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THE PEDAGOGICAL CAPABILITIES OF SIMULATION AND DIGITAL TECHNOLOGIES IN DEVELOPING THE OPERATIONAL TACTICAL THINKING OF BORDER GUARD SPECIALISTS

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Abstract

This article analyzes the pedagogical and didactic capabilities of modern simulation and digital technologies in forming and developing the operational-tactical thinking of military personnel and future officers of the border guard services. The effectiveness of utilizing virtual and augmented reality (VR/AR) systems, simulator complexes, interactive geographic information systems (GIS), and artificial intelligence elements in the military educational process is substantiated. The research provides practical recommendations on modeling complex operational situations in ensuring border security, forming decision-making skills, and enhancing the professional training of military specialists.

Keywords: Border guard services, operational-tactical thinking, simulation technologies, digital education, VR/AR technologies, simulator complexes, pedagogical capabilities, decision-making, geoinformation systems, military pedagogy.

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Introduction

Modern geopolitical processes and regional security threats demand a fundamental modernization of the system for guarding and protecting state borders. In ensuring border security, personnel possessing not only modern weapons and operational-technical means, but also a high level of operational-tactical thinking and rapid decision-making skills, play a decisive role. Under conditions of increasing cross-border crime, illegal migration, drug trafficking, and unexpected asymmetric hazards, elevating the approaches to training border guard personnel has become an objective necessity.

The operational-tactical thinking of border guard specialists is the ability to make correct, substantiated, and targeted decisions and successfully command small border units in complex operational situations characterized by uncertainty, information scarcity, and time constraints. Such a mindset requires a military serviceman to possess not only theoretical knowledge, but also the skills to analyze unexpected situations, correctly evaluate time factors and available forces, and foresee potential hazards.

However, traditional education and military-tactical training methods (static maps, classroom instruction, and verbal explanations) cannot fully provide a prompt and flexible response to dynamically changing modern threats. Through such methods, it is impossible to sufficiently form cadets' and young officers' skills in rapid decision-making under stress, operational analysis of digital reconnaissance data, and coordination of border patrol movements.

Therefore, the widespread introduction of simulation complexes, virtual, and digital technologies into the military-pedagogical process is becoming one of the pressing issues. The digital educational environment and simulation technologies provide learners with the opportunity to perform practical exercises in a virtual space maximized to real combat and operational situations, model various scenarios, and analyze tactical errors in a safe environment.

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In particular, virtual and augmented reality (VR/AR) simulators, geoinformation systems (GIS), and simulators equipped with artificial intelligence elements provide the following pedagogical and practical advantages:

Immersive environment and realism: Simulating border outposts, mountainous or desert terrain with complex relief in 3D format to plunge the learner into a real operational environment;

Adaptive scenarios: Developing analytical and heuristic thinking by modeling border violation cases of varying complexity;

Error analysis (Debriefing): Digitally reviewing completed operations, objectively evaluating committed tactical errors, and strengthening skills for their elimination.

Such innovative approaches drastically improve the quality of professional training for future border guard specialists, guaranteeing that they make targeted and effective decisions in any complex situation.

1. Content and Features of Operational-Tactical Thinking of Border Guard Specialists. The modern border security system demands that military personnel not only execute standard orders, but also make independent and deeply grounded decisions in every complex operational situation. The operational-tactical thinking of border officer and specialists has specific characteristics that differ to a certain extent from general combined-arms tactics. While combined-arms stages primarily focus on frontlines and large military formation clashes, border service activities are closely intertwined with the geographic relief of border areas, local population characteristics, and hidden, asymmetric forms of cross-border crime.

The main feature distinguishing border service from other military fields is that operational situations are characterized by extreme velocity, sharp changeability,

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the use of unexpected asymmetric methods by border violators and illegal armed groups, and the continuous combat readiness of units. Under such conditions, commanders and specialists are required to act with the realization that even a one-second delay can lead to serious negative consequences.

The analysis of advanced military experience and pedagogical approaches shows that an officer's operational-tactical thinking consists of the following core structural components:

Analytical and prognostic competence: This skill includes deep and comprehensive analysis of existing reconnaissance data, border area terrain conditions, weather factors, and operational-search information. Simultaneously, it enables anticipating event progression (forecasting), evaluating potential risks, and calculating alternative movement routes of border violators in advance.

