feedback) was used. Analysing the graph above, it can be seen that the proposed model was received with great interest by both students and academic staff. This can be justified especially by the fact that the ongoing conflict in Ukraine has generated enormous interest, and, implicitly, the educational audiences have become strongly interested in teaching and learning on HW.

Also, the positive feedback of the conceptual model is supported by the respondents' scores for their perceptions regarding the educational initiative of HW. The correlation analysis generates a value of 0.496 which suggests a moderately positive relationship. This means that the conceptual model might be improved by increasing the interest of audiences in education and training in the field of HW.

Although positive feedback was obtained at the level of each design element, the comparative analysis highlighting the lower values registered for the MOOC. This finding can be based on the idea that the MOOC represents a new pedagogical methodology that has not been used by the surveyed audiences. Also, another interpretation of this result can be justified by the possibility that the respondents could have associated the MOOC with online teaching/learning, which, at the level of military educational audiences, also generated some negative effects for educating and developing critical skills.

Regarding the detailed analysis of the HWRC, Figure 4 highlights the audience's interest in the topics specific to the compulsory lectures.

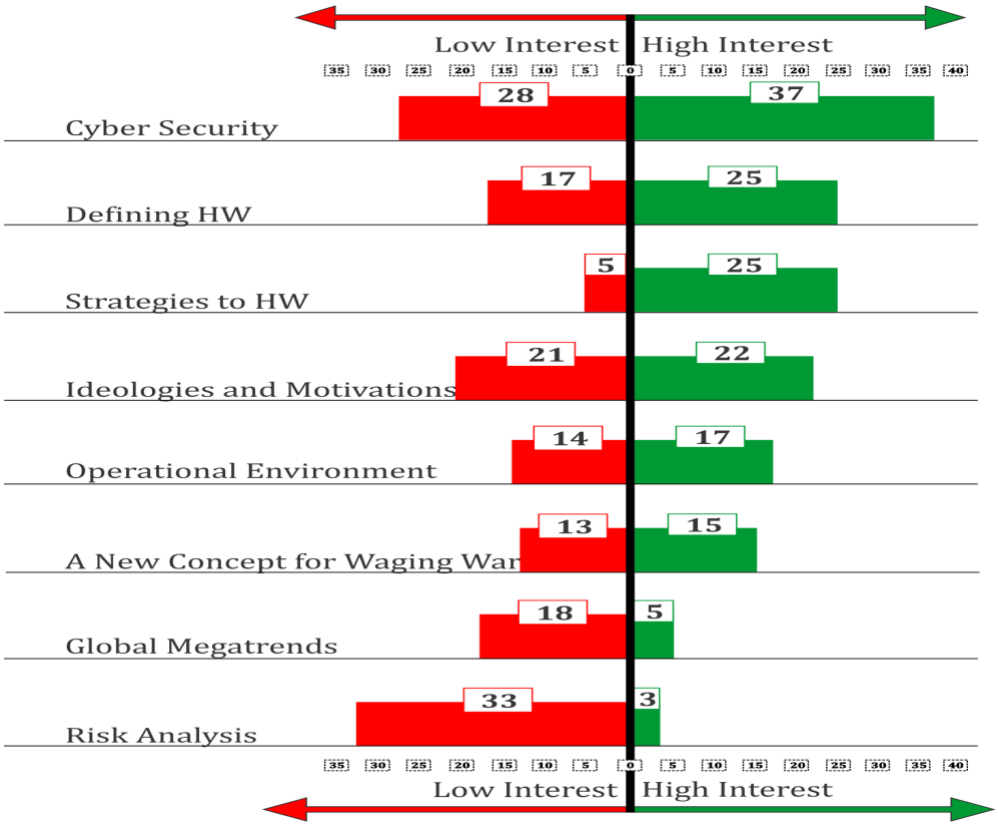

Figure 4. The audience's interest in the topics for compulsory lectures
Source: authors' own research; data collected during multiplier event (https://bit.ly/43yLS5x).

