Implementation of the Type-Variety Principle in Modern Teaching and Learning Methods and Realization of Scientific Research

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1. INTRODUCTION

The aim of the article is to study the issues associated with the concepts of diversity and type variety, as well as the development of these concepts for the formation of innovative solutions in various spheres of human activity, e.g. education and science, technicaland economic spheres, social policy, military, agriculture, beekeeping, etc. In modern society, the concepts of diversity and type variety are becoming increasingly important in various areas, and their relevance is exponentially growing every year. Diversity is a combination of multifunctional intelligent solutions and productsof all spheres of human life, uniqueness and development of ideas to improve the society and processes, with respect to the tolerance of society to multicultural diversity and multicultural interaction. Diversity plays a crucial role in increasing labor productivity, reliability, sustainability and fault tolerance of critical infrastructure that leads to the improvement of products and processes. Moreover, diversity contributes to unique perspectives that stimulate innovation and social progress, introducing new ideas that contribute to positive change. Scientifically, diversity refers to the state or quality of being different and distinct, as defined in various disciplines such as biology, philosophy, and ecology. In cybernetics, W. R. Ashby was one of the first scientists to introduce diversity, while defining it in terms of the number of distinguishable elements in a system and their logarithmic relationships [1]. Despite its wide application, diversity remains a multifaceted concept that requires deeper study and understanding of its mechanisms.

2. METODOLOGY

Historically, diversity studies started in the space industry needing reliable systems [2; 3], and were applied to minimize the risk of failure in such areas as non- destructive testing [4], fraud detection [5], and water quality management. Thus, the type-diversity principle was formulated as one of the principles of system analysis which can generally be used in solving different problems and can be formulated as follows [6]: **the type-variety principle** is the purposeful application of components (e.g., systems, elements, technologies, raw materials, models, algorithms, etc.) of different nature (the principle of operation/construction) which perform the same functions but can be used separately: their simultaneous combination and interaction eliminates the recurrence of common failures, as well as provides a qualitatively better solution of the problem of highly reliable long-term functioning of systems (e.g., exception of a possible repetition of general failures, defect detection, analysis of the projects, development of innovative products, business processes, etc.).

The systemic approach, operations research methods, and the method of sequential analysis of alternatives form the methodological foundation of this study and are applied when implementing the type-variety principle [2-6]. Mechanisms of the type-variety principle involve the formation of multiple combinations of diverse sub-options which, through the use of sequential analysis procedures, generate potential solutions for two-level mathematical models in discrete optimization problems. The developed solution algorithm and procedures for eliminating non-promising options in the process of forming diverse optimal solutions are presented in [2-3].

The mechanisms of the type-variety principle are applied to develop innovative and efficient solutions to challenges across various fields of scientific research [7] and education [8-9] that demonstrates the connections between diversity, type variety and innovation and their application in teaching and learning methods, as well as the development of hierarchically interconnected educational programs and targeted scientific research to address relevant challenges. The relationships between diversity and innovation have been the subject of extensive research over the years. One of the main challenges

faced by present-day Ukraine is the energy supply to its territories. A promising approach to address this issue is the formation of a type-variety energy portfolio by the generation companies in different regions of Ukraine, based on the experience of European countries [10]. An important example of application of the type-variety principle is its use in the interdisciplinary areas of medicine that focus on the creation of various type-variety exercises for the rehabilitation of patients undergoing treatment of specific physical and psychological traumas by utilizing physical exercises derived from diverse medical practices [11]. This principle underscores the importance of universities in fulfilling their Third Mission which ensures a connection between education, science, and their societal roles.

3. RESULTS AND CONCLUSIONS

The goal of this research is to demonstrate, through system analysis and the concepts of diversity and type variety, the emergence and nature of the type-variety principle as an outcome of scientific exploration across various critical applied fields. These fields involve the development of new mathematical models, methods, and algorithms, while highlighting the principle's innovative aspects and its application to solving urgent scientific, technical, and social problems. Based on this principle, the authors proposed a specific methodology to be used in education and research. This methodology has evolved into a systematic practice, enabling rapid responses to urgent challenges in education and science which are continuously evolving in today's fast-changing world. In particular, the proposed type-variety principle and associated ideology could facilitate the introduction of modern, innovative teaching and learning methods into the educational process in Ukraine and the European Higher Education Area (EHEA) in general. In 2024, there is a renewed emphasis on cutting-edge forms of teaching, learning, and assessment in the interactive world that aim at guiding educators and policymakers toward productive innovations rooted in diversity and type variety. In the nearest future, we expect to observe the application of the proposed **type-variety principle** and ideology to achieve an ambitious global goal, i.e. to establish transnational joint educational provisions on the European and global scale.

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