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SIMULATIONS AND THE QUALITY OF MILITARY EDUCATION

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Abstract: *Education is a key activity in the development of society. According to the needs of the development of modern society, education evolves and requires adaptation, improvement and innovation. Key features of modern education are cost and quality. It is imperative to reduce costs and at the same time increase quality. A modern tool, based on information and communication technologies, which enables the increase in the quality of the educational process and the reduction of costs, are simulations. The essence of simulations, in addition to reducing costs, is the acquisition of knowledge and skills, using improvised platforms, with as realistic a picture of reality as possible. In addition to economic elements, simulations require active engagement of all participants in the teaching process, activation of ideas and problem solving. Such an approach leads to constant improvement of the simulations themselves, work methods, knowledge and the entire education process. The paper discusses the application of simulations in the educational process, from the aspect of improving and acquiring new knowledge and determining existing ones. Although still an under-researched area, there is a solid number of works that point to the importance of simulations in the educational process. By analyzing the existing literature, the authors conclude about the degree of development of simulations and their applicability in the educational process, point to the educational capacity of simulations and the need for their development in all areas of social life. Considering the wide range of different views of the authors on simulations, the authors have carefully analyzed the literature, with the aim of proving the applicability and usability of simulations, while respecting the evidence of the existence of shortcomings. In the conclusion, an overview is given of the need for further study of simulations in the function of innovation and improvement of the education process.*

Key words: *simulations, education, knowledge, skills, development*

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1. INTRODUCTION

Education is a process of planned and organized influence on people, which includes the adoption of a certain system of scientific knowledge and the formation of a scientific view of the world, the development of interest and desire for self-education and the development of mental abilities (Teodosic, 1965). That is, education is the process of acquiring knowledge, skills and habits, developing on that basis understandings, beliefs, attitudes and practical actions, as well as certain personality traits (Kolar, 1967). In addition, education and training are one of the key activities of human resources management in the organization (PrZulj, 200). Education makes it possible to change and improve the life of an individual and the social community. Educational needs occupy a significant place in the system of human and social needs, while education and knowledge are the key resources of the future that will determine the nature of human relationships. Educational needs cannot be separated from the development process (Ilic, Janjic, 2019), and the development process from the learning process. In this sense, the whole life is learning, so education has no limitations in duration (Simeunovic, 2000). Information and communication technologies bring new opportunities to the world of knowledge acquisition. Namely, computer technology, robotization, automation, virtualization, data transfer in real time, etc. they made it possible to simplify and present the problems of education in a different way. Simplification implies simplification to an acceptable extent, so that the basic characteristics of the simulated system are not lost in the model.

2. ORIGIN AND DEVELOPMENT OF SIMULATIONS AND SIMULATION MODELS

The development of simulations is directly related to the creation of "simulators", devices, programs, i.e. built systems that perform simulations. Simulators are intended for training people in managing real technical systems (Penzer et al., 2001). The appearance of the first "real" simulators, related to the training of riders, dates back to the Middle Ages and the training of knights in combat. War games, challenging and outwitting opponents, on the battlefield are centuries old. Their effectiveness was particularly evident in the training of the Roman legions. That modeling helped make the Roman army the largest the world had seen for almost 2,000 years (500 BC - 1500 AD). War games, as a type of simulation model, were developed in Europe by the Prussians at the end of the 18th and the beginning of the 19th century. Already in 1824, war games were incorporated into the training of the Prussian army. At the end of the nineteenth century, Major V.R. Livermore introduced modern war games to the US military. In 1883, he translated the German (Prussian) rules on war games, which they made based on the experiences of the American Civil War and the Prussian wars they fought in 1866 and 1870-1871. years.

Simulation models represent a simplified and abstract image of a real system. The model is a representation of the system with all the characteristics perceived by the person simulating the system (ZiZovic & Pamucar, 2019). The simplified image of the model depends on the level of abstraction of the observed system. The basic idea of the simulation model is to imitate a real system. An important element of the simulation is the environment. The environment when simulating a real system must match the goals of the simulation and reality as much as possible.