Considering the correlation of positive and negative scores (high interest, low interest), it can be concluded that the topics with the greatest interest are related to defining HW and strategies for countering the HW. At the opposite side are risk analysis and global megatrends, because, probably, the audiences want to first clarify the fundamental aspects of HW and then go on to a wider approach.

Interesting and puzzling is the score obtained by the cyber security topic, which the respondents consider the most interesting but at the same time one of the least interesting topics specific to the compulsory lectures. And this result can be justified by the fact that most of the respondents were military students who felt the difficulty of the cyber security discipline during the international semester, due to the complexity of the field and its implications on the activities carried out. The same imprint could be also identified regarding the topics dedicated to the elective seminars (Figure 5).

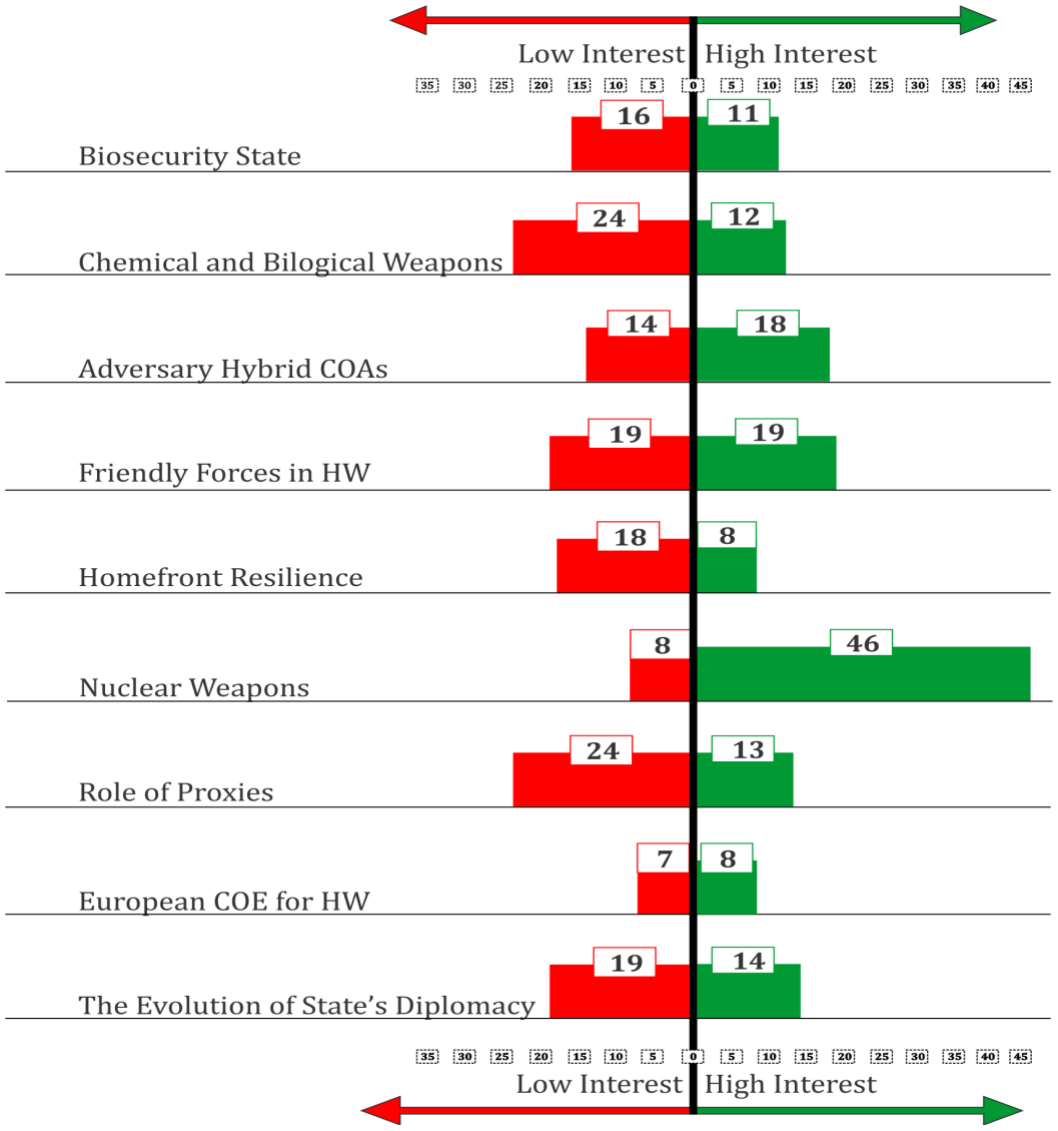

Figure 5. The audience's interest in the topics for elective seminars

Source: authors' own research; data collected during multiplier event (https://bit.ly/43yLS5x).

