

## **Technology for a Systems Approach in the Development of Military Education under the Rapid Development and Growth of Armaments and Equipment**

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### **Abstract**

*Research on military education under the rapid development and growth of armaments and equipment is booming. The field is continually gaining more key insights about this important and complex pedagogical problem. Academic interest on the systemic approach in the development of military education has consistently been a multidisciplinary effort. But perhaps systemic approach in pedagogic researchers are particularly well situated to be the leading voices on the public's understanding of military education and many are heeding the call. With that responsibility in mind, in this paper, we offer to consider four elements of the educational process for the future of pedagogic research that we believe can help focus this line of inquiry to better ensure we address some of the most pressing problems. Based on critical assessments of the gaps in the literature, the paper cites the need to combine all elements of the educational process into a single system to achieve a focused result in the training of military personnel in educational institutions. Our list is not exhaustive, nor do we suggest that areas we do not cover are not important. Rather, we make these observations with the goal of spurring a conversation about the future of military education research, but especially a systemic approach in the development of military education.*

**Key-words:** Systems Approach, Military Education, Pedagogical Process, Decision Making, Professional Officer Training.

### **1. Introduction**

The systems approach should be perceived as a summary of most of the complex tasks to the project result, which can be used to improve the quality of the solution of one or more of the main tasks.

System analysis allows us to highlight some particularly important elements for the effective functioning of the pedagogical system. It is quite obvious that in the pedagogical structure the following links of the subsystems come first: "teacher - pupil", then "pupil - content", "pupil - means", "teacher - content", "teacher - means", "pupil - pupil". For example, if we consider in detail the subsystem "teacher - student", with the greatest force appear such factors as: (a) the degree of connection of the student with the teacher (from complete freedom of choice in a rigid determination) (b) interaction of biological (innate) circumstances with social (acquired) influences and properties; (c) communication style of the teacher (authoritarian, collegial, liberal-democratic). All subsystems are dialectically complex interacting. System analysis guides the researcher to study the possible types of interaction of subsystems, to identify the most favorable conditions for the functioning of the entire system.

The holistic approach in pedagogy is seen as a development of the systemic approach. It provides in the study to pay special attention to the pedagogical process as an integral system that has a certain structure, where each element performs its function to solve problems, and the movement of the element is subordinated to the pattern of movement of the whole. It is this approach that points to the inseparability of learning and education, that is, the training and development of the individual is undivided.

## **2. Literature Review**

Famous scientists, the founders of the systems approach as a method of scientific knowledge, are Bertalanffy L. von, Bogdanov A.A., Simon, Drucker P., Chandler A. Their works date back to the 40-50s of the twentieth century.

On the basis of the "general theory of systems" of the Austrian biologist Bertalanffy L. von a line of scientific research is being developed. This allows us to define and explain the essence of the proposed theoretical approach as a direction of scientific cognition [1].

The systemic approach was developed and researched by the classics of science Lomov B., Anayev B., and Anokhin P. According to concept of Lomov B., the main quality of a person is a social system.

Afanasyev B. argues that only the systematic approach allows you to integrate heterogeneous private problems, bring them to a common denominator and thus a complex group of different problems to present as a single problem [3].

The concept of "system" as a new "paradigm" or a new "philosophy of nature" is revealed in Kuhn's writings [2].

According to opinion of Anokhin K., the use of a systematic approach is necessary for the final result to be truly productive. The task of the scientist was to fill the chasm that divides in many sciences the level of the complete and the level of the personal. The researcher notes that it is impossible to fill this gap with words and definitions; effective principles of work in this direction are needed [4].

### **3. Methodology**

First, the authors conducted a literature search, collected abstracts, and applied the original inclusion criteria. Electronic databases were searched January 2021. These were: Web of Science and Google Scholar, as well as the regular library of the national university. The terms used for the search were "systems approach," "pedagogical process," "military education," "decision making," and "professional officer training." Reference lists of included articles were searched to identify additional relevant research.

The systematic review was conducted in accordance with the views of classical pedagogy. The descriptive data analyzed in this paper were drawn from manuscripts that met the standard. Conclusions were presented regarding the teaching-learning process and the assessment of tactical learning outcomes in the training of a future officer. Studies that used tools designed to self-rating students (questionnaires, video tests, pattern recognition, etc.) and interviews were eliminated to prevent real-world assessment results.

