TRANSFORMATION OF METHODOLOGICAL TRAINING OF FUTURE GEOGRAPHY TEACHERS ON THE BASIS OF THE CONCEPT OF SUSTAINABLE DEVELOPMENT

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Summary

The article provides a theoretical and methodological analysis of the transformation of the system of training future geography teachers in the context of the implementation of the sustainable development paradigm. Global environmental, social and economic challenges necessitate a rethinking of the methodological training of teachers, since geography is an important integrative discipline for the implementation of the Sustainable Development Goals (SDGs). Based on a review of the scientific literature, five important components of the sustainable development competence of a geography teacher have been identified: systemic-spatial, prognostic, normative-value, transformative-pedagogical and reflective-personal.

A conceptual model of the transformation of methodological training is proposed, which includes the reorientation of the target component (training of a "teacher-agent of change"), modernization of the content of disciplines (integration of SDGs, local context), introduction of innovative technologies (GIS, STEM projects, problem-based learning, simulation games) and transformation of assessment procedures (authentic assessment, reflective portfolio). International experience (European countries) and individual Ukrainian practices are summarized. The results of the study can be used to develop updated educational programs for teacher training in higher education institutions.

Key words: sustainable development, Sustainable Development Goals, geographical education for sustainable development, GIS technologies, STEM education, competency-based approach, transformative learning, New Ukrainian school.

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1. Introduction

The modern world is facing challenges of unprecedented scale and complexity: global climate change, degradation of natural ecosystems, depletion of soil cover, rapid loss of biodiversity, growing socio-economic inequality and resource depletion threaten the well-being of current and future generations. These processes necessitate a change in the global educational paradigm. The international community responded in 2015 with the adoption of the “2030

Agenda for Sustainable Development" with 17 Sustainable Development Goals (SDGs) and the deployment of the UN Global Framework for Education for Sustainable Development "ESD for 2030" *(UNESCO, 2020)*. Education for Sustainable Development (ESD) requires a radical transition from passive acquisition of knowledge to the formation of an active life position, systemic, critical and predictive thinking, and the ability to act as drivers of transformational processes.

In this context, the figure of the geography teacher acquires special importance. Geography is a complex integrative discipline that organically combines natural science (geology, hydrology, climatology, soil science), economic and socio-cultural knowledge, forming spatial thinking and a systemic view of the complex interaction of man and the environment. As J. Morgan *(Morgan, 2012)* notes, geographical education should develop a "geographical imagination" that allows students to critically reflect on global processes. It is the geography teacher who is the natural conductor of sustainable development ideas in school, capable of integrating the global context of the SDGs with local community problems. However, as evidenced by the analysis of educational programs of various higher education institutions of Ukraine, where future geography teachers are trained (classical and pedagogical universities), there is an urgent need to reorient methodological training on the principles of sustainable development, because the traditional content of professional disciplines remains largely academically isolated and focused on reproductive knowledge acquisition. There is a contradiction between the requirements of the time, recorded in international documents and standards of the New Ukrainian School (NUS), and the real state of methodological training of geography teachers in HEIs.

The purpose of the article is to substantiate the theoretical foundations and propose a practical model for the transformation of methodological training of future geography teachers in accordance with the principles of education for sustainable development. In accordance with the purpose, the following tasks have been defined: to analyze scientific approaches to SSR in the context of geography teacher training; to identify key components of sustainable development competence; to develop a model for the transformation of methodological training; to outline the prospects for its implementation.

2. Literature review

The analysis of scientific discourse shows that the concept of sustainable development in education is explored in several interrelated dimensions. The fundamental theoretical basis of the study is the concept of "transformative learning" by J. Mezirow (1991), which emphasizes the importance of critical reflection and dialogue for restructuring the deep beliefs of participants in the educational process. A significant contribution to the development of sustainable development competencies was made by de Haan (2006), who proposed the concept of "Gestaltungskompetenz" (competence of shaping the future), and A. Wiek et al. (2011), who developed an integral framework that includes systemic, predictive, normative, strategic and interpersonal thinking. In the context of geographical education, the studies of several authors are important. In particular, J. Huckle and M. Summers (2019) emphasize the need to develop "spatial-relational thinking" – the ability to understand spatial relationships between objects and phenomena. Norwegian scientists K. E. Iversen and G. N. Andersen (2022) prove the value of a local history approach in the training of future geography teachers. Based on the classic concept of "disorienting dilemmas" by J. Mezirov, A. Wals (2015) justifies the feasibility of using cognitive dissonance as a trigger for transformative learning in the process of greening education.