It can be seen the detached scores in favor of the topic of nuclear weapons while on the opposite are topics related to chemical and biological weapons, respectively role of proxies. And here can be identified a situation that, at least at first glance, seems paradoxical. Although nuclear and chemical and biological weapons fall into the same category (WMD), it can be noticed that the preference for dedicated topics is in the antithesis because the first one is selected as the most interesting, different from chemical and biological weapons which is the least interesting. The explanation can again be derived from the context of the conflict in Ukraine, where information is aggressively circulated regarding the nuclear capabilities of various states, as well as the strategies regarding their use. On the other hand, the results obtained for these topics could have been influenced by the effects of social opportunity. These effects exist when the respondents give a culturally acceptable answer rather than describe what they really think about the topic.

A last aspect related to the feedback analysis is transposed on the degree of preference regarding the pedagogical methodologies, this being highlighted in Figure 6.

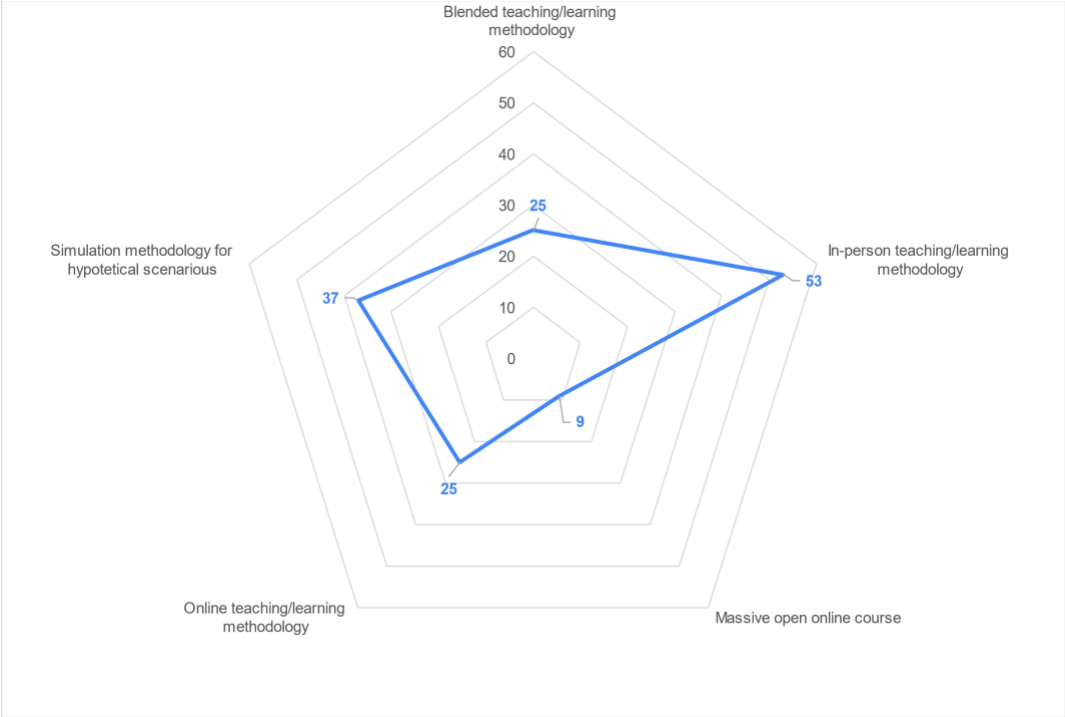

Figure 6. The audience's preference on teaching/learning methodologies
Source: authors' own research; data collected during multiplier event (https://bit.ly/43yLS5x).