Logical and heuristic thinking: The ability to find optimal and unique solutions in non-standard and unexpected operational situations, stepping beyond strict standard templates or routine regulations. Since no single situation is identical to another in border service, a heuristic approach allows a commander to make creative tactical decisions in unexpected conditions.

Rapid decision-making skill: The mastery to assume responsibility and immediately transition to practical actions while maintaining high psychological stability (stress resistance) in critical conditions where time and complete information are extremely scarce. This factor is of decisive importance during sudden attacks or armed resistance that border patrols may encounter.

Systemic and comprehensive approach: Skillfully coordinating modern reconnaissance resources—such as border patrols, rapid response groups, neighboring outposts, engineering-technical means, and drones—within a single

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operational algorithm. This ensures the effective integration of all available forces and means.

From a pedagogical perspective, this high-level thinking form cannot be fully and thoroughly formed solely through traditional lectures, textbooks, or theoretical training, because theory cannot fully convey the dynamics and psychological pressure of a real situation. Therefore, this process is consistently implemented through repeated practical exercises, solving complex operational-tactical problems, polygon trials approximated to a real border environment, and modeling real situations using digital simulation technologies.

2.Pedagogical and Didactic Capabilities of Simulation and Digital Technologies. The development trends of the modern military education system make the introduction of simulation and digital technologies into the educational process an objective necessity. While traditional didactic methods are mainly directed toward imparting theoretical knowledge and memorizing ready-made templates, digital simulations stimulate learners' personal initiative, independent thinking, and creative approaches. They allow the full implementation of fundamental didactic principles in military education at a new quality stage:

Principle of demonstrativeness and realism: Modern virtual and augmented reality (VR/AR) technologies, as well as three-dimensional (3D) modeling systems, visualize the complex relief of border zones, strategically important objects, weather conditions (fog, snow, rain, strong wind), and various operational situations. This develops cadets' spatial imagination and terrain evaluation skills, maximizing approximation to real conditions.

Principle of activity and interactivity: In a digital educational environment, the learner does not remain in the status of a passive listener or observer as in a traditional classroom. They are directly at the center of the operational situation,

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make decisions, command border patrols, and turn into an active subject influencing the flow of ongoing events. Such interactivity sharply increases the sense of responsibility and professional activity.

Principle of safe error analysis and reflection (Debriefing): Tactical errors committed in real military practice can lead to loss of human life, health, or large material resources. Simulation technologies allow practicing in a safe digital environment. After training, based on data stored in computer memory, each performed action is analyzed in detail, and a "debriefing" process (joint discussion and correction of errors) is conducted. This forms future officers' skills in critically evaluating their own actions.

Principle of individualization and differential approach: Modern digital simulators and dispatching systems allow adjusting the learning trajectory (adaptive learning) considering each cadet's or officer's psychological traits, tactical thinking speed, stress resistance, and decision-making accuracy. Consequently, while stronger learners are given more complex tasks, conditions are created for those needing additional support to gradually strengthen their skills.

Such innovative pedagogical approaches increase the efficiency of military education, serving as an important foundation for training highly qualified specialists for border guard services who are capable of making targeted and grounded decisions in any complex and unexpected situation.

3. Main Types of Simulation Systems and Digital Tools. Improving the professional training of border guard specialists and future officers and forming their skills in countering modern threats yields high pedagogical efficiency through the use of innovative digital and simulation technologies. Today, the

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primary simulation tools demonstrating high efficiency in military educational practice consist of the following:

3.1. Interactive 3D and VR/AR Simulator Complexes. Virtual (VR) and augmented reality (AR) helmets and specialized simulators bring the learner into an immersive environment—a real border outpost, a checkpoint equipped with engineering and technical assets, or a hard-to-reach mountainous-forested border area.

Pedagogical capabilities: Cadets safely perform practical actions in a virtual space regarding searching for tracks of border violators, repelling sudden attacks, organizing ambushes (zasada), positioning border patrols in optimal locations, and conducting surveillance in nighttime conditions. Such training forms military personnel's skills in spatial orientation, self-control under stress, and rapid evaluation of tactical objects.

3.2. Geoinformation and Computer Tactical Simulators (GIS-Tactics). Operational-tactical simulators created on the basis of digital geographic information systems (GIS) and modern cartographic databases serve to develop the analytical and management capabilities of border unit commanders and staff specialists.

