### 'ION CREANGA' STATE PEDAGOGICAL UNIVERSITY OF CHISINAU DOCTORAL SCHOOL OF EDUCATION SCIENCES

By manuscript title C.Z.U: 373.3.091(043.2)=111

### CHIRIAC ELENA

## THE FORMATION OF THE ECOLOGICAL CULTURE OF PUPILS OF YOUNG SCHOOL AGE THROUGH THE INTEGRATION OF CURRICULAR CONTENTS

**SPECIALIZATION: 531.01 – GENERAL THEORY OF EDUCATION** 

THE ABSTRACT of the doctoral thesis in educational sciences

**CHIŞINĂU, 2025** 

This thesis was elaborated as part of the Doctoral School of Education Sciences of 'Ion Creanga' State Pedagogical University of Chisinau, Moldova.

#### **Composition of the Scientific Specialized Council:**

- 1. COROPCEANU Eduard, doctor in chemical sciences, university professor, 'Ion Creanga' State Pedagogical University of Chisinau, Moldova president of the committee
- 2. HADÎRCĂ Maria, doctor in pedagogical sciences, associate researcher, 'Ion Creanga' State Pedagogical University of Chisinau, Moldova **doctoral supervisor**
- PANICO Vasile, doctor in pedagogical sciences, university professor, 'Ion Creanga' State Pedagogical University of Chisinau, Moldova – official reviewer
- 4. MARIN Mariana, doctor in pedagogical sciences, associate professor, State University of Moldova official reviewer
- VOINEA Mihaela, doctor in educational studies, associate professor, 'Transylvania' University of Brasov, Romania – official reviewer

The presentation of the thesis will take place on 24.06.2025, at ten o'clock in the meeting of

the Commission for the public defense of the PhD thesis at the 'Ion Creanga' State Pedagogical

University of Chisinau, Moldova, I street, Creangă 1, building 2.

The doctoral thesis and the abstract of the thesis can be accessed at the Scientific Library of 'Ion Creanga' State Pedagogical University (www.upsc.md) and on the website of ANACEC (https://www.anacec.md/ro/technical-staff/evaluations).

The abstract was sent on \_\_\_\_\_, 2025

#### President of the committee:

COROPCEANU Eduard, dr. in chemical sciences, prof. univ.

#### **Doctoral Supervisor:**

HADÎRCĂ Maria, dr. in pedagogical sciences, conf. cerc.

Perp

Author: CHIRIAC Elena

© CHIRIAC Elena, 2025

### TABLE OF CONTENTS

THEORETICAL FRAMEWORK OF THE RESEARCH	4
CONTENTS OF THE THESIS	9
Chapter I. Ecological culture: referential and analytical framework	9
Chapter 2. Theoretical framework for the constitution of ecological culture of pupils of year	oung
school age through the integration of curricular contents	15
Chapter 3. The experimental approach to developing ecological culture of pupils of young sc	hool
age through STEAM integration	20
GENERAL CONCLUSIONS AND RECOMMENDATIONS	26
BIBLIOGRAPHY	29
LIST OF THE AUTHORS' PUBLICATIONS ON THE TOPIC OF THE THESIS	31
ANNOTATION	33
ANNOTATION(Romanian)	34

#### THEORETICAL FRAMEWORK OF THE RESEARCH

**Topicality and importance of the research topic.** In the knowledge-based society, also known as *learning society*, lifelong education and the culture acquired as a result of learning are essential objectives of the training-development of the personality in the making, which is why these days great emphasis is placed on the pedagogical training of the *general knowledge* of the young school age pupil, which also includes ecological culture.

At this stage of development of society, when there is a strong interdependence between nature, culture and society, pedagogy, "as an interrogation of education, which deals not only with *what is*, but above all, with *what should be*, is in permanent dialogue with the educational reality, questioning and analyzing it", changes its approaches and means of intervention on the educational reality [15, p. 19].

However, as some specialists claim, in the knowledge society, education "is responsible for everything that happens in the life of people" (A. Marga), that is why the paradigms of education are changing, "a new vision of learning" is required (T. Callo), other ways of structuring content are proposed and the learning process is being reconsidered, reconfigured in the context of societal challenges and approached "as a mechanism for changing behavior" (C. Cucoş), lifelong learning being identified as the most effective means of knowledge and solving the problems people are facing in today's society [22; 3; 16].

Under these circumstances, at the level of global policies, various strategic documents of the highest value had been elaborated, to which many countries, including the Republic of Moldova and Romania, have adhered, where the role of ecological education in the formation of ecological culture is recognized [3; 26; 29; 30]. It is therefore high time for education and pedagogical research to take responsibility for the formation of pupils' ecological culture as an element of functional general knowledge.

The international organizations UNESCO and UNEP point to environmental education as a global problem, the solution of which is a basic prerequisite for the preservation of planet Earth. Ecological culture – the integrative quality of a cultural person – is formed not only in the process of ecological/environmental education, but also in the process of socialization with others (colleagues, family, community), through familiarization with social norms that correspond to the ideas of culture, morality and citizenship [29; 30].

Hence, education is seen today as a decisive factor in the progressive formation of a cultural personality, this finality being determined both by pupils' knowledge and abilities and by the attitudes and value choices cultivated in children and young people, the human being having the capacity to act in a transformative manner on the environment and on his own being. Therefore, the importance of the research topic also derives from the major changes and transformations taking place in contemporary society, which call for the integration of ecological/environmental education in the educational process, as well as its correlation to the STEAM teaching-learning methodology, which aims to "stimulate integrated learning of natural sciences applied to technology and engineering, with a permanent logical-mathematical argumentation", this being defined by S. Cristea as "a direction for the development of the educational process, affirmed in education policy and necessary in the informational, knowledge-based society" [13, pp. 54-56].

Nowadays, *ecological culture* is treated as a part of universal human culture, which is a system of theoretical knowledge, moral and ethical, public and individual norms, views, attitudes and values concerning the relationship between man and nature. Every human on the planet must have a certain level of ecological culture, which is formed on the basis of ecological education and ensures the development of the pro-environmental behavior [7; 25; 40; 41].

#### Description of the research situation and identification of the research topic

The following *theories* have served as theoretical landmarks for research: general educational theory, curriculum theory and methodology, pedagogical research theory and methodology, instruction/learning theories, etc. (R.W. Tyler, B. Bloom, R. Gagne, G. Văideanu, D. Salade, S. Cristea, VI. Guţu, I. Neacşu, M. Călin, I. Cerghit, etc.); *principles* regarding the unitary character of education, the unity of the "nature-society-man" system, the principle of pedagogical communication, the formative orientation of teaching activity, accessibility, respect for the correlation between objectives, contents and strategies in the design of the educational process (C. Cucoş, L. Vlăsceanu, Vl. Pâslaru, etc.); *concepts: the problems of the contemporary world*, reflected in studies by N. F. Reimers, J. Botkin, N. Vernadski, A. Toffler, L. Antonesei, etc.; *education as initiation into culture*, which involves acquiring cultural tools and ensuring the dynamic aspect of learning (C. Cucoş); *models* for an integrated approach to the contents of learning (J.-Y. Boyer, P. Galison, L. Ciolan, etc.); *ideas and notions* concerning ecological education, ecological culture, STEAM education, educational contents, curricular integration, pro-environmental behavior, educational values, etc. (G. Văideanu, A. Nicolau, C. Bîrzea, S. Cristea, C. Cucoş, L. Vlăsceanu, Vl. Pâslaru, T. Callo, G. Chirica, M. Marin, V. Bocancea, etc.).

The analysis of the educational policy documents (curriculum, syllabuses, textbooks) shows that the objective of forming an ecological culture in primary school pupils is only tangentially pursued through the teaching/learning of the school subject Science/Natural Science, which is based on the interdisciplinary approach to learning content, not on their integrated approach, which proves to be more effective, as authors of recent studies on science subjects or ecological/environmental education have demonstrated ( L. Ciolan, I. Botgros, A. Kerekeş, V. Bocancea, etc.).

In the Republic of Moldova, the ecological/environmental education and the formation of the ecological culture matter was approached by the following researchers: I. Dediu, Gh. Duca, R. Cucereanu, E. Morei, V. Panico, E. Coropceanu, T. Cozari, S. Jurat, I. Bumbu, G. Chirică, E. Popov, S. Leșenco, E. Haheu, A. Buga, E. Buzinschi, S. Golubițchi, L. Namolovan etc.

In Romania, the promotion and integration of new education thechniques in basic education, implicitly also ecological/environmental education, has been the concern of researchers such as: C. Bîrzea, S. Cristea, C. Cucoş, O. Mândruță, L. Ciolan, B. Stugren, M. Petre, V. Petre, V. Dinu, C. Dumitru etc.