The systems approach is an integral part of the teaching-learning process, not an add-on to it. Assessment helps identify the capabilities and weaknesses of participants. This information facilitates adjustments to the teaching-learning process to help students, individually and collectively, improve their performance. It also allows teachers to summarize what they have learned by identifying issues that still need to be addressed [5].

### **4. Result and Discussion**

In a general, a system is an integral complex of related elements, a set of interacting objects, a combination of essences and relationships.

The need to understand the fact that pedagogy is a very complex system consisting of a large number of goals, objectives, principles, forms, and methods will shape the definition of the systemic approach in pedagogy. Influencing the individual for the purpose of upbringing and teaching is impossible without an awareness of the uniqueness of each individual, both psychologically and physiologically. In addition, effective upbringing and education is impossible without understanding that the personality in the process of its formation can change dramatically under the influence of the collective, the media, books, movies and other factors.

For our study, the technology of the system approach in the development of military education in conditions of rapid development, growth of armaments and equipment is the most appropriate.

In our opinion, definition of "system" by Anokhin P. can be considered as the most appropriate. According to the author, a system is a complex of imaginatively involved components, where interaction and relationships take on the nature of component interaction to produce a focal result [5]. This is precisely the definition of "system" that fully satisfies the analysis and synthesis of "artificial systems" in such an area of human activity as the specific educational process of a military educational institution.

Systemic approach entered the national pedagogical science in the late 60's of the XX century.

The system approach in the pedagogical process is a scientific method of cognition of complex-organized objects, through the isolation of a set of key elements constituting this object, the relationship between them and the laws of functioning.

The development of systemic pedagogical research in the educational process of a military educational institution significantly modifies the ways of characterizing individual, separate objects of the system of educational process. They are viewed as elements of certain pedagogical systems, i.e., their properties and existence are put into dependence on other elements of these systems from the very beginning.

Systemic approach means consideration of educational processes from the perspective of the theory of systems. This is the doctrine of complexly organized objects, systems, representing the structure of elements, parts and performing certain functions. The pedagogical system, including goals and content of education, didactic processes and their forms, student and teacher, is such an object. According to the systemic approach, scientific analysis and practical activity should be based on the systematicity principle: analyze, design and improve pedagogical processes, considering the links between all elements of the system, as well as its external relations with society, its institutions. Changing one element leads to changes in others, which is especially important to consider when

innovating, reforming education. It should be emphasized that the key concept of the systems approach is "system".

According to the principle of structural organization of the educational process as a pedagogical system of a military educational institution (complex systems) reflects both the presence of certain rigid (unambiguous, unchangeable) deep connections between the elements, and the essential independence (autonomy of the elements). Only on the basis of an internal "combination" of rigid links and autonomy is a highly selective and purposeful functioning of pedagogical systems in general possible. Revealing the dialectics of the relationship between dependence and independence (autonomy) lies at the heart of the development of cognition of complex pedagogical systems. More precisely, dependence (connection) is not something that can only be or not be. The basic fact is that dependencies have internal gradations in their "intensity," have a greater or lesser "degree of availability," and the disclosure of the dialectics of interrelationships in the real world excludes and relies on an analysis of the interpenetration of limiting (opposite, mutually exclusive) cases, on an analysis of their mutual exclusion and identity

The founder of the theory of functional systems Anokhin P. presented science with a revolutionary view on the application of the systems approach. Usually a "system" is defined as a complex of interacting elements that are united by a certain structure. The meaning of the latter is seen as the laws of connection and functioning of the elements. But what is to be understood by the interaction of elements? After all, this is not new knowledge, but the simplest axiom for any science. In the theory of functional systems, the relation of elements was designated in a different way, which changed the very understanding of "system".

A living system does not arise without limiting the degrees of freedom that order the organization of the elements. The multiple elements of a living system have a huge number of degrees of freedom, but how are they constrained? What determines the formation and realization of the system? The answer is the system-forming factor, and by this we mean the result of the system - the useful adaptive effect in the "organism-environment" relation. The organization of processes in the system is determined by the future, for the sake of which it is formed, i.e. behavior is determined not by the past (stimulus), but by the future (result) - this is very important and changes everything greatly.

Along with the concepts of "system" and "educational system" the terminological component of the system approach includes the following concepts: system (presence of integral properties), component (part of the system), element (the minimum unit of the system), structure (the way of

establishing connections and relations), connection (presence of mutual dependence), system-forming factor (circumstances that maintain the integrity, stability, uniqueness of the system).

One of the components of the systematic approach are principles - the basic provisions and rules of activity on cognition and transformation of systemic objects.