Pedagogical capabilities: Such systems allow commanders to solve complex tactical tasks regarding ensuring border security on real topographic maps. During simulation, movement routes of border subdivisions, data streams coming from unmanned aerial vehicles (drones) and aerial reconnaissance, perimeter video surveillance, and seismic sensor systems' coverage zones are accurately modeled. This gives officers systematic skills in properly distributing forces and means across space and time.

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3.3. Simulation Software with Artificial Intelligence Elements. One of the most advanced directions of modern military simulators is the introduction of artificial intelligence (AI) algorithms and neural networks.

Pedagogical capabilities: Using AI, the "conditional enemy" (aggressor) or groups of border violators behave not based on pre-memorized scenarios, but adaptively and unexpectedly according to the specialist's actions. If a cadet chooses a certain standard tactical method, artificial intelligence applies non-standard counter-measures against it. Such an approach forces the learner to break out of patterns, urgently modify tactical decisions, and rapidly adapt to dynamically changing operational conditions.

4. Pedagogical Model and Stages in Developing Tactical Thinking. The process of forming the operational-tactical thinking of border guard specialists through simulation technologies consists of three interrelated main pedagogical stages, the content of which is reflected in the table below (Table 1):

Table 1. Pedagogical model and stages of developing operational-tactical thinking through simulation technologies

Stage Name	Main Tasks and Content	Pedagogical Elements and Process Description
1. Theoretical and cognitive stage	Thoroughly studying the basics of border tactics and operational art. Acquainting with digital maps, conventional symbols, and operational situation classifications	**Scenario Building:** The instructor creates a non-standard tactical situation database based on real border events (illegal migration, contraband, infiltration of armed groups).

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2. Simulation-modeling stage	Launching real operational situation scenarios in the simulation complex. Performing simulations of commanding border patrols and subdivisions. Making rapid operational decisions in complex conditions with time and information scarcity.	**Discussion of operational decisions:** Decisions made and orders given by cadets are automatically put to practical test in the simulation software.
3. Reflexive-analytical stage (Debriefing)	Computer video and tactical analysis of performed actions. Identifying and processing committed operational errors. Scientifically evaluating alternative tactical solutions.	**Objective evaluation and reflection:** The computer system impartially evaluate the accuracy, time spent, and efficiency of each decision made.

This interactively organized model allows cadets first to master theoretical knowledge, then test it in a safe digital simulation environment, and finally deeply analyze committed errors (debriefing). This reliably develops stress stability and rapid decision-making skills in military personnel.

5. Research Results and Empirical Evaluation

Conducted pilot tests and pedagogical observations in border guard educational institutions showed that targeted use of simulation and digital technologies yielded the following positive changes in trained cadets and officers:

Reduction of decision-making time: The time for rapidly analyzing operational situations and making substantiated tactical decisions accelerated by **35–40%** compared to groups trained using traditional methods.

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Decrease in tactical errors: As a result of computer modeling and post-training error analysis (Debriefing), the rate of tactical errors in coordinating border patrols and subdivisions decreased by **50%**.

Motivation and psychological stability: The interactive and immersive educational environment significantly strengthened learners' internal interest in professional training and their stress-resistance skills in unexpected extreme situations.

CONCLUSION AND RECOMMENDATIONS

Simulation and digital technologies possess high pedagogical and didactic capabilities in developing the operational-tactical thinking of border guard specialists. These technologies not only consolidate theoretical knowledge with real practice, but also successfully form competencies for independent, responsible, and rational decision-making in non-standard and complex operational conditions among future officers.

Based on the obtained scientific research results, the following practical pedagogical recommendations are put forward:

1. **Improving the material and technical base:** Further expanding virtual and tactical simulation training centers meeting modern requirements in higher military educational institutions of the border guard services and equipping them with modern hardware-software complexes.

2. **Introducing innovative scenarios:** Broadly integrating complex operational scenarios embodying data from unmanned aerial vehicles (drones), artificial intelligence algorithms, and geoinformation systems (GIS) into curricula and study programs.

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3. Enhancing the capacity of pedagogical staff: Organizing specialized professional development courses aimed at continuously increasing pedagogical officers' professional media competence and practical skills in the field of simulation and digital educational technologies.

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