In Russia, environmental education, the formation of ecological culture and ecological awareness through basic education have been topics of interest for researchers: А. Захлебный, И. Цветкова, Л. Печко, Л. Мазитова, В. Зотов, О. Филатова, Л. Моисеева, Л. Иванова, И. Кастунов, , А. Поддьяков, Н. Шумакова, Н. Семенова, А. Савенков etc.

At the state level, **in the Republic of Moldova** the realization of environmental education is supported by strategic policy documents. Thus, in 2001 the Concept of the country's environmental policy was adopted, which expresses the commitment to ensure public

access to information in the field, including more active involvement in decision-making on the environment and natural resources.

In 2014, the **Environmental Strategy for the years 2024-2030** was approved, which covers the improvement of water quality, sustainable increase in the area of forests and protected areas, ensuring responsible consumption of natural resources, active transition to green and circular economy and ensuring resilience to climate change [29].

The studies examined in the current research have highlighted the following aspects as necessary to be pursued in the process of forming pupils' ecological culture:

- the shaping of pupils' ecological attitudes (А. Миронов, А. Захлебный, И. Цветкова, Л. Печко, В. Зотов, Л.В. Моисеева, И.Р. Кастунов, С. Стасіип, R. Lierman etc.);
- the shaping of pupils' ecological culture (Н.С. Дежникова, Е.М. Клемяшова, Л.Ю. Иванова, И.В. Снитко, И. Цветкова, Л. Печко, L. Bobâlnea, G. Chirică etc.);
- the shaping of pupils' ecological awareness (М. Висh, S. Husey, P. Weller, T. Heyd, V. Plumwood, С.Д. Дерябо, В. Скребець, В.А. Ясвин, В. Niculescu etc.).

One of the premises that led to the development of this research topic is also the fact that the concept of ecological culture of the young pupil is not yet clarified and systematized as an element of the pedagogical training profile, and the models and methodologies for integrating content for the purpose of ecological culture formation are not sufficiently known, valued and applied in primary education. Moreover, we point out the existence of **contradictions** in the issue of ecological culture training for young age pupils, such as:

- social demands regarding the need to raise pupils' level of ecological culture, on the one hand, and educational activity that is poorly geared towards achieving this goal, on the other hand;
- the existence of theoretical results on how to make the process of ecological culture training more efficient through inter/transdisciplinary connections and the lack of a pedagogical concept on how to operationalize them at the primary school level;
- the need to optimize the educational process, on the one hand, and the insufficient use of curricular integration models capable of contributing to the formation of ecological culture, on the other.

The conceptual and methodological shortcomings, as well as the contradictions highlighted above, have generated the following **research problem**: *What would be the theoretical and methodological landmarks necessary for the integration of curricular content in order to form ecological culture in pupils of young school age?* 

The **purpose of the research** stems from this question and aims to determine the theoretical and methodological bases for the formation of *ecological culture in pupils of young school age* through the integration of curricular content.

In this sense, the **object of the research** is the process of formation of *ecological culture in pupils of young school age*.

**Research hypothesis:** The process of formation of the ecological culture of young school age pupils organized by the integration of curricular contents will be effective if:

- the *theoretical-methodological* bases of formation of ecological culture of young school age pupils are determined and the necessity for integrated curricular contents is argued;
- the basic components of ecological culture will be elucidated and operationalized at the early school stage;

- the pedagogical model and methodology of ecological culture formation of young school age pupils through integration of curricular contents will be developed;
- the strategies, methods and techniques for integrated ecological culture formation of young school age pupils are identified, which will be valorized and validated at the level of school practice.

From the purpose and the hypothesis of the research the following **research objectives** have been identified:

1. The examination of theoretical approaches, the delimitation of the concepts of ecological education and ecological culture of pupils, with reference to the status quo in the educational field.

2. The determination of theoretical points of reference and ways of integrating curricular content for the formation of the ecological culture of young school age pupils.

3. The elaboration of the pedagogical model for the formation of the ecological culture of young school age pupils through the integration of curricular contents.

4. The identification of effective strategies, methods and techniques of integrated ecological culture of young school age pupils.

5. The experimental validation of the strategies and methods of ecological culture of young school age pupils.

6. The formulation of general conclusions and practical recommendations.

The scientific research methodology was based on the application of the following methods: *theoretical methods* (scientific documentation, analysis and synthesis, generalization and systematization, abstraction and theoretical modelling); *practical methods* (observation, questioning, comparison, pedagogical experiment); *hermeneutic methods* (interpretation of theoretical sources and experimental data); *statistic and mathematical methods* (inventorying, analyzing and processing of experimental data).

The novelty and scientific originality of the obtained results resides in: the systematization of theoretical approaches on the research topic; the elaboration of a new vision on the formation of ecological culture at the level of primary grades; the scientific argumentation of the integration of curricular contents in the formation of ecological culture of primary school pupils; development of the model and adaptation of STEAM methodology in the process of integrated formation of ecological culture of the young school age pupils; as well as some of the pedagogical tools of integrated teaching-learning of contents, which favor the process of formation of ecological culture and determine the active involvement of pupils in solving environmental problems.

The scientific problem solved by this research consists in: determining the theoretical and methodological landmarks necessary for the formation of the ecological culture of the young schoolchild; developing the theoretical concept of integrated ecological culture formation at the primary school stage; conceptualizing and validating the *Pedagogical model of ecological culture formation of young schoolchildren*; establishing the levels of ecological culture formation of primary schoolchildren; developing the STEAM methodology, its application algorithm and strategies for ecological culture formation through the integration of curricular content.

**The theoretical significance of the research** is given by: synthesizing the theoretical approaches on the formation of ecological culture; the delimitation of the concepts of *ecological* 

*education* and *ecological culture*; revealing the components of the concept of ecological culture of the young schoolchild; operationalizing the concept of ecological culture, the indicators and descriptors of performance, as well as the levels possible to be achieved at that age; designing strategies for the formation of ecological culture in pupils of young school age from the perspective of curriculum content integration.

The applied value of the research results from: determining the educational contents that can be integrated into a STEAM curriculum; adapting the STEAM methodology to the specifics of the formation of ecological culture in young school-age students; outlining the set of curricular tools needed in the process of formation of ecological culture in primary school students; developing educational resources (training and assessment tools, practical activity systems, reading materials, etc.) for the formation of ecological culture; the didactic use of the optional curriculum 'The Little Ecologist' for pupils of the second grade in the process of formation of ecological culture; the divelopment and implementation of the in-service training program for teachers 'Formation of ecological culture in pupils through STEAM integration'; the development of the collection of didactic projects with the use of STEAM.

#### Main scientific results submitted for presentation:

(1) Scientific argumentation of the necessity and possibility of a pedagogical integration curricular contents in the process of formation of ecological culture.

(2) Systematization of a new vision of ecological culture formation in young school-age students, focused on STEAM integration of instructional contents.

(3) Elaboration of the pedagogical model for the formation of the ecological culture of young school-age pupils.

(4) Design and experimental validation of an optional curriculum centered on an integrated approach of curricular contents and aiming at the formation of elementary ecological culture.

**The implementation of the scientific results of the research** has been realized within the framework of the pedagogical experiment, through the assessment of the state of the matter under investigation, experimentation and validation of the methodology for the formation of ecological culture in primary school pupils and its related tools - the optional curriculum 'The Little Ecologist' applied in the Secondary School no. 11 'Stefan Octavian Iosif', Brasov, Romania (academic year 2023 - 2024) and the Teacher Training Program 'Forming ecological culture in pupils through STEAM integration' applied within the AO 'Innovation in Performance Education' ICITT, period 18.03.2024 - 30.03.2024.

The endorsement and validation of the scientific results was realized through the following publications: (a) four articles in scientific journals: the Univers Pedagogic Journal, Didactica Pro... Journal, Acta et Commentationes Journal (Education Sciences), Bulletin of Transylvania University of Brasov, Series VII Social Sciences and Law; Journal of Romanian Literary Studies; (b) nine scientific communications in scientific conferences, national and international scientific congresses, as well as in scientific and methodological seminars organized during 2020-2025 in the R. Moldova and Romania; (c) collections of educational theory and practice, New research directions in pedagogy, Cracow, Poland.

#### **CONTENTS OF THE THESIS**

In Chapter I, entitled "Ecological culture: referential and analytical framework", the approaches of ecological education and culture in pedagogue literature are examined, the conceptual delimitations are made in the connection between *ecological education* and *ecological culture*, the curricular framework in which the process of formation of ecological culture is currently carried out is analyzed, the problems and difficulties in the process of formation of ecological culture of young school age pupils are highlighted, these being considered as premises for enhancing the process of shaping the ecological culture in the young generation through an integrated approach of the curricular contents.