The simulation allows the participants of the simulation, an interactive relationship with the system based on the steps that need to be taken in order to solve the given problem (Launce, 2004). The simulation environment plays a significant role in the learning process of the simulation participants, because the information obtained is used to improve the characteristics of the simulation, thereby improving knowledge and the learning process.

3. CONCEPT AND CHARACTERISTICS OF SIMULATIONS

Simulation is a way of displaying the behavior of a real system or the way a real process unfolds through experimentation on a model that is made to represent a real system or situation, including those aspects of reality (elements and connections between them) that are of interest for study (Jurisic, 2021). Simulation is, therefore, a state in which we represent something with the help of something else, that is, in which we pretend that something is as if it were something else (Afric, 1999). That is, simulation is "the operation of the model as a function of time (i.e. starting the model to work and monitoring the behavior of the model by recording the values of the selected quantities) (Jankovic & Nikolic, 2019)." There are several basic types of simulations:

- constructive simulation,
- virtual simulation i
- live "vivo" simulation.

Constructive simulation represents scientific-research simulation as a method of operational research. In this type of simulation, the executors have simulated the activities and assets and the environment, so that there is no impact on the output results of the simulation when it is started. This type of simulation is suitable for analyzing certain concepts, predicting certain results, practicing working under stress, making certain measurements, generating statistical indicators and performing analyses (Pamucar et al., 2016).

Virtual simulation implies the use of virtual means to perform certain activities, and it is easiest to demonstrate this through various simulators, e.g. fire fighting, driving, etc. In these simulations, the human is in the focus and in these types of simulations, motor skills (skills such as piloting a plane, steering a ship), decision-making abilities in certain conditions, as well as the ability to communicate and coordinate with the environment are practiced.

Live simulation implies the use of means and people that are real, but the effects are simulated (simulating actions in the case of a chemical accident, a traffic accident, etc.). These are essentially training activities of various services, such as the army, police, firefighters, on dedicated ranges where real equipment is used, in an approximate environment in which they operate and the activities are almost identical to those in reality.

4. ADVANTAGES AND DISADVANTAGES OF APPLYING SIMULATIONS

The question arises of the applicability of simulations to different areas of social life. Most researchers and authors in this field agree that there is no limit. If it is profitable and contributes to the improvement of the characteristics of the organization, simulations can be applied (Milosevic et al., 2021). A particularly significant application of simulations is in the case of phenomena (events, situations) whose way of creation, development and effects cannot be shown realistically (eg, natural disasters, experiments that can endanger life, etc.). Therefore, the application of simulations has its positive and negative characteristics.

The positive aspects of simulation are: reduction of organizational costs, reduction of safety risks for training participants, the possibility of a greater number of repetitions of certain actions (parts of the studied area), the possibility of adjustment and adaptation of conditions as close as possible to real ones.

Cost reduction refers to: impact on people (life and health, level of acquired knowledge), impact on material resources, impact on the environment, impact on the organization and impact on social conditions (Pamucar & BoZanic, 2019). Bearing in mind the above-mentioned impacts, simulations can significantly contribute to reducing costs through:

increasing the level of safety of people in training, increasing the level of acquired knowledge, motivating people, spending less material resources, improving the organization through noticing mistakes and learning through simulations, developing awareness in the social community or organization.

Reducing security risks refers to the application of simulations in high-risk professions (construction, mining, military, police, traffic, etc.). Simulations aim to generate or improve knowledge, in conditions that do not affect the life and health of people and the environment.

Simulations as a didactic tool have certain disadvantages. According to Heineke and Meile (Heineke, Meile, 2000) some of them are:

- the "game" scenario is a model of reality, which means that it was created as a simplified,

- decisions in the simulation are made without responsibility, the outcomes of the simulation do not affect the condition of the participants or other people in the real world (e.g. financially),

- the game describes only some selected aspects and concepts from reality, so that education is limited only to parts of knowledge or skills that are taken into account in the game scenario,

- participants can understand the simulation as a game and entertainment rather than education,

- due to the lack of responsibility for decisions and the perception of simulation as entertainment, the behavior of game participants may differ significantly from their behavior in real life.

