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DIGITAL TRANSFORMATION IN HIGHER MILITARY EDUCATION: INTEGRATION OF MODERN SIMULATORS AND INTELLIGENT TECHNOLOGIES

Yusufali Bakhodirovich Safarov
Candidate of Historical Sciences, Associate Professor
Email: yusufali.safarov@mail.ru

Abstract

This article provides a comprehensive analysis of the profound transformation processes within the methodology of higher military education at the present stage, adhering to IMRAD standards. It examines the impact of the evolution of armed conflict, digitalization processes, and the concept of network-centric warfare on the structure and content of military specialist training. The research substantiates the convergence of systematic-activity, competency-based, and contextual approaches, and proposes a complex model for integrating artificial intelligence-driven adaptive simulators and Live, Virtual, and Constructive (LVC) modeling systems into the educational environment of higher military educational institutions.

Keywords: Higher military education, digital transformation, adaptive simulators, LVC modeling, network-centric warfare, competency-based approach, artificial intelligence.

Introduction

The profound geopolitical changes of the 21st century, the emergence of fundamentally novel conventional and non-conventional threats, and rapid technological breakthroughs impose strict requirements on national security systems. As the core element of this system, the Armed Forces rely directly on the professionalism, analytical thinking, and rapid decision-making culture of their officer corps for combat readiness [1].

Modern military conflicts demonstrate a radical transformation in the nature of armed warfare: classical linear fronts are being replaced by network-centric operations, autonomous robotic strike complexes, hybrid warfare methods, and cognitive-information operations. Under such dynamic conditions, retaining traditional educational paradigms in higher military education institutions (HMEIs) negatively

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impacts national defense capabilities, making a fundamental restructuring of military education methodology an objective necessity [2].

Traditionally focused on the reproductive transfer of fixed volumes of knowledge, skills, and competencies, academic training models show severe limitations today. The rapid obsolescence of military-technical information outpaces standard development cycles for curricula. Consequently, a modern officer must not merely accumulate factual knowledge, but rather develop flexible systematic thinking, methodological culture, and the ability to make grounded, non-standard decisions under severe time constraints and high situational uncertainty [3].

The aim of this study is to provide a comprehensive theoretical and methodological analysis of the current state of the higher military education system, identify key pedagogical contradictions, and establish an innovative methodological platform for training next-generation military cadres.

2. METHODOLOGY

The research relies on systematic, comparative-analytical, synergistic, and modeling approaches. The theoretical foundation of modern higher military education methodology integrates several fundamental pedagogical and military-theoretical concepts:

2.1. Adapting the Competency-Based Approach to the Military Sphere

The modernization of state educational standards prioritizes the formation of universal, general professional, and specialized competencies. In military education, a competency is not a mechanical sum of acquired knowledge, but an integrated personality trait manifested in the ability to mobilize internal resources for operational-tactical tasks [4].

An officer's professional competency encompasses:

High psychological resilience and stability against combat stress factors;

Readiness to take calculated risks while strictly adhering to the principle of single-command (edinonachalie);

Personal responsibility for the execution of combat missions and the lives of subordinates.

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2.2. Systematic-Activity Approach and Inter-Service Cooperation

The development of a military service member occurs through active, purposeful professional activity. In HMEIs, this approach requires modeling real service and combat activities within the educational process [5]. Cadets transition from passive recipients to active management subjects capable of coordinating actions across various military branches (motorized infantry, artillery, aviation, electronic warfare).

2.3. Contextual Learning and High-Tech Simulation Environments

Grounded in A.A. Verbitskiy's theory, contextual learning ensures a smooth, dynamic transition from academic activity to professional practice [6]. In military training, this requires a "high-tech context," meaning the training ground must closely mirror the information-control space of a real combat environment.

3. RESULTS

Comparative analysis and theoretical generalizations identified the core differences between traditional and modern high-tech military education methodologies, systematized in Table 1.

Table 1. Comparative analysis of traditional methodological forms versus modern high-tech methodological elements in HMEIs.

Comparison Criteria	Traditional Methodology of HMEIs	Modern Innovative Methodology of HMEIs
Primary Educational Vector	Transmission of ready-made academic knowledge; algorithmic execution of orders.	Development of critical/systemic thinking, creativity, and decision-making under uncertainty.
Nature of Collaboration	Vertical management (instructor–cadet), strict linear discipline, and rigid frameworks.	Networked, team-oriented, horizontal cooperation based on Mission Command principles.
Main Didactic Tools	Printed textbooks, paper maps, static mock-ups, and classical field ranges.	LVC modeling environments (Live, Virtual, Constructive), intelligent adaptive simulators, VR/AR complexes.
Assessment & Control	Discrete exams, written tests, and time-bound traditional physical/tactical norms.	Continuous digital audits based on Big Data analytics; dynamic evaluation of decision-making efficiency.
Personalized Approach	Unified curriculum, rigid time limits applied uniformly to the entire group.	Adaptive learning pathways, dynamic profiling of learners' psychophysiological metrics.

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The research indicates that the network-centric warfare concept requires junior and mid-grade officers to make autonomous decisions grounded in the Mission Command philosophy [7], necessitating the extensive use of decentralized scenarios in training.

4. DISCUSSION

Evaluating these findings from the perspective of military pedagogy and practical requirements reveals several vital aspects:

1. Transformation of Roles in the Pedagogical Process:

While traditional education positioned the instructor as the sole source of knowledge, the digital and network-centric environment elevates them to a **moderator, mentor, and architectural designer** of the learning space. Cadets evolve from passive objects into active researchers who build situational awareness independently [8].

2. The Role of Artificial Intelligence and Big Data:

Integrating Big Data analytics and AI-driven adaptive simulators into HMEIs enables the hyper-personalization of education. Simulators track not only final outcomes but also real-time psychophysiological parameters (reaction time, stress levels via heart rate, error patterns), automatically adjusting learning pathways [9].

3. Inter-Service Cooperation and Interdisciplinary Integration:

Modern combat operations cannot be resolved within a single military branch. Therefore, implementing interdisciplinary complex projects and joint staff exercises in military universities systematically enhances future officers' multi-service command competencies [10].

5. CONCLUSION AND RECOMMENDATIONS

Conclusions

Modernizing the higher military education system requires a synthesis of traditional military values, contemporary psycho-pedagogical advancements, and cutting-edge digital technologies. The convergence of systematic-activity, competency-based, and contextual approaches provides a robust theoretical foundation for training a highly professional officer corps.

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Recommendations

Based on the study's outcomes, the following practical recommendations are proposed for improving higher military education:

Recommendation 1: Fully integrate a unified distributed simulation network based on Live, Virtual, and Constructive (LVC) modeling technologies into the educational process of HMEIs.

Recommendation 2: Significantly increase the proportion of situational exercises based on the Mission Command methodology within curricula to foster rapid, non-standard decision-making skills under extreme conditions.

Recommendation 3: Implement an adaptive assessment system powered by Big Data analytics to continuously monitor each cadet's psychophysiological and professional performance in real-time.

Recommendation 4: Establish dedicated continuous professional development modules aimed at training HMEI faculty members in digital pedagogy and intelligent simulation management.

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