In Ukraine, research in the field of environmental education and education for sustainable development is conducted in several directions. The fundamental theoretical foundations were laid by L. M. Tytarenko (2011) and O. L. Prutsakova (2021). The issue of methodological training of geography teachers was directly developed by O. M. Topuzov (2021), T. G. Nazarenko (2022), I. O. Dimarchuk (2018) and S. L. Kapirulina (2023). The role of geoinformation technologies in the training of future geography teachers is highlighted in the works of V. M. Samoilenko (2014). At the same time, despite a significant number of scientific publications on individual aspects of the problem, there is a lack of comprehensive scientific research devoted to the systemic transformation of the methodological training of future geography teachers in a holistic paradigm of education for sustainable development. This emphasizes the relevance of the presented study.

3. Results and Discussion

The transformation of methodological training of future geography teachers on the basis of OSR involves a radical revision of its leading goals, content, methods, forms of organization and assessment procedures. In contrast to the traditional model, which is focused mainly on the translation of subject knowledge and the formation of individual methodological skills, the transformative model emphasizes the development of students' ability to critically reflect on the educational process, design transformative learning experiences for students and act as agents of change. The initial theoretical construct is the concept of "double transformation" by Sterling *(Sterling, 2011)*, according to which a future teacher must undergo his own deep transformation of value orientations and thinking in order to then effectively contribute to the transformation of his students. This corresponds to the principle of coherence (congruence) in teacher education *(Korthagen et al., 2001),* and namely – teachers should be taught in the way we want them to teach themselves.

Based on the analysis of UNESCO framework documents (2017, 2020) and the works of Wiek et al. (2011), taking into account the specifics of geographical education, five key components of the geography teacher's sustainable development competence have been identified. Firstly, this is systemic-spatial competence – the ability to analyze complex multi-level relationships between natural, social and economic systems in their spatial dimension from local to global. Secondly, predictive competence involves the ability of a future teacher to construct alternative scenarios for the development of geosystems, to think in different time dimensions (past – present – future) and to assess the long-term consequences of human impact on the environment. Thirdly, normative-value competence is the ability of a future teacher to identify the values behind certain decisions, analyze them, find a compromise in situations of value choice, resolve moral and ethical dilemmas related to sustainable development, and form their own environmental ethics. Fourthly, transformative pedagogical competence is the ability of a future teacher to design, implement, and analyze such learning situations that encourage students to think critically, actively participate in solving problems, and make responsible, informed decisions. Fifthly, reflective-personal competence is the ability of a teacher to constantly analyze their own beliefs, values, pedagogical actions, and their effectiveness, as well as the readiness for continuous professional self-development as a teacher-agent of change.

The proposed conceptual model of the transformation of methodological training of future geography teachers covers four interrelated areas. The first area is the reorientation of the target component. The traditional goal, which was to form the skills to teach geography

methodically and correctly, is significantly expanded. Instead, a new target is set: to prepare a teacher as an agent of change in the field of sustainable development, capable of independently designing and implementing transformative educational practices. Accordingly, the UN Sustainable Development Goals are used not only as the thematic content of individual lessons, but as a systemic strategic guideline that determines the selection, justification and evaluation of all pedagogical decisions in the process of training a future teacher.

The second area is the transformation of the content component. The content of methodological disciplines, in particular "Geography Teaching Methods", "Modern Educational Technologies", "Innovations in Education" and the "Pedagogical Practice" program, is enriched with several mandatory components. First of all, this is the integration of sustainable development ideas through the introduction of special content modules, namely: "Methodology of Teaching Global Problems of Humanity", "Cross-cutting Lines of SDGs in School Geography Courses" and "Local Dimension of Sustainable Development: Researching Your Community". The last module involves the practical mastery by students of geoinformation mapping tools for monitoring local environmental problems. In addition, the transformation of the content of pedagogical practice consists in the transition from passive observation to the development by future teachers of original STEM projects, educational cases and environmental quests adapted to the concept of sustainable development of a particular region. An important component of this transformation is the formation of skills for critical analysis of educational materials, in the process of which students learn to evaluate school textbooks and programs from the standpoint of education for sustainable development. Special attention is focused on the design of transformative activities, which is manifested in the development of lessons and extracurricular activities with the mandatory integration of the local ecological and geographical context and the issues of the Sustainable Development Goals. The final vector is a significant strengthening of interdisciplinary connections. Students comprehensively master the methodology for organizing integrated learning, which allows for the organic combination of geography with biology, economics, history and civic education.

The third area is the modernization of technological tools. There is a decisive transition from reproductive methods (narration, explanation, working with a textbook) to active, interactive and research methods. The dominant methods and forms are problem-based learning based on the material of real local dilemmas of sustainable development; project technology and the STEM approach (water quality monitoring, school energy efficiency, creation of an ecological trail); geographic information systems (GIS) – using ArcGIS, QGIS, Google Earth, StoryMaps to create thematic maps, visualize spatial data (anthropogenic load, dynamics of land use changes) and perform geoinformation analysis; simulation games and role-playing games (climate summit, UN model); case studies (analysis of real situations of implementing the principles of sustainable development); field research and practice (study of local environmental problems – soil erosion, water pollution, state of green areas).