Bearing in mind the mentioned shortcomings, the teacher has a significant role in the educational process. Just as learning itself and students have faced great changes, it is inevitable that teachers, college professors and lecturers will face them during their approach to work (Holmes, Gardner, 2006). Lecturers are no longer required to use only a textbook, but also a regular evaluation of their resources: searching, evaluating, planning, implementing and managing them in order to provide the best learning outcomes. Learning based on simulations allows both parties, the lecturer and the student, to enrich their teaching and learning experiences through a virtual environment that supports not only the transfer of knowledge, but also research and its application (Komazec et al., 2014).

5. IMPLEMENTATION OF SIMULATIONS IN THE EDUCATION PROCESS

The essence of simulations is learning. Regardless of whether it is a dedicated simulation for learning a specific subject, or simulating the environment for any reason, at the end of the process, information and results are obtained as a result of learning, which serve to make decisions and increase knowledge. The rapid development of information technologies led to the development of software simulations and their use in teaching in order to improve the traditional, ex-cathedra, way of education and adapt it to modern requirements and trends (Plecic, 2017).

Various studies have shown that simulations improve learning outcomes by connecting abstract concepts to concrete experience and enabling participants to gain a better understanding using active learning and problem solving (Hunzeker, Harkness, 2014). Since simulations represent real-life situations, they have choices and limitations that reflect real problems (Prensky, 2001), and in many situations it has been shown that carefully designed and tested simulations can be extremely powerful educational tools (Finkelstein et al., 2005).

Simulations represent one of the most effective ways of learning higher order skills: analysis, synthesis and creation of new knowledge (Leger et al., 2011).

Based on the existing literature on business simulations and games, they are used to study many disciplines/sciences (Andreu, Garcia, 2014): engineering, military sciences, administration and political sciences, economics, business, marketing, international relations, management , foreign languages, medicine, chemistry, mathematics, physics, social and emotional learning, and even in teaching ethics (Buck, 2013). Their contribution to experiential learning and creating empathy for real life situations is a vital component of entrepreneurial education (Akerman, 2011).

6. SIMULATIONS IN THE PROCESS OF HIGHER EDUCATION

Simulations have been applied in the process of higher education for the last decades. Significant application is achieved through the development of computers and information technology (Kundra & Sureka, 2016). The peak is achieved with the introduction of the Internet and information and communication technologies (BoZanic et al., 2016). The basic characteristics of simulations in the higher education process are (Kincaid & Westerlund, 2009):

- applicability for all categories of persons who learn to emphasize knowledge;

- help to analyze and perceive the complexity of phenomena and relationships in the environment;

- enable the study of mathematics, science and technical skills in an applied, integrated way;

- provide realistic training and acquisition of skills in various fields, especially in science and industry;

- reduced cost price i

- security risks for the participants are reduced, ie excluded.

Simulations, in addition to the basic postulates in education, also generate additional values (Zhang &Liu, 2018). The applicability of the findings that arise in research processes is especially emphasized (Gilbet &Troitysch, 2005).

Abstract learning quantitative skills is less effective than learning them in the natural context of decision-making. It is known that simulations can influence the improvement of students' quantitative and financial skills (Vos & Brennan, 2012). They find use value not only in university teaching, but also for training human resources in companies. Simulations increase motivation to learn and encourage explicit and implicit knowledge through visualization of the problem at hand. The activities of the participants are interpreted into action in the very structure of the simulation, which, like an operating system, leads to the fact that complex cause-and-effect relationships between goals, resources, results and consequences of actions, i.e. decision-making, can be seen more clearly. Therefore, the simulation method requires competence in introduction and coordination in future education that encourages independent and creative learning. But what is common to all who use simulations or similar learning methods is the desire to face the challenges of the future in the best possible way (Schwagele et al., 2014).