The examination of the theoretical approaches and the conceptual delimitations based on the connection *ecological education-ecological culture* led to the determination of the conceptual bases, the establishment of the evolution and interdependence of the concepts, the outlining of the main characteristics and the importance of exploiting all the components of the concept of EC (cognitive, socio-affective, behavioral) in designing the process of shaping the ecological culture of the young schoolchild. The analysis of the current curricular framework confirmed the hypothesis according to which the CEF activity is insufficient, therefore it needs to be intensified, reinforced, so it implies the identification of other models and strategies of CEF and their valorization, the integration of environmental knowledge, the development of analytical capacities of pupils regarding the environment, promoting a respectful and responsible regard towards nature, as well as the stimulation of environmental problem-solving abilities.

Based on the undertaken analyses, it was concluded that, in a modern and complex world, full of challenges and contradictory tendencies, the idea of culturalization of the person through environmental education functions as a guiding principle, and the *cultural values* promoted through the educational contents, including those specific to ecological education, represent the basic pedagogical resources used in the activity of permanent training-development of the human personality. Thus, at all levels of education, schools are required to ensure the gradual development of pupils' general knowledge, which is equivalent to "a body of knowledge and behavior that characterizes a given society", manifested in civic awareness and moral duty, responsibility for the environment and respect for nature and its resources [12].

Culture, in broad terms, is defined as "the totality of spiritual values derived from all fields of human knowledge-science, technology, art, economics, politics, etc." [12], and *ecological culture* is treated as a part of universal human culture, being represented by a system of knowledge, habits and social relations, moral and ethical norms, views, attitudes and values concerning the relationship between man and nature [7; 4; 39]. Every child, young man, citizen, human on the planet must have a certain level of ecological culture, which is built on a foundation of ecological education.

A summary of the evolution of concepts related to the issue of ecological education is presented in the table below, in which the authors' personal contribution to its development is also highlighted.

Author Conce	ts Contribution	Title	
W. B.Stapp J.F.Disinger	al -He defined EE as a process that enables individuals to explore environmental issues. -He emphasized the necessity of an interdisciplinary approach and of active implication in environmental problem-solving.	The Concept of Environmental Education (1969) Ecological education in a European context (1983)	

## Table 1.1. The evolution of concepts of ecological education (with examples of authors and works)

V.I. Vernadski C. Drăgan	Ecological culture	-Addresses the need to understand and integrate environmental principles into human behavior and socio-economic decisions. -Underlines the need to develop a set of values, knowledge and behaviors that support the protection of the environment and the sustainable use of natural resources.	Biosphere (1926) Ecology and environmental protection (1975)
C. Noica		-Emphasizes the importance of respect for nature and a harmonious relationship between man and his natural environment, hence C. Noica can be considered a precursor of the modern concept of ecological culture. -He signals the global ecological crisis and argues that solving it requires a profound	The Komanian Jeeting of being (1978) The Turning Point: Science, Society, and the Rising Culture
F.Capra M.Ielenic și C. Ioniță		<ul> <li>change in the way society views and interacts with nature.</li> <li>Explores the relationship between geography and environmental protection, emphasizing the importance of ecological education and the shaping of an ecological culture.</li> </ul>	(1982) Geography and environment (2005)
M. Drăgănescu S. Cristea I.A. Popa	Ecological awareness	<ul> <li>Emphasized the importance of ecological education and explained the need to develop ecological awareness.</li> <li>Developing environmental awareness is essential for implementing effective solutions to ecological crises.</li> <li>Ecological awareness can influence perception and response to global and local climate issues.</li> </ul>	Ecological Education and Ecological Awareness (2006) The Educational Dimension of Environmental Protection Ecology and Ecological Culture (2012)
C.Cucoș L.Ciolan	Pro- environm ental behavior	<ul> <li>-Defined the pro-environmental behavior as being manifested by those actions and attitudes that actively contribute to the protection and improvement of the environment.</li> <li>-Defined pro-environmental behavior as behaviors that promote sustainability and reduce negative environmental impacts.</li> </ul>	Ecological Awareness and Climate Change (2018) Average Behavior and Ecological Education (2017) Average Behavior and Environmental Policies (2020)
David Orr	Ecological Literacy	- He criticized the traditional education system for not placing enough emphasis on the link between knowledge and practical ecological action, pointing to the need for ecological literacy among pupils.	Ecological Literacy: Education and the Transition to a Postmodern World (1992)

Thus, the analysis of the studies conducted in the area shows that the natural environment has been a permanent object of study since the earliest stages of the development of civilization and societies, and that ecology as a science has also developed, introducing into the educational setting the concepts of ecological education (EE), ecological thinking, ecological culture (EC), ecological awareness, etc., which can be taken as a basis for conceptualizing and developing a vision of the process of formation of ecological culture (FEC) in young pupils.

According to S. Cristea, *ecological education* or *education related to the environment* is aimed at the formation and cultivation of problem-solving skills triggered by the application of industrial and post-industrial technologies on a social scale, which have had numerous negative effects on nature and human existence [12, p. 254].

According to A. Naess, ecological education aims to train and develop the skills necessary to solve the challenges generated by the rise of industrial and post-industrial technologies among the socially disadvantaged, which had a significant impact on nature and human existence. It is essential that pupils, from an early age, should be familiarized with the negative effects on the environment and the fundamental role that it plays in our lives, which should be integrated into their education from the earliest stages of education [37].

According to researchers "ecological education primarily ensures the creation of a pupil's scientific worldview, which is the core of consciousness; it gives unity to the spiritual aspect of a person; it equips him with ecologically acceptable, socially meaningful principles in his attitude towards the environment." [40; 42].

In a curricular sense, ecological education is made up of specific contents, set according to specific aims and objectives, ethical principles of any educated individual, through which it orients pupils towards pro-environmental attitudes, behaviors and actions, based on which ecological culture is built, as well as ecological awareness, developed through education. These educational contents bring new messages deriving from the challenges faced, and their novelty generates innovative responses, with an inter- or transdisciplinary character, due to the complexity of society's problems [7, p. 235].

According to G. Chirica, the shaping of ecological culture refers to the need for a unitary approach in the achievement of ecological education, to be applied throughout the educational process, from pre-primary education to university and postgraduate level, should include an ecological training system adapted to the age and level of development of pupils/students [7, pp. 235 - 236].

On the other hand, ecological culture is the result of an ongoing quest, information and research, in the course of which we organize the knowledge and experiences acquired in cognitive, behavioral and affective-motivational [6, p. 390].

Given the future-oriented perspective of educational content, G. Văideanu conceived, in a UNESCO report (1987), a new categorization of information resources for educational systems, in which he provided relevant guidelines for the outlining of new curricular areas, indicating "new educations" [28, p. 123], among which also Ecological Education, whose aim is to form ecological culture, and curriculum designers in Romania and Moldova were guided by these guidelines in the design of curricular contents.

Thus, in the current curriculum in Romania designed for primary education, the instructional content for the subject "Natural Sciences" includes specific EE themes, oriented towards the formation-development of pupils in an ecological perspective. In the Republic of Moldova, the ecological education of primary school pupils is targeted through the subject 'Science', which, as its title indicates, includes content from various areas of the exact sciences,

adapted to the level of objectives specified for each grade. In accordance with the provisions of the curriculum for primary education (2018), the following aims of the training process are established, presented in Table 1.2 [17, pp. 77, 81, 86]:

At the end of second grade	At the end of third grade	At the end of fourth grade
-It describes natural phenomena characteristic of each season; It groups plants and animals according to their function and habitat; -It establishes the role of the different parts of plants and animals; -It organizes the life stages of a plant or animal; -It completes observation sheets; -It clarifies the importance of flora and fauna for the ecosystem; -It develops a personalized project for relaxation and learning, proposing measures to protect plants and animals, showing the following im- portant <b>attitudes and val-</b> <b>ues:</b>	-It describes the conditions and habitat of living organisms; -It provides information about Moldova: geographical location, land features and water resources; -It implements a research process according to an established plan; -It groups plants and animals according to various categories and ecosystems; -It localizes the water courses and landforms of Moldova on the map; -It details the water cycle in nature; -It drafts environmental conser- vation measures, promoting es- sential ecological behaviors and values:	<ul> <li>-It identifies the elements of the Solar System;</li> <li>-It groups the entities of the environment (living organisms/animals, natural/processed materials);</li> <li>-It describes the structures of the human body, the stages of life and the essential functions of the human being;</li> <li>-It conducts research according to a set plan;</li> <li>-It evaluates the impact of modern technologies on human existence;</li> <li>-It justifies the consequences of the motion of the Earth;</li> <li>-It establishes hygiene rules to maintain the well-being of the hu- man body;</li> </ul>
-precision and logic in the correct application of specialized terminology; -willingness to explore and apply appropriate techniques and tools for collecting and organizing data; -analytical and innovative approach in nature discovery research; -interest in actively supporting environmental values and a healthy lifestyle.	-precision and clarity in the use of specific terminology; -curiosity and willingness to use appropriate methods and tools for collecting and organizing data -analytical and innovative approach to exploring the natural environment; -active interest in promoting ecological principles and healthy lifestyle.	-It develops projects to solve environmental problems, demonstrating <b>important</b> <b>attitudes and values</b> such as: -precision and logic in the use of specific terms; -curiousness and willingness to use appropriate methods and tools to collect and organize data; -critical and innovative thinking in exploring the environment; -interest in the active support of environmental values and a healthy lifestyle.