The problem of achieving a systemic approach in the educational process of a military institution requires compliance with the basic principles of the systemic approach in the process of a military educational institution. These are:

*Integrity.* This principle makes it possible to consider the system as a whole and, at the same time, as a subsystem for the higher levels of the educational process of the military educational establishment.

*Hierarchical structure* of the educational process of a military educational institution, i.e., the presence of a multitude (at least two) elements arranged on the basis of subordination of the lower level elements to the higher-level elements of the pedagogical process. The implementation of this principle can be clearly seen on the example of an organization (a higher military educational establishment). As it is known, any organization is an interaction of two subsystems: 1) the one that controls; and 2) the one that is controlled. One is subordinate to the other, especially it stands out in the hierarchical structure of a military organization (subdivision).

*Structurization* makes it possible to analyze the elements of the system and their relationships within a particular organizational structure. As a rule, the process of functioning of the system is caused not so much by the properties of its individual elements, as by the properties of the structure itself.

*Multiplicity* allows the use of multiple cybernetic, economic and mathematical models to describe individual elements and the system of the educational process of a higher military educational institution as a whole.

*Systemicity* is such a property of an object that the object is capable of possessing all the attributes of a system.

In the course of the study, the authors came to the consensus that the process of using the system approach in the educational process of a military educational institution cannot be haphazard. It assumes the following sequence of procedures:

- Fixing of some set of elements by separation from other elements of pedagogical process;
- Determination and classification of connections of the set - external (i.e. connections of the set with the rest of the world) and internal (i.e. connections between elements of the set);

- Definition - based on the analysis of the set of external relations and principles of interaction of the system with the pedagogical environment;
- Identification among the set of internal links of a special type - system-forming, providing, in particular, a certain ordering of the pedagogical system;
- Clarification, in the process of studying the ordering, structure, and organization of the pedagogical system (structure expresses the invariant aspect of the system, while organization expresses the quantitative characteristic and orientation of ordering);
- Analysis of the basic principles of pedagogical system behavior, defined by the system itself as an integral organized set of military training specifics;
- Study of management processes that ensure the stable nature of behavior and achievement of effective military education outcomes by the system.

Authors define the systems approach as a direction of the methodology of socio-scientific knowledge and social practice, based on the study of objects as systems. In discussing the most important principles of the systematic approach in military education, we believe it is necessary to include the following:

- The decision-making process must begin with the establishment of goals and objectives;
- It is necessary to consider the whole problem as a whole, as a unified system and to identify all consequences and interrelations of each particular decision;
- It is necessary to identify and analyze possible alternative ways of achieving goals and objectives;
- Goals and objectives of individual subsystems must not conflict with the goals of the whole system;
- Transition from the abstract to the concrete;
- Unity of analysis and synthesis, logical and historical;
- Identifying different quality relationships in the object in their interaction.

Among the basic principles of military education that make the entire learning process systematic are the following: (a) integrity; (b) structurality; (c) interdependence of the structure and the environment; (d) hierarchy; (e) determination; (f) dynamism; (g) inertia; (h) availability of a controlling parameter; (i) availability of controlling parameter; (j) presence of direct and return ties; (k) the number of descriptions of each system.

Makarenko A. pointed out the impossibility of forming a personality in parts. Therefore, the integrity of the approach is a necessary necessity, as his idea is expressed in the fact that the properties of the whole is not a product of the properties of its elements [6].

The law of hierarchical ordering of systems means that any system consists of other systems and theoretically there can always be found a higher-level system that contains lower-level systems [1]. Hierarchy is the arrangement of parts or elements of a whole in order from highest to lowest.

The laws of hierarchy or hierarchical ordering were among the first laws of systems theory that Bertalanffy von L. singled out and investigated.

Van Geeg characterizes hierarchy by the following characteristics:

1. A system always consists of other systems;
2. For any given system, a system can be found that encompasses it;
3. Of the two given systems, the system encompassing the other is called a higher-level system;
4. The lower-level system, in turn, consists of other systems, and in this respect, it can also be regarded as a higher-level system.

Hierarchy of systems exists due to the fact that lower level systems are components of higher-level systems [7, p. 468].

According to Kariippanon K., developing systems that achieve consistency in terms of structure and outcome, are accountable and equitable, yet are simultaneously able to be flexible and adaptive to respond to local context as schools venture into uncharted waters, is the significant challenge that lies before Departments of Education [8]. The use of patterns of construction, functioning and development of systems helps to clarify the idea of the studied or projected object, allows you to develop recommendations to improve organizational systems, system analysis techniques.