7. SIMULATIONS IN PRACTICAL TEACHING

A special type of teaching is practical teaching, i.e. acquiring skills. Depending on the activity in which the practical teaching is carried out, this type of teaching can be simple (eg cooking) to very complex (eg military training, pilot training, car driver training, etc.). Simplicity or

complexity implies different criteria: number of classes, presence of danger, number of participants, number of repetitions, complexity of the environment, etc. The very fact that it is a practical lesson indicates that in addition to people, the means on which people are trained and qualified (plane, ship, etc.) and facilities (spaces) where the means are used (airport, port, part of the city, etc.)). With simulations, a large part of the influence of assets and objects (spaces) is excluded or reduced, which implies a smaller impact on people and assets, objects (spaces).

The introduction of simulations oriented towards the aspect of acquiring skills is not something new. Simulation oriented towards the conceptualization of the competence model (Karl, 2012) (capabilities) is a model developed for the training of civil engineering students and professionals, but with the intention of inspiring other fields as a transferable and universally applicable method. Competency methods are: competency testing (at the end of the simulation), self-assessment (online self-assessment at any time) and third-party assessment (by the instructor during the simulation) (Geuting, 2000). In this way, reliable measurements of the effectiveness of the acquisition of skills/competencies can be obtained, which would not be possible to do on the basis of subjective evaluation or self-assessment. In addition, this multi-faceted measurement method reduces the risk of misjudgment for the entire group.

8. SIMULATIONS FOR RESEARCH PURPOSES

Research is a special form of learning, which confirms existing knowledge and generates new knowledge (new knowledge can also be a refutation of existing knowledge). A large number of persons or individuals participate in the research process, depending on the complexity of the research subject. It is very difficult to create a real system in a simulated environment. Learning through simulation in research processes gives precisely the possibility of improving knowledge through attempts, i.e. adjusting the simulation based on the conclusions from the previous iteration. Namely, research is the foundation of scientific knowledge. The task of science is to expand and consolidate acquired knowledge about the world (environment), to provide ever more complete explanations of phenomena and thus help in solving the cognitive and practical problems that people face (Popadic et al., 2018). There are different ways of arriving at the truth, but scientific truth is arrived at exclusively through the application of scientific methods. The scientific method enables science to persevere in its intention to find out the truth in a manner applicable to every occasion, place and time, adapted to that place, occasion and time. The scientific method, in such a way, enables the survival of science. The seriousness of scientific research, therefore, is obvious as well as the need to make the conditions for research as realistic as possible. There are a large number of cases when it is not possible to conduct real research, in which case simulations are used. Although, by their meaning, they refer to the imitation of a real system, simulations intended for scientific research must apply the scientific method. Considering this fact, building a simulation of a real system in the initial period can have many disadvantages, scientists have an obligation to carefully build simulations based on scientific methods.

Simulation is a powerful and important tool for researchers, because it provides the possibility to evaluate projects, plans and/or policies without experimenting on a real system, which can be extremely expensive, time-consuming or simply impractical. It provides answers to possible questions about the system, and thus the costs of field tests, prototypes, etc. are reduced (Budimir, 2013). All of these possibilities to explore possible scenarios and test hypotheses make simulations an important tool in science education.

9. CONCLUSION

The future of education lies in the application of simulations. From the analysis of works in this field, it can be concluded that the authors agree that simulations have a large number of advantages and very few disadvantages. The fact is that they are an interactive educational tool whose motivating environment creates a great similarity with the real environment. The application of modern information technologies, in addition to the impact on business, also reflected on education, which took on new aspects, methodology and ways of generating knowledge. In education, it has long been accepted that participants should be encouraged to actively engage in the teaching process, and thus simulations are a technique of active learning. The use of simulations implies a simulated environment in which decisions are made at the level of specific periods. Simulations influence participants to engage more than classical methods such as reading or following lectures. They provide a more realistic environment and create connections between participants in which they experiment with different roles.

The field of application of simulations in education has a tradition, but will gain importance in the future. Future research should focus on the interaction of humans, machine learning and the environment. The symbiosis of these three factors gives quality in bringing the simulations closer to the real environment. It is of particular importance for simulating systems with an increased risk for the safety of simulation participants.

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