Table 1.2. Elements of the ecological	competence
---------------------------------------	------------

In Romania, EE contents are established in the curricula for primary education and are included in the following subjects: *Mathematics and Environmental Exploration*, preparatory, first and second grades (2013) and *Natural Sciences*, grades III - IV (2014). We note that the titles of the school subjects, in particular, those for first and second grade, suggest that the

interdisciplinary approach underlies the teaching-learning process of contents, and that the formation of correct behavior in relation to the surrounding nature is a major objective pursued through the system of activities proposed at this level of schooling, which are presented in Table 1.3.

Preparatory class	First grade	Second grade
3.2.Showing concern for correct behavior in relation to the family environment. -The creation of drawings with the following themes: home, one's bedroom; - Taking part in actions involving a clean and friendly environment within the classroom; -Identifying the positive and negative effects of one's own actions on the surrounding environment; Producing drawings/posters/colla ges showing rules of a	<ul> <li>3.2. Showing care for the correct behavior in relation to the natural environment.</li> <li>-Practical activities for the maintenance of the vegetation area in the school yard or the nature corner in the classroom;</li> <li>Use of tools and resources for environmental sanitation (rake, protective gloves, etc.);</li> <li>Re-using materials in activities (yogurt cups for decoration and using them as plant pots, using images from publicity leaflets to create strings, to illustrate the seasons, etc.);</li> <li>Identifying the importance of energy in human life, ways of saving energy;</li> <li>Expressing opinions (agreement/disagreement) on certain behaviors and opinions;</li> <li>Recognizing one's own mistakes in terms of environmental behavior.</li> </ul>	<ul> <li>3.2. Showing care for the correct behavior in relation to the natural and social environment.</li> <li>Hiking in order to observe natural environments;</li> <li>Identifying the consequences of some human actions on natural environments;</li> <li>Expressing opinions (agreement) on certain attitudes and behaviors observed;</li> <li>Making posters about the rules to be respected in the forest/in designated picnic places/on the street, etc.;</li> <li>Individual and team thematic projects;</li> <li>Planting trees;</li> <li>Initiating and participating</li> </ul>
Creating posters on col- ective hygiene.		in eeo programs/projects.

Table 1.3. Specific objectives and activities (preparatory class, first grade, second grade)

As it is shown in this curriculum framework, the objectives and activities specific to EE are present in the watermark of the instruction contents, as well as the educational values specific to EC, which are emphasized in both cases, even if they are placed differently (in the Romanian programs the values are placed on top of the objectives, while in the Moldovan curriculum they are placed after the system of activities).

Similarly, we also note that one of the current trends concerning the curricular organizing of the contents of instruction, including those specific to ecological education, is *the promotion of interdisciplinarity*, argued as follows by C. Cucoş: "a school content structured in an interdisciplinary way is more appropriate to the reality described and ensures a unified, coherent perception of existential phenomenology" [15, p. 77].

Moreover, we note that, at international level, in addition to the interdisciplinary approach, there is also recognized the trend of integrated approach to EE contents, which is due especially to the implementation of the STEAM integrated education model, defined by S.

Cristea as "a direction of development of the educational process, necessary in the trainingdevelopment of pupils and students in the informational, knowledge-based society." [13, pp. 54-56].

The main educational and formative source in the field of FEC today is given by the contents and activities specified in the curriculum for the "Science"/"Natural Sciences" subject, which are supplemented by EE-related teaching materials and supported non-formally by the customs and traditions of the local community culture in all its aspects [8; 9; 11; 13], while the educational objectives express, in a behavioral anticipatory way, the necessary targets to be achieved, the final learning achievements, which are achieved in the sphere of educational stages and learning of school subjects, through learning units, chapters, homework, lessons or other forms of organization of the teaching activity [12].

However, in the current context of the design and implementation of EE, but especially considering the complicated nature of the ecological reality in which children and adolescents grow up and develop, emphasizes the need to streamline the process of ecological culture formation. Solving these problems calls for a comprehensive, coherent and systemic approach to a trans curricular ecological education, even at an early school age. However, it is precisely at this age in the consciousness of the pupil that the first contradictions arise between the knowledge acquired and the behaviors formed at school, on the one hand, and the negative experience of some in relation to the natural environment, on the other, that children acquires "spontaneously" and which contradicts the behaviors formed deliberately among young pupils through the educational process, who still do not understand the interdependence of nature and human life and are not aware of the need to protect the environment.

Therefore, in order to ensure the effectiveness of the current process of FEC small schoolchild a paradigm shift in addressing environmental issues is necessary, through the integration of curricular contents but also a clarification of the concept and methodology of EC formation.

**Chapter 2**, titled **"Theoretical framework for the constitution of ecological culture of pupils of young school age through the integration of curricular contents"**, presents the theoretical concept of the inter-transdisciplinary approach to ecological education at the primary school level, emphasizes its purpose and its goal – the formation of pupils' ecological culture at the elementary level, reveals the EC components, the stages of the process of FEC and the achievable levels at each educational stage. The ways of curriculum integration of environmental content are described and the pedagogical model for the formation of ecological culture in young school-age students is presented, taking advantage of the STEAM methodology of curriculum content integration.

In Figure 2.1 we present the stages of the process of pupils' EC training-development, designed at all educational stages, and the levels that can be achieved at each stage, in relation to the ISCED levels, which derive from the European Model for structuring the purposes of the education system established for key competences [14].



Figure 2.1. Stages and levels in the development of ecological culture in pre-university education

In the context of the research topic, examining different views on the concept of EC, we have reframed the definition as follows: *the ecological culture of the young pupil is the basic finality of ecological education implemented at the primary school level, which is manifested in elementary environmental knowledge, actions and facts, beliefs, pro-environmental attitudes and behaviors, ecological skills and habits, oriented towards the development of the ecological consciousness of the personality in the making.* 

On the basis of analyzing the studies developed by several researchers (C. Andon, E. Haheu, L. Gordea, S. Gînju and others), we determined the structure of the concept of ecological culture, which consists of the following components: *the cognitive component, the procedural component* and *the attitudinal component* [1, p. 251].

*The cognitive component* of ecological culture (Fig. 2.2) concerns knowledge and is concerned with primary school pupils' acquisition of some elementary fundamental information about nature, the formation of subjective and organized representations of the environment, of perceptions of the unity of the surrounding world, the ability to recognize ecological connections and interdependencies, and of the reflection on ways of interacting with and about the natural environment.

	Тне со	GNITIVE COMPONENT
a system o	of nature sciences knowledge	understanding the specificity and the com-
the capacity to think within the limits of ecological protection		tion between them
		the integration of environmental knowledge
knowledge a th	and representations about a environment	knowing the laws of the environmental protection
		subjective attitudes towards nature
	personal strategies and tec intellectual, aesthetic deve sition of information a	hnologies for environmental activities (moral, elopment etc. based on natural objects, acqui- about nature, rules of behaving in nature)

Figure 2.2. The cognitive component

*The procedural component* of the ecological culture at primary school pupils (Fig. 2.3.) refers to the applied part of knowledge and involves the formation of pro-environmental skills/behaviors, by carrying out activities of recognition, analysis, classification, relating and reflecting on environmental issues.



Figure 2.3. The procedural component

As for *the attitudinal component* of ecological culture (Fig. 2.4.), it is related to the axiological part of learning and is expressed in the display of environmentally friendly attitudes typical of the beginner learner, including the power to empathize, to feel and express empathic and aesthetic feelings, abilities related to self-respect and evaluation of others in the context of the relationship with the natural environment.



Figure 2.4. The attitudinal component

Therefore, the two variables of the present research are: the ecological culture of the young schoolchild, with the structure highlighted on the three basic components (dependent variable) and the STEAM integrated curriculum model (independent variable) as a possible value to be exploited in the process of FEC.

In order to objectively measure the dependent variable, we proceeded to operationalize the concept of ecological culture on its structural components:

- **Cognitive** (Identifies the main elements of the environment (air, water, soil, plants, animals and understands their role in maintaining the natural balance; Knows species of plants, animals in Romania; Explains the effects of deforestation, pollution and waste on nature; Recognizes and gives examples of air, water and soil pollution, etc.)
- **Behavioral** (Sorts, disposes of waste correctly; Uses water and energy responsibly; Avoids littering; Creates new objects from recyclable materials; Participates in community initiatives etc.)
- Attitudinal (Shows care for plants and animals through protective gestures; Expresses concern about pollution and environmental degradation; Expresses concern about environmental problems, etc.) [29].