Although the online teaching/learning methods have proven their usefulness during the Covid-19 pandemic, the surveyed audience remains dependent on in-person and simulation methodologies because it offers the most complex teaching experience, it allows for more intensive interaction and exchange of information and ideas in real time, maybe due to the fact that the majority of the surveyed educational audience was given by students and academic staff from the military academic environment. Instead, as it has been previously highlighted, the MOOC methodology remains a solution that must be applied more intensively to prove its validity and usefulness. Moreover, MOOC can be a useful tool in disseminating information about the characteristics of HW, its forms of manifestation,

and the ways of countering it to as large a number of interested persons as possible, with different professional experience and diverse interests, who can study at their own place from the privacy of one's own home to develop certain knowledge and respond to various curiosities. Thus, a well-made MOOC, tested and validated under real conditions, which enjoys support and assistance for a long period of time, will contribute to the creation and development of a security culture that has at its centre the knowledge and understanding of the concept of HW and which will bring benefits both to academic communities and to society as a whole.

All these results answer to the last research question of the study, consisting in 'What is the initial impact generated by the proposed conceptual model for education and training of HW on the educational audiences?'.

Conclusion

Consequently, considering the argumentative aspects, and especially the positive feedback received during the multiplier event, it can be concluded that the answers to all research questions have been identified. In this regard, critical analysis of relevant resources and CTA, by answering to the first two research questions, have contributed significantly to the design of HWRC, TSM, and MOOC, while the logical scheme and statistical grouping, by answering to the last research question, triggered an initial positive feedback from the surveyed population.

Also, the conceptual model with all descriptive elements is of major importance for current educational requirements. Moreover, it becomes easily understandable that the desideratum of teaching and learning of HW must be supported by a specific design at the level of reference curriculum, teaching methodology, and in terms of online support capabilities. The main characteristics of the elements of the proposed conceptual model consist of the following:

- HWRC – must include an accentuated diversity of topics, considering the complexity of HW; because HW environments are by nature volatile, uncertain, complex and ambiguous (VUCA), it should also include topics related to the ways to reduce the manifestation of these characteristics, such as the use of EDTs, where the AI applications could be used during gamification or simulation of HW hypothetical scenarios for developing and optimising the common operational picture (Tudorache, 2021). On the other hand, the ChatGPT, an extension of AI, has already proven its usefulness not only in supporting decision-making in VUCA contexts, but also regarding the facilitation of didactic activities;
- TSM – to meet the requirements of teaching/learning the HWRC, this assumes the use of an interdisciplinary and transdisciplinary methods that generate visible effects in theoretical and praxiological framework; should be developed by SMEs in the field of pedagogy based on the analysis of feedback questionnaires;
- MOOC – will be used as an educational enabler, no matter the nature of teaching/learning strategy adopted (in person, online, hybrid, or blended); on the other hand, it will boost LTT capabilities, but also to reach a wider audience as possible.

To ensure the quality of the implementation of the proposed qualitative model, each of its products must be piloted through LTT activities, organised in detail, and benefiting from the multinational experience in the military and civil fields of the project members.

Piloting the products with the involvement of military and civilian students represents a unique opportunity to identify the differences in perception and understanding specific to the two environments and will allow the development of quality, flexible, and adaptable final products.

On the other hand, the overall study and its specific results have some limitations, in particular, regarding the number of respondents, which was satisfactory but not extremely representative to draw strong conclusions. Moreover, the military-pronounced nature of the sample and the poor expertise of some civilian respondents could have influenced the results obtained. From this perspective, the study should be strengthened by other researches that address issues similar to education and training in the field of HW.