Furthermore, the regularities of the pedagogical process according to the system of the educational process of a higher military educational institution are:

1. Regularity of the dynamics of the pedagogical process. The magnitude of all subsequent changes depends on the magnitude of changes at the previous stage. This means that the pedagogical process as a developing interaction between teachers and cadets has a gradual, "step-by-step" character; the higher the intermediate achievements, the weightier the final result.
2. Regularity of personality development in the pedagogical process. The pace and achieved level of personality development depend on: (a) heredity; (b) educational and learning environment; (c) inclusion in educational and pedagogical activities; (d) applied means and methods of pedagogical influence.

3. Regularity of management of educational process. The effectiveness of pedagogical influence depends on: (a) the intensity of feedback between educators and students; (b) the magnitude, nature and validity of corrective influences on the students.
4. Regularity of Stimulation. Productivity of pedagogical process depends on: (a) action of internal stimuli (motives) of educational activity; (b) intensity, nature and timeliness of external (public, pedagogical, moral, material, etc.) stimuli.
5. Regularity of unity of sensual, logical and practical in the pedagogical process. The effectiveness of the teaching and educational process depends on: (a) intensity and quality of sensual perception; (b) logical comprehension of perceived; 3) practical application of comprehended.
6. Regularity of unity of external (pedagogical) and internal (cognitive) activity. The effectiveness of the pedagogical process depends on: (a) the quality of pedagogical activity; (b) the quality of own educational activity of students.
7. Regularity of pedagogical process conditionality. The course and results of the educational process depend on: (a) needs of society and personality; (b) opportunities (material and technical, economic, etc.) of society; (c) conditions of the process (moral and psychological, sanitary and hygienic, aesthetic, etc.).

The elements of a professional training system in a higher military education institution are the training tools that are part of the system and perform certain functions. In terms of the professional training system, each element is a subsystem, but in terms of its internal structure the element will represent a system. The sub-elements will act as elements of the system (second order).

In the course of practical work on the system approach in the military institute, the authors identified the elements of the system of professional training in the training of servicemen there are means (aspects) of training:

- Theoretical training;
- Pedagogical training;
- Psychophysical training;
- Practical combat training.

It should be noted that relative to "itself" each named element is a system.

The figure shows the main pedagogical systems (basic professional training systems) involved in the formation of an officer of the Armed Forces. Each of them has its own goals and objectives, specific content, means, and methods. Since the professional training of future officers represents an integrative process of forming those very four basic systems (theoretical, psychological-pedagogical,

psychophysical, practical combat training), the specific goals and objectives of professional training, naturally, must change the content, organizational and procedural didactic principles, methods of forming professional qualities, methods of pedagogical study of evaluation of professional readiness of an officer of the Armed Forces.

Figure 1 - The Basic Professional Training Systems for Future Officers of the Armed Forces



The elements are included in the system by a single attribute: the degree of freedom by which they can become necessary to obtain the result of the system. The elements included in the system are ordered according to certain parameters. The main tool for ordering the interaction of the elements of the system results, which stabilize the organization of the system.

Each basic system in the process of professional training of servicemen must solve specific tasks of such training, which we call aspect-based. Psychophysical training while solving its basic task (development of basic physical qualities, hardening of the organism, etc.) for professional training purposes can solve aspect tasks (formation of emotional stability, endurance under overload, hardening of the organism, etc.) by a special purposeful organization and functioning of the specific physical training process of military institute personnel.

According to the same principle, the specific functioning of theoretical, psychological-pedagogical, and practical training as basic systems should be organized in accordance with the goals and objectives of the future officer's professional training.

Integration of the aspects of the basic systems for the pedagogical training of an officer is the focus of the efforts of the pedagogical system to achieve a single programmed result. As a result of integration is the formation of pedagogical readiness to educate and train personnel, which corresponds to the plan of training and educational work in the Armed Forces. Pedagogical training

must be carried out systematically, professionally, purposefully. Subsequently, it allows for high efficiency in the diverse actions of individual information processes.

The basic systems of professional training (Figure 1) have a conditional level of involvement in the training process. However, the basis of the schematic representation is the inseparability of all subsystems in the training of the future officer. The interchangeability or absence of any one subsystem of training leads to irreparable consequences. As a result, the serviceman's readiness for professional activities will not be fully formed. Theoretical training is based on the formation of professional competence, the content part of the training (knowledge, skills and abilities) acquired in full.