Among the models of integration, we have identified STEAM education promoted as a model of integrated study of curricular contents included in the Science domain, which has become a focal point in curriculum development in recent years. It is believed that this model allows the pedagogical integration of instructional contents, favoring the formation of "21st century skills", including critical thinking, problem solving, collaboration and creativity.

Based on the synthesis of the ideas, concepts, modalities and levels of pedagogical integration [7; 9; 22] we represented in a microsystem the following four modalities of curriculum content integration (MCCI), the last two of which were exploited in the experimental research.



Figure 2.5. Modalities of curricular contents integration

Linking the concepts of ecological culture and curriculum integration to the STEAM education model, in which we also include the Arts (A) domain, we have represented in a cluster the possibilities of integrating contents with an ecological theme (Figure 2.5.), which allows

visualizing the specific domains integrated in the FEC process and their relationship within the thematic framework.



# Figure 2.6. The cluster of curricular contents of EE integration through STEAM (second grade)

Thus, the operationalization of the concept of ecological culture and of integration of instructional contents through the STEAM model provides educational theory and practice with a solution to streamline the process of FEC, through which the interconnectivity between science, technology, ecology, art and mathematics can be harnessed for the purpose of a unified understanding of the surrounding world by young learners.

The Pedagogical Model for Formation of Ecological Culture (PMFEC) represents another important outcome of the present research, which is grounded on specific EE theories, paradigms, principles, values, integrates and valorizes the components of EC and specifies the various ways of integrating its contents, using STEAM methodology and strategies for this purpose (Figure 2.7.).



Figure 2.7. The Pedagogical Model for Formation of Ecological Culture

The pedagogical model development for FEC for primary school pupils reproduces, on the two projected dimensions (theoretical and methodological), the essential elements of the phenomenon investigated – the process of FEC, it valorizes the ways of integration (inter-, intraand transdisciplinary) of curricular content, it highlights the educational tools and strategies necessary to ensure the holistic, integrated and sustainable process of formation of EC, having a dual function: a) theoretical foundation of the pedagogical action projected and b) final validation of the methodology designed for this purpose. Through the application of the training model and the planned teaching-learning-evaluation strategies, pupils have the opportunity to form a unified and profound understanding of the relationship between man and nature, essential for the implementing of a responsible ecological behavior. Chapter 3, entitled "The experimental approach to developing ecological culture of pupils of young school age through STEAM integration", presents the results of the experimental research, in which the pedagogical model, the STEAM methodology for the development of ecological culture of pupils of young school age and the related pedagogical tools, the curricular contents integrated in the optional curriculum "The Little Ecologist", the teaching-learning-assessment strategies and methods applied in the training process were validated. Table 3.1. shows the design of the pedagogical experiment conducted on the three stages, specifying the aims and objectives pursued in each stage, as well as the activities carried out in each experimental stage.

Stages	Aims and objectives	Planned and accomplished activities
Observation stage	<ul> <li>Evaluation of the initial level of ecological knowledge in pupils of young school age.</li> <li>1. The evaluation of fundamental environmental and protection of the environment knowledge.</li> <li>2. The assessment of attitudes and behaviors towards the protection of the environment.</li> <li>3. The identification of the awareness of the human impact on the environment level.</li> </ul>	Assessment activities by simplified questionnaires in the form of games, evaluation pre-tests, structured observation sheets and guided discussions with drawings about clean and polluted nature.
Training stage	It consisted in the development of the process of ecological culture formation based on the optional curriculum with the involvement of the experimental sample. 1. Pupils' acquisition of ecological knowledge through interactive and exploratory STEAM activities on environmental protection. 2. Shaping positive ecological attitudes by involving pupils in STEAM learning experiences that encourage empathy and responsibility towards nature. 3. Developing active ecological behaviors by participating in practical environmental actions and applying ecological principles in everyday life.	Environmental lessons and experiments through STEAM activities (experiments, observations, didactic games). Projects and practical activities of recycling campaigns, tree planting and green spaces cleaning. Reflection workshops and debates on ecological themes, interactive presentations to reinforce values and positive attitudes towards nature.
Control stage	Evaluation of the level of ecological culture developed in young school age pupils after the implementation of the optional curriculum "The Little Ecologist" (second grade) and comparison of the results obtained by the sample subjects at the observation and control stages. 1. Assessment of the progress of pupils' progress in terms of environmental knowledge, attitudes and behaviors, compared to the initial level observed. 2. Analyzing the effectiveness of the optional curriculum "The Little Ecologist" by comparing the results obtained by the subjects of the experimental sample at the observation and control stages.	Application of post-tests and questionnaires to assess knowledge, attitudes and observations regarding environmental behaviors. Comparative analysis of the results of the observation phase, highlighting pupils' progress. Interpretation and dissemination of conclusions.

Table 3.1. The design of the pedagogical experiment regarding the formation of ecologicalculture of primary school pupils (second grade)

3. Identifying the impact of the educational intervention	
on the development of pupils' ecological culture and	
formulating recommendations for optimizing the teaching	
process in the field of ecological education.	

The assessment referential for measuring the performance levels applied in the FEC process is developed based on the operationalization of the EC concept in compliance with the Methodology for the implementation of criteria-based assessment through descriptors in grades I-II, approved by the National Council for Curriculum, Order no.623 of June 28, 2019. According to this methodology, we have established three possible levels to be reached in the FEC process at the early schooling stage: *minimum, medium, maximum,* which we have presented and described in performance indicators and descriptors (Table 3.2).

Table 3.2. Indicators and performance descriptors for assessing ecological culture in<br/>young school age pupils (second grade)

Indicators	Performance descriptors				
	Minimum level	Medium level	Maximum level		
Ecological knowledge					
Identifies the main elements of en- vironment (air, water, soil, plants, animals) and their roles in main- taining the natural balance.	Recognizes the el- ements, but doesn't correlate.	Identifies the ele- ments and par- tially explains their role.	Clearly explains the role of each element in the ecosystem.		
Knows plants, animals of Romania species, explains the importance of protecting them.	Identifies some species.	Explains why they are im- portant.	Proposes measures of protection.		
Explains the effects that deforesta- tion, pollution and waste have on nature.	Recognizing only one impact.	Lists more ef- fects, without de- tails.	Clearly explains and offers concrete examples.		
Recognizes and offers examples of air, water and soil pollution.	Identifies only one type of pollution.	Recognizes more types, without ex- amples.	Identifies all the types and offers relevant ex- amples.		
Lists recycling, water saving and tree planting actions.	Knows only a few actions.	Explains their benefits.	Actively applies and promotes these actions.		
Ecological attitudes					
Shows care for plants and animals through protective gestures.	Expresses occa- sional interest.	Participates ac- tively in care ac- tivities.	Initiates and promotes protective gestures.		
Expresses concern about pollution and environmental degradation.	Observes, but doesn't react.	Manifests con- cern, discusses.	Takes initiative in re- ducing pollution.		
Expresses their concern about eco- logical problems.	He acts indiffer- ent.	Observes the problems but doesn't react.	Reacts actively and proposes solutions.		
Ecological behaviors	Ecological behaviors				
Sorts, properly disposes of waste.	Doesn't sort.	Sorts occasion- ally.	Sorts constantly and correctly.		

Uses water and energy responsibly.	Is not aware of the importance sav-ing.	Applies some measures.	Has a consistent sav- ing behavior.
Avoids littering.	Frequently litters.	Avoids littering but doesn't act proactively.	Participates in clean- ing actions, encour- ages others.
Creates new objects out of recyclable materials.	Doesn't reuse ma- terials.	Recycles occa- sionally	Creatively applies re- using methods.
Participates in commentary initia- tives.	Doesn't engage.	Participates occa- sionally.	Participates actively.

**The observation experiment** was conducted at the beginning of the 2023 - 2023 school year, on a sample of 111 pupils from the second grades of the Secondary School No. 11 "Ștefan Octavian Iosif" in Brasov and aimed at determining the initial level of pupils' declarative and procedural knowledge of the environment, that can be attributed to the pupils' ecological culture.

At the observation stage (Fig. 3.1.), the minimum level was prevalent in more than half of the total number of pupils, followed by the medium level in about one third of the total number of the evaluated pupils, and the maximum level was only found in about one eighth of the total number of pupils.



# Figure 3.1. Levels of pupils' ecological culture formation, by grade (observation stage, beginning of school year 2023-2024)

The observation experiment phase carried out with second grade pupils demonstrated the existence of EC-related school pre-acquisitions, concretized in declarative knowledge and procedural knowledge, which, however, needed to be deepened and complemented with *values* and *attitudes* towards the environment and developed on the behavioral side of the pupils, with the active involvement of parents.

At the same time, the distribution of the initial levels of pedagogical training of ecological culture obtained at the stage of the observation experiment highlighted the need for a paradigm shift in the approach to the contents of instruction, which led us to develop a project of pedagogical intervention, concretized in the optional curriculum "The Little Ecologist", based on the STEAM integration methodology and interactive teaching-learning didactic strategies.