The fourth area is the transformation of assessment procedures and pedagogical practice. The traditional assessment system, based mainly on reproductive tasks (answers to the exam, writing lesson notes), is being replaced by authentic assessment. Students develop, present and defend completed methodological products (series of lessons with a built-in ESD component, training modules, methodological manuals for teachers), publicly defend educational projects carried out on the basis of schools or public organizations, maintain a reflective portfolio, where they record the dynamics of their own beliefs, difficulties and findings, and also participate in mutual evaluation of each other's work. The tasks of pedagogical practice are also significantly transformed: it becomes mandatory to design, conduct and analyze non-standard forms of work

with students (ecological quests, debates, round tables, research papers) with subsequent presentation of the results at the final conference.

An analysis of international experience reveals several exemplary models. The Swedish experience of teacher training *(Gericke et al., 2019)* demonstrates the effectiveness of integrating interdisciplinary modules on education for sustainable development into pedagogical programs. The Finnish system (University of Helsinki) is based on phenomenon-based learning *(Symeonidis & Schwarz, 2016).* The Polish experience is also interesting. In particular, a study by Joanna Zawiejska from the Pedagogical University in Krakow revealed significant gaps between the content of university training of geography teachers and their real role in implementing education for sustainable development at school *(Zawiejska, 2021).* In Ukraine, elements of transformative training are being implemented in various higher education institutions. In particular, at Borys Grinchenko Kyiv University, students master the course "Geography and Sustainable Development"; at the Kharkiv National Pedagogical University named after G. S. Skovoroda, a project approach is being implemented in pedagogical practices; In addition to integrating environmental topics into professional disciplines, Uzhhorod National University offers a course on "Sustainable Development of Society" for future geography teachers, and also offers a module on "Geography of Risks and Sustainable Development" within the framework of teacher training programs. However, the systemic transformation of methodological training at the national level has not yet been completed. Most educational programs for training future geography teachers in Ukraine require further alignment with the principles of sustainable development, as modern innovative practices are often local or initiative-based and require systematic methodological generalization.

It is important to emphasize that the greatest effectiveness can be achieved by combining the global Sustainable Development Goals with the local context. The global goals themselves become understandable and meaningful only when they are linked to the real problems of a specific community, school or district. For example, when studying the topic of "Soils", a future teacher should organize research with schoolchildren on erosion processes in their own territory, thanks to which the problem of preserving the soil cover ceases to be a topic from a textbook. At the same time, there are certain conceptual contradictions that should be taken into account. In particular, there is tension between two approaches to education for sustainable development: normative, when the teacher clearly defines the boundaries of "right" and "wrong", and critical, which encourages students to constantly doubt and analyze. The first approach risks turning into "green indoctrination" (imposing the only correctly defined opinion), while the second can lead to disorientation of students in choosing their own environmental position. In addition, there are significant structural constraints in Ukraine, namely: overloaded curricula, lack of funding for the purchase of specialized commercial tools (in particular, licensed GIS software), and insufficient preparation of university teachers themselves to work in the new paradigm. Therefore, the successful implementation of the proposed model requires not only the efforts of individual teachers, but also systemic transformations at the institutional level of the entire educational system.

4. Conclusions and further recommendations

Transformation of the methodological training of future geography teachers on the principles of education for sustainable development is an objective requirement of the time. Its necessity is due to the international obligations of Ukraine, the reform of the New Ukrainian School and the didactic potential of geography as an integration discipline. Such a

transformation involves a transition from a descriptive-reproductive model of teaching to a value-activity, transformative model. The competence of sustainable development of a modern geography teacher is a multi-component formation that goes beyond purely subject knowledge. It includes the ability to system-spatial analysis, forecasting future changes, value-normative reflection, designing transformative educational situations and critical reflection on one's own pedagogical activity.

The proposed four-sphere model of transformation of methodological training (targeted, content-based, technological, evaluation) allows for a systematic update of the training of future geography teachers, where important innovations are the integration of the Sustainable Development Goals with the local context, the introduction of active teaching methods (GIS, STEM projects, simulation games, field research) and the transition from traditional to authentic assessment (portfolio, project defense). Successful implementation of the model requires not only updating curricula, but also profound changes at the level of pedagogical culture of teachers of higher education institutions, their readiness to work in the paradigm of transformative learning. Promising areas of further research are: development of educational and methodological complexes based on the proposed model (in particular, electronic manuals on the use of GIS); empirical study of the dynamics of the formation of sustainable development competence in future geography teachers; organization of systematic advanced training of teachers of higher education institutions; initiating changes to educational standards regarding the mandatory integration of the SDGs into the methodological training of geography teachers.

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