A particularly important aspect of an officer psychophysical training is the psychological readiness for professional actions during an extreme situation.

The main component of theoretical training of servicemen is the pedagogical process, which is a movement from the goals of education to its results by ensuring the unity of training and education. Therefore, the essential characteristic of the pedagogical process is the internal unity of its components and their relative autonomy [9].

The main component of theoretical training of servicepersons is the pedagogical process. Therefore, the essential characteristic of the pedagogical process is integrity as an internal unity of its constituent components, their relative autonomy. Theoretical training is a specially organized interaction of teachers and students to address the content of education, aimed at meeting the needs of both society and the individual in its development and self-development.

For example, psychophysical training is derived from the basic systems of military training. Its integration with the systems of special training and the formation of practical skills is carried out, on the one hand, through the internal structure and functioning of the corresponding aspects of the basic systems and, on the other hand, from the focusing result of all pedagogical flows. This is a fundamentally important circumstance.

The organizational structure of practical combat training is the selection of goals and objectives for the functioning of the military training system. Practical combat training of a serviceman is carried out through the formation of personality by means of the system of moral and psychological training, which is the basis for the functioning of the pedagogical processes of all means of training.

The levels of involvement of basic systems in the functioning of the main derivative systems of future officers' training are conditional.

The relationship, for example, the system of psychophysical training with other systems will be largely determined by the formative property of the basic systems of future officers' training. Psychophysical training is a comprehensive pedagogical process aimed at the formation of future officers intellectual, volitional, socio-psychological, physical qualities, which can be classified into three levels.

The psychological level includes: analytic-synthetic functions of thinking, mental mobility, memory (short-term, verbal-logical, operative, sound, manual, etc.), perception (speed, completeness, differentiation), attention (volume, flexibility, concentration, separation, switching), speed of evaluation, creative comprehension of a large flow of information and competent decision-making.

The socio-psychological level, which determines the moral-will and organizational-communicative qualities and psychological attitudes.

Physical training of the formation of vitality, hardening of the body, physical performance in accordance with the standards.

Analyzing the interaction between the systems for training future officers, we can summarize that the end result ensures the professional reliability of a serviceman. Removing at least one of the components from the pedagogical process will lead to a violation of the interaction of information flows, will affect the final result (due to the lack of complete focus in the necessary time for adaptation).

To solve the problem of professional training on the basis of a system-functional approach, considering the human factor is possible if the entire information structure of training in a particular period of training of future officers is streamlined [10].

Accordingly, the conceptual apparatus should provide:

- Systematic analysis of the entire training system, considering the different levels of its hierarchy;
- The possibility to justify the main criterion of the training process design;
- Theoretical orientation in developing the principles of training organization;
- Modeling and synthesis of training systems of different levels of complexity.

## 5. Conclusions

The results of research carried out to improve the training of future officers, but without considering the whole structure, cannot then be included in the system to get holistic-integrative nature. As a result of interaction with other means of training, a certain effective means may change

or acquire new qualities that are not considered in the research carried out in a systemic organization. This affects the resulting focused outcome of professional training in a military institution.

The system of professional training technology in a military educational institution is a complex object of research. This complexity is due to the following factors:

- The variety of formative training tools;
- The different nature of information flows;
- The different "shaping capabilities" of individual training tools;
- The complexity of the organization and structure of different systems (subsystems, elements) of training;
- The need to manage different pedagogical processes;
- The special complexity of the interaction between the professional training system as a whole and its subsystems (elements) with the body (in the general sense).

In order to concretize the essence of professional training in a military educational institution, an important element is the issue of interaction between other systems of formation of future officers of the Armed Forces, providing their professional formation. This necessity is caused by the current uncertainty in the structure of the systems, in their interaction to obtain a single result. It should be noted and the fact that it is quite difficult to answer such questions within the analytical style of thinking.

Thus, methodological positions in understanding the essence of system approach technology in military education converge to the fact that they start from an understanding of the educational development of the pedagogical system. In this connection methodology of system approach in military education is based on the solution of two interrelated tasks: first, on the study of system objects as a form of existence and movement of the real world, as manifestation of its ordering; second, on constructing a system of categories, reflecting systemic connections of the studied. Thus most fully and consistently the methodological program in military education is disclosed in representation of the system approach as a methodology of integration of various slices of knowledge about an object in a system picture.

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