The training experiment phase was carried out during the whole 2023-2024 school year and aimed at forming the ecological culture of the pupils in the experimental sample (second grade A, B), based on the STEAM integrated contents in the "The Little Ecologist" curriculum (Annex 5 of the thesis). For the organization and conduct of the training experiment, *an algorithm for applying the methodology* was designed STEAM methodology aimed at the necessary steps to be taken and strategies to be implemented in the process of shaping the ecological culture of second grade pupils.

The algorithm for the formation of ecological culture in young pupils (second grade) includes the steps of the FEC process (raising awareness, stimulating curiosity, knowledge acquisition, application, etc.), didactic strategies and teaching methods applied in the FEC process, which are correlated with the objectives of the pedagogical training experiment, presented in Table 3.1.



Figure 3.2. The algorithm of developing ecological culture of young pupils

In following the methodological route designed for the implementation of the experimental training endeavor in second grade, the emphasis was placed on the integrated approach to the curricular content, structured in thematic modules related to the surrounding nature, and the operationalization of the structural components of the concept of ecological culture (cognitive, procedural and affective).

The training experiment focused on the application of the teaching-learning strategies, methods and techniques designed in the "Little Ecologist" curriculum for the organization and the implementation of the students' FEC process, materialized in a set of specific activities achievable at the second-grade level, which are presented in Figure 3.3.



#### Figure 3.3. Strategies, methods and techniques applied in the training experiment

At the **control experiment stage**, which aimed to evaluate the level of ecological culture formed in young school-age pupils through the application of the optional curriculum "Little Ecologist" (second grade) and to compare the results obtained with those of the control stage, the qualitative evolution of the results and the impact of the educational intervention on the formation of ecological culture of the pupils in the experimental sample were observed. Thus, by comparing the performance levels obtained by the pupils in the experimental sample with those of the pupils in the control sample, the results obtained show the following (Fig. 3.4.):



# Figure 3.4. Levels of pupils' ecological culture formation recorded at the monitoring stage, presented comparatively (*E. s. and W. s.*), second grade (end of school year 2023-2024)

These results demonstrate the relevance of the applied curriculum, the effectiveness of the applied strategies, methods and techniques in the FEC process and emphasize the fact that the

quantitative values/performances of the pupils in the experimental sample are quite significant, compared to the control sample, which confirms the scientific basis of the hypothesis formulated at the beginning of the research.

At the same time, the analysis of the fluctuation of the results shows us the significant increase of such educational values as declarative knowledge and procedural skills of the pupils included in the experimental sample, thus highlighting the importance of curricular integration of STEAM contents in the process of shaping ecological culture at the early schooling stage.

Sam	mla	Parcentage of FC level (%)			
Sample		rescentage of EC level (%)			
		Minimum level	Medium level	Maximum level	
Declarative	observation	26 (51 %)	17 (33,3 %)	8 (15,7 %)	
exp. sample	control	7 (13,6 %)	25 (49 %)	19 (37,3 %)	
Procedural	observation	34 (66,7 %)	13 (25,5 %)	4 (7,8 %)	
exp. sample	control	3 (5,8 %)	36 (70,6 %)	12 (23,6 %)	
Declarative	observation	28 (46,1 %)	22 (37,3 %)	10 (16,6 %)	
witness sample	control	26 (43,6 %)	24 (39,4 %)	10 (16,9 %)	
Procedural abilities witness sample	observation	35 (58,7 %)	19 (31,6 %)	6 (9,7 %)	
	control	28 (47 %)	24 (39,8 %)	8 (13,1 %)	

## Table 3.3. Comparison of data on the distribution of levels of ecological culture formation in the observation and control study *(no. of pupils per sample and %)*

By comparing the results represented in the diagrams in Fig. 3.1. and Fig. 3.4., reflecting the distribution of the levels of development of ecological culture in the observation and control study, a substantial increase in the level of ecological culture development was observed in the experimental sample (Fig. 3.5.), compared to the results in the control sample. Thus:

- The *minimum* level of ecological culture decreased by more than 49 % (25 pupils) in the experimental sample compared to the control sample, where it decreased by only 7 % (4 pupils).
- The *medium* level of ecological culture increased in the experimental sample by about 30 % (15 pupils) and in the control sample on average by 5 % (3 pupils).
- The *maximum* level of ecological culture increased in the experimental sample by about 18% (9 pupils), and in the control sample by only 2% (1 pupil).

We emphasize that in the process of FEC, pupils have acquired detailed knowledge about ecology, ecosystems and the impact of human activities on the environment, as well as environmental protection abilities, especially in the STEAM-based projects, which have given them a deeper understanding of fundamental ecological concepts. Through practical activities and

experiments, they learned about the structure and functioning of different ecosystems, including the interdependent relationships between plants, animals and the environment.



## Figure 3.5. Results of the FEC process on increasing the level of ecological culture in both samples (Ex. s. and W. s.)

Within the training experiment, pupils were involved in the realization of STEAM projects, such as "Curious Hedgehog – journey through his world", "Adventures in nature – discovering the natural environments" and "Be the superhero of the Blue Planet", which strengthened knowledge and skills in the formation of ecological culture at second grade level.

In parallel, we designed and implemented an in-service teacher training program entitled "*Forming ecological culture in young pupils through STEAM integration*", which aimed to sensitize teachers to the importance of forming pupils' ecological culture, increasing the interest of participants in the STEAM model and methodology. The program was capitalized in the training organized by the AO "Innovation in Performance Education" ICITT, in the period 18.03.2024 - 30.03.2024, through 150 hours, carried out in sessions on online platform and equated with 5 transferable credits.

In essence, the training experiment demonstrated that the integrated approach to curricular content, applied on the STEAM methodology, played a defining role in the FEC process, facilitating the linking of different subjects, such as natural sciences, mathematics, technology and the arts, to provide pupils with a holistic perspective on environmental issues. The operationalization in the FEC process of the tools developed for this purpose - the optional curriculum, the training algorithm, the strategies and methods selected for the application of the methodology - proved their effectiveness and relevance, encouraging pupils to engage in environmental learning activities. Therefore, the process of shaping the ecological culture of young school-age pupils through the integrated approach of STEAM content proved to be effective and relevant in terms of the school results obtained, which confirmed the scientific value of the hypothesis formulated, the validity of the pedagogical model and its implementation methodology and demonstrated the necessity and usefulness of curriculum integration. At the same time, the use of the STEAM methodology as a means of content integration in the FEC process and at the level of teacher training had a significant impact on raising teachers' awareness of the need to form an ecological culture in the young pupils.

#### GENERAL CONCLUSIONS AND RECOMMENDATIONS

The theoretical and praxeological investigation carried out on the topic "The formation of the ecological culture of young school-age pupils through the integration of curricular contents" has gone through all the stages of pedagogical research and involved the study of research approaches in the field, the explanation of basic concepts, the highlighting of unresolved issues, the existence of some teaching and learning problems and identifying possible solutions in the process of formation of ecological culture in young pupils.

The synthesis of the theoretical approaches, the conceptual-methodological framework developed for the design and realization of the process of formation of ecological culture of young school-age pupils, the strategies applied in the training experiment and the interpretation of the results of the experimental research on the formation of ecological culture in pupils confirmed the topicality and importance of the investigated topic, the correctness of the research hypothesis, the realization of the research aim and objectives, demonstrating the scientific novelty and originality, the theoretical and applied value of the research. The arguments in this regard are synthesized in the following conclusions.

1. The analysis of theoretical approaches on the issue of environmental education and the formation of ecological culture in young pupils has demonstrated the topicality and importance of scientific research in the field, the evolution of the concepts of *environmental education* and *ecological culture*, but also the identification of relevant aspects still not valued in the pedagogical plan, thus stimulating the idea of *conceptualizing and designing the process of formation of ecological culture of primary school pupils*.

2.At the same time, the research revealed the existence of some relevant aspects of the concept of ecological culture not yet elucidated in the pedagogical plan, *such as what it represents at the age of young pupils*, as well as some contradictions between theoretical approaches and practice of realizing ecological education, between the goals projected in the educational policy documents and the results of the current process of formation of ecological culture, thus highlighting the need to capitalize on them in order to improve school performance.

3.As a result, the **auctorial concept on the formation of ecological culture of young school-age pupils** was developed and the definition was adopted: *the ecological culture of the young pupil is the basic finality of ecological education carried out at primary school level, which manifests itself in environmental knowledge, beliefs, attitudes, values and behaviors (environmental facts, abilities and habits), being oriented towards the formation of the ecological awareness of the personality in the making.* 

4.Scientifically, it has been demonstrated that, in the face of the global, national and local environmental crisis, in the face of the education system, it is necessary to formulate an educational goal to form a certain level of ecological culture of pupils, starting with primary school, as well as to operationalize the concept of ecological culture, by taking advantage of the integrated approach to STEAM content, developing performance criteria and descriptors, setting performance levels, etc.