Acknowledgement

The present study was conducted under the research project "Interdisciplinary Education and Training on Hybrid Warfare" (2021-1-HU01-KA220-HED-000032179), which is financed by ERASMUS+ for the time period of 1st November 2021-31st October 2024.

References

Anton, M. (2016). Hybrid Pedagogies for Hybrid War. *Proceedings of the Scientific Research and Education in the Air Forces: AFASES 2016, 1*, 509-516.

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, *25*(8), 652-661.

Deterding, S., O'Hara, K., Sicart, M., Dixon, D., & Nacke, L. (2011). Gamification: Using Game Design Elements in Non-Gaming Contexts. *Proceedings of CHI' 11 on Human Factors in Computing Systems*, 2425-2428.

European Commission (2014). Report on Web Skills Survey: Support Services to Foster Web Talent in Europe by Encouraging the use of MOOCs Focused on web Talent – First Interim Report. Retrieved from https://silo.tips/download/report-on-web-skills-survey.

Grunwald, T., Clark, D., Fisher, S. S., McLaughlin, L. M., Narayanan, S., & Piepol, D. (2004). Using Cognitive Task Analysis to Facilitate Collaboration in Development of Simulator to Accelerate Surgical Training. *Studies in Health Technology and Informatics*, *98*, 114-120.

Klimova, B. F., & Kacetl, J. (2014). Hybrid learning and its current role in the teaching of foreign languages. *4th World Conference on Educational Technology Researches, WCETR2014*, 477 – 481.

Kopp, M., & Lackner, E., (2014). Do MOOCS need a special instructional design?. *EDULEARN 14 Proceedings*, 7138-7147.

Lan, M., & Hew, F. K. (2020). Examining learning engagement in MOOCs: a self-determination theoretical perspective using mixed method. *International Journal of Educational Technology in Higher Education*, *17*(7), 4-24.

Multinational Capability Development Campaign [MCDC] (2017). *Understanding Hybrid Warfare*. Retrieved from

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/647776/dar_mcdc_hybrid_warfare.pdf.

"Nicolae Bălcescu" Land Forces Academy website (2023). *Multiplier Event Within the Interdisciplinary Education and Training on Hybrid Warfare Project*. Retrieved from https://www.armyacademy.ro/engleza/ev_2023_05_11_1.php

Rao, S. C. (2019). Blended Learning: A new Teaching Methodology. *Journal of Research Scholars and Professional of English Language Teaching (JRSP-ELT)*, *3*(13), 1-6.

Rațiu, A., & Tudorache, P. (2021). Comprehensive Integration of Power Instruments and Civil-Military Capabilities for Countering Hybrid Threats. *Proceedings of the 17th International Scientific Conference Strategies XXI*, *17*(1), 104-109.

Thiele, R. (2020). Artificial Intelligence – A Key Enabler of Hybrid Warfare. Hybrid CoE Working Paper 6. Retrieved from https://www.hybridcoe.fi/wp-content/uploads/2020/07/WP-6_2020_rgb-1.pdf

Tudorache, P. (2021). Applicability of Artificial Intelligence in Decision-Making for Land Forces. *Czech Military Review*, *30*(2), 39-54.

Vassileva, B., & Zwilling, M. (2018). Hybrid Warfare Simulation-Based Learning: Challenges and Opportunities. *Information & Security: An International Journal*, *39*(3), 220-234.

List of abbreviations

AFA	Armed Forces Academy
AI	Artificial Intelligence
BIU	Bar Ilan University
COA	Course of Action
CSNSC	Centre for the Study of New Security Challenges
CTA	Cognitive Task Analysis
EDT	Emerging and Disruptive Technologies
HW	Hybrid Warfare
HWRC	Hybrid Warfare Reference Curriculum
LFA	Land Forces Academy
LTT	Learning, Teaching, Training
MOOC	Massive Open Online Course
SME	Subject Matter Experts
TPM	Transnational Project Meeting
TSM	Teaching and Simulation Methodology
UNITO	University of Turin
UPS	University of Public Services
VUCA	Volatile, Uncertain, Complex, Ambiguous
WMD	Weapons of Mass Destruction