5. The synthesized theoretical landmarks for the formation of ecological culture of pupils of lower school age (Chap. 2, subchap. 2.1.) reflects the theoretical vision of how to design and implement the process of formation of ecological culture at the primary school stage, which has been concretized in: the STEAM model and methodology of formation of ecological culture through the integration of curricular content, teaching-learning strategies designed and applied in the pedagogical experiment, which constitute relevant scientific results of the conducted research.

6.The pedagogical model for the formation of ecological culture (MPFEC), based on theories, concepts, principles and ways of approaching the ecological culture, revealed the necessary conditions of possibility for the formation of ecological culture in primary education in Romania and Moldova, emphasizing the modalities for STEAM integration of contents, the importance of the integrated approach to curricular contents and the opportunities for creative development of the school curriculum. (Chap. 2, subchap. 2.3).

7. The optional curriculum "The Little Ecologist", conceived as the main tool for the formation of ecological culture in children of young school age and applied in the pedagogical experiment, offered

significant methodological possibilities for the use of *teleological* (goal, objectives, competences), *epistemological* (concepts, principles, norms), *of content* (themes of study and training), *technological* (strategies, methods, techniques, learning activities) curricular components as a foundation for its implementation in the educational process.

8. The STEAM methodology and the algorithm of its application in the process of formation of ecological culture, as well as learning strategies, methods, techniques and activities proved to be effective in increasing ecological knowledge levels, abilities and attitudes in pupils of young school age. It provides the necessary methodological framework for linking and integrating curricular contents, stimulates critical thinking and creativity of pupils and facilitates inter-/transdisciplinary learning by connecting different disciplines for a comprehensive understanding of environmental issues. The implementation of this methodology in the school curriculum is a viable strategy for the formation of responsible citizens who are aware of their impact on the environment.

9. The experiment on the formation of ecological culture, conducted on the optional curriculum, using the STEAM methodology at the primary school stage, demonstrated a significant increase in the levels of formation of ecological culture in young pupils. The pupils have shown a deeper understanding of ecological concepts, an increased sensitivity to environmental issues and a proactive attitude in protecting nature. Thus, the values obtained by this experiment confirm the validity of the developed pedagogical model and the effectiveness of the STEAM methodology applied in the formation of ecological culture in pupils of young school age (Chap. 3, subchapters 3.3, 3.4).

However, we cannot say that the level of ecological culture of primary school pupils (grades 1-2) has been established once and for all. The process of integrated ecological culture formation needs to be continued at secondary school level and deepened at the high school level. Our research has shown us only that the foundations of ecological culture, that is to say, a general elementary level of it, can be started in primary education, but once started, the process must be continued at all stages of schooling, starting in the family and kindergarten, followed in primary school, continued in secondary school, deepened in high school and developed throughout life.

As this research is open to further investigation, we make the following **recommendations:** 

#### For the researchers in the field:

**1.**To use the results of the present research for the development of other pedagogical research projects on the formation of ecological culture at other school age stages.

**2.**To engage in the development of an integrated curriculum for the formation of ecological culture for the pupils of V-IX grades and X-XII, by selecting STEAM contents, by determining the levels of ecological culture formation, by developing evaluation criteria and performance indicators for the different levels of formation of ecological culture for those respective grades.

#### For the primary teacher training institutions:

**1.**To make use of the research results, in particular, the model and methodology of ecological culture integrated formation in initial and further training.

**2.**To promote, through training courses, the STEAM education model as an effective way of integrating curricular contents in the process of forming pupils' ecological culture.

**3.**To train teachers in the development of STEAM projects in order to strengthen the process of forming pupils' ecological literacy at all educational levels.

#### For primary school teachers:

**1.**To be informed by the results of the research on how to make the process of ecological culture formation of small grade pupils more effective, using STEAM strategies, methods and techniques.

**2.**To engage in the process of promoting STEAM education through the implementation of the "The Little Ecologist" curriculum and the methodology of ecological culture formation in the design and realization of classroom activities.

#### BIBLIOGRAPHY

- 1. ANDON, C., HAHEU, E. *Theory and methodology of familiarizing preschoolers with nature*. Chisinau: UPS "Ion Creangă", 2014. 251 p. ISBN 978-9975-46-216-7.
- 2. BOCANCEA, V., ACHIRII, I., FRANŢUZAN, L., MARIN, M. *STEM Education as a model for curricular integration in the field of exact sciences*. Chisinau: Ministry of Education and Culture, 2022.
- CALLO, T. *The Culture of learning: an updated vision of student formation and cultivation.* In: Reconfiguring the School Learning Process Amid Societal Challenges: CALLO, T., BÂLICI, V., HADÎRCĂ, M. Chisinau, 2023. ISBN 978-9975-46-860-2.
- 4. CALLO, T., CUZNEŢOV, L., HADÎRCĂ, M. [et al.]; coord. şt.: Maria Hadîrcă; *Comprehensive Education: Theoretical-paradigmatic and applied foundations*. Acad. of Sciences of Moldova, Inst. of Educational Sciences. - Chişinău: Institute of Educational Sciences, 2015 ISBN 9789975-48-093-2). ISBN 978-9975-48-096-3.
- 5. National Curriculum reference framework, approved by Order of the Ministry of Education, Culture and Research no. 432 of May 29, 2017. ISBN 978-9975-31577-7.
- 6. CHELCEA, S., ILIUȚ, P., (coord.). *Encyclopedia of Psychosociology*. Bucharest: Economică, 2003. 390 p. ISBN 973-590-834-4.
- CHIRICĂ, G. Ecological education of the growing generation findings and perspectives. In: Environment and climate change: from vision to action, international conference (2015), Chişinău, 2021, pp. 235 - 236. ISBN 978-9975-46-220-4.
- 8. CIOLAN, L. *Defining and explaining the concept of integrated learning through STE(A)M*. Journal of Educational Sciences, 7(2), 2019. pp. 89-95. ISSN 1857- 2062.
- 9. CIOLAN, L. Integrated learning foundations for a transdisciplinary curriculum. Iași: Polirom, 2008. ISBN 978-973-46-1034-1.
- 10. Education code of the Republic of Moldova: no. 152 of 17.07.2014. In: Official Gazette of the Republic of Moldova, 24.10.2014, no. 319-324, art no. 634 [cited 12.06.2023].
- COROPCEANU, E., CAZACIOC, N. *The STEAM educational concept a manifesto of technological transfer in education*. In: Univers Pedagogic, 2023, no. 3(79), pp. 59-66. ISSN 1811-5470. DOI: <u>https://doi.org/10.52387/1811-5470.2023.3.09</u>.
- 12. CRISTEA, S. *Dictionary of Pedagogy*. Chisinau: Litera Publishing House, 2002. ISBN 9975-74-248-3.
- 13. CRISTEA, S. *STEM Education*. In: Didactica Pro..., no. 1 (119), Chisinau, 2020. ISSN 18106455.
- 14. CRIŞAN, Al. Benchmarks for the design, updating and evaluation of the National Curriculum in Romania. Bucharest: ISE, 2016. ISBN 978-606-8966-06-9.
- 15. CUCOŞ, C. *Pedagogy. Third revised and expanded edition*. Iaşi: Polirom, 2024. 536 p. ISBN 978-973-46-9955-1.
- 16. CUCOŞ, C. *The pedagogy of school and lifelong education*. Bucharest: Polirom, 2004. ISBN 973-46-0270-0.
- 17. National Curriculum. Primary education. Chisinau, 2018. ISBN 978-9975-3258-0-6.
- 18. GÎNJU, S. *The values of ecological education and environmental protection*. In: Univers Pedagogic, 2012. No.2, pp. 78-81. ISSN 1857-3517.
- 19. GHIBU, O. *About Education*. Bucharest: Publishing House of the Inspectorate for Culture of Bucharest Municipality. 1995. 78 p.
- 20. HADÎRCĂ, M. *Key competences and the problem of learning integration*. In: School learning in the context of school learning. Materials of the Cross-border Scientific Symposium. Chişinău, 2023, 304 p. ISBN 978-9975-46-859-6.
- Decision on the approval of the Environmental Strategy for the years 2014-2023 and the Action Plan for its implementation no. 301 of 24.04.2014. In: Official Gazette of the Republic of Moldova, 06.05.2014, no. 104-109 art. No: 328.

- 22. National Education law no. 1/2011, published in the Official Gazette, Part I no. 18 of January 10, 2011. In force since February 09, 2011, being partially replaced by Law 198/2023, Law 199/2023.
- 23. MARGA, A. *Education in the knowledge society*. Iași: Polirom Publishing House, 2010, pp. 17-20. ISBN 978-973-46-1791-3.
- MARIN, M. A possible methodology for curricular integration through STEM / STEAM / STREAM activities in general education. In: School learning in the context of school learning. Materials of the Cross-border Scientific Symposium. Chisinau, 2023. ISBN 978-9975-46859-6.
- PANICO, V. Education for change and development a component of new educations. In: Materials of the Republican Conference of Teaching Staff: Psychopedagogy of Primary and Preschool Education, Ed. 1, March 10-11, 2018, Chisinau. Chisinau, Republic of Moldova: Tiraspol State University, 2018, Vol. 4, pp. 239-245. ISBN 978-9975-76-232-8.
- 26. Environmental Strategy for the years 2014 2023 and the Action Plan for its implementation. Chisinau, 2014.
- 27. National Strategy for Sustainable Development of Romania 2030. Bucharest: Ministry of the Environment, 2018. Available at <a href="https://dezvoltaredurabila.gov.ro">https://dezvoltaredurabila.gov.ro</a>.
- 28. VĂIDEANU, G. *Environmental education and ecological education*. Bucharest: Didactic and Pedagogical Publishing House, 1986. 123 p.
- 29. VOINEA, M. Intercultural education as the "encounter" with the other. Braşov: Transilvania University Press, 2014, 136 p. ISBN 978-606-19-0438-9. <u>https://oldsite.bibnat.ro/dyndoc/publicatii/CIP/Bibliografia%20cartilor%20in%20curs%20de%20aparitie%20CIP%20-</u>%20decembrie%202014.pdf.
- 30. UNESCO. Education for sustainable development goals: learning objectives. Paris, 2017. DOI: https://doi.org/10.54675/CGBA9153. ISBN 978-92-3-100209-0.
- 31. UNEP. Environmental education: guiding principles and strategies. Nairobi: UNEP, 2021.
- 32. BRUNNER, W. Ecologic! *Educația ecologică: metode și exemple*. Chișinău: Elan Poligraf, 2005. 72 p. ISBN 978-9975-46-216-7.
- 33. COYLE, K. *Environmental Literacy în America*. What Ten Years of NEETF/Roper Research and Related Studies Say About Environmental Literacy în the U.S., Washington D.C., The National Environmental Education and Training Foundation, 2005. https://eric.ed.gov/?id=ED522820&utm\_source=chatgpt.com.
- 34. De LANDSHEERE, G. *Les objectifs pédagogiques en question*. Paris: Presses Universitaires de France PUF (1 mai 1992). Langue, Français. Broché, 344 pages. ISBN-10, 2130447619. ISBN-13, 978-2130447610.
- 35. GARDNER, G.T., STERN, P. *Environmental problems and human behavior*. Boston: Pearson Custom Publishing. 2003. ISBN 0-536-68633-5.
- 36. HOWE, R.W., DISINGER, J.F. *News about environmental education research*. Environmentalist 11, 5–8, (1991), martie, 1991. DOI https://doi.org/10.1007/BF01263191.
- 37. NAESS, A. Ecology, Community, and Lifestyle: Outline of an Ecosophy. New York: Cambridge University Press, 1990. ISBN 0521348730.
- 38. ВЕРНАДСКИЙ, В.И. *Biosphere*. Leningrad: Nauka, 1926.
- ГОРОЩЕНКО, В.П. Methodology of Teaching Natural Science: A Textbook for Students of Pedagogical Schools/ V.P. Goroshchenko, P.A. Stepanov. -M.: Prosveshchenie1976. 239 p. ISBN 002-19. <u>https://www.libex.ru/detail/book644441.html?utm\_source=chatgpt.com</u>.
- 40. ДЕЖНИКОВА, Н.С., ИВАНОВА, Л.Ю., КЛЕМЯШОВА, Е.М., СНИТКО, И.В., ЦВЕТКОВА, И.В. *Fostering ecological culture in children and adolescents.* Moscow, Publishing House of the Pedagogical Society of Russia, 2001. 64 p.
- 41. ПЕЧКО, Л. *Aesthetic mastering of nature in the process of personality formation*: abstract of the dissertation of Dr. filolog nauk. [Text]/ L. R. Pechko. М., 1994. 49 p.
- 42. СУРАВЕГИНА, И.Т. СЕНКЕВИЧ, В.М., КУЧЕР, Т.В. Environmental education at school // Soviet Pedagogy, No. 12, 1990. 12-14 p. ISSN 0130-5358.
- 43. <u>https://mecc.gov.md/sites/default/files/curriculum\_educ\_ecol\_i-xii.pdf</u>/

### LIST OF THE AUTHORS' PUBLICATIONS ON THE TOPIC OF THE THESIS

#### Articles in scientific journals indexed in international databases:

 CHIRIAC, E. Ecological Culture — values and functions in the education process of young schoolchildren. In: Revista Univers Pedagogic, 2021, no. 3(71), pp. 110-113. ISSN 1811-5470. DOI: <u>https://doi.org/10.52387/1811-5470.2021.3.16</u>.

Available: <u>https://ibn.idsi.md/ro/vizualizare\_articol/141157</u>.

- HADÎRCĂ, M., CHIRIAC, E. Formation of ecological culture in primary education. In: Revista Didactica Pro..., journal of educational theory and practice, 2024, no. 1-2(143-144), pp. 90-95. ISSN 1810-6455. DOI: <u>https://doi.org/10.5281/zenodo.10719469</u>. Available: <u>https://ibn.idsi.md/ro/vizualizare\_articol/203826</u>.
- 3. **CHIRIAC, E.** *The development of critical thinking and creativity in the process of forming the ecological culture of primary school students*. In: Acta et commentationes (Științe ale Educației), 2024, nr. 4(38), pp. 120-127. ISSN 1857-0623. DOI: <u>https://doi.org/10.36120/2587-3636.v38i4.120-127</u>. Available: <u>https://ibn.idsi.md/ro/vizualizare articol/220919</u>.
- 4. CHIRIAC, E. Training Ecological Thinking in Early School Age Students through Integration of Curriculum Contents. Bulletin of Transilvania University of Braşov. Series VII: Social Sciences and Law In: Publisher: Transilvania University Press Subject(s): Sociology and Anthropology; Psychology and Pedagogy; Social Work; Frequency of Philosophy and History Relations: 2 (from 2011)1 (up to and including 2010) ISSN (Print): 2066-7701 ISSN (CDROM): 2066-771X ISSN (Online): 2971-9410 ISSN-L: 2066-7701 CNCSIS Code: 925

Status: Active DOI: <u>https://doi.org/10.31926/but.ssl.2024.17.66.4.18</u>. Available: https://webbut.unitbv.ro/index.php/Series VII/article/view/8985.

5. **CHIRIAC, E.** *Curriculum integration strategies for the formation of ecological culture in early school-age students.* Journal of romanian literary studies. In: Publishing House: ARHIPELAG XXI, Tîrgu-Mureş, Romania. Vol. no. 40 / 2025, pp. 845-850. E-ISSN: 2248-3004.

Available: https://asociatia-alpha.ro/Jrls/40-2025-Jrls-b.pdf.

#### Articles in conference proceedings and other scientific events:

1. **CHIRIAC, E.** Formation of the ecological culture of the young schoolchild through the integration of curricular contents. In: Materials of the scientific student conference with international participation, Ed. 70, April 28, 2021, Chisinau. Chisinau: Printing House of the Tiraspol State University, 2021, Edition 70, Vol.2, pp. 19-24. ISBN 978-9975-76-339-4.

Available: https://ibn.idsi.md/ro/vizualizare\_articol/141096.

- CHIRIAC, E., CHIRICĂ, G. The potential of curricular objectives and contents in the formation of ecological culture of primary school students. In: Education in the face of new challenges, November 5-6, 2021, Chisinau. Chisinau: Tiraspol State University, 2021, Vol.1, pp. 188-194. ISBN ISBN 978-9975-76-372-1 (PDF). https://ibn.idsi.md/sites/default/files/imag\_file/188-194\_8.pdf. Available: https://ibn.idsi.md/ro/vizualizare\_articol/148974.
- 3. HADÎRCĂ, M., CHIRIAC, E. Environmental education and ecological culture of the student in the context of current societies. In: Conference on Quality Education in the Context of Societal Challenges, Ed. 1, October 21, 2022, Chisinau. CEP UPS "I.Creangă",

2022, p. 159-167. ISBN 978-9975-46-638-7. Available: <u>https://ibn.idsi.md/ro/vizualizare\_articol/179931</u>.

- 4. **CHIRIAC, E.** *Contributions on the integrated approach to content in the formation of ecological culture in young schoolchildren.* In: Student Scientific Conference with International Participation, April 20, 2022, Chisinau. Chisinau: Tiraspol State University, 2022, Edition LXXI, pp. 375-383. ISBN 978-9975-76-394-3. <u>https://ibn.idsi.md/sites/default/files/imag\_file/375-383\_2.pdf</u>. Available: <u>https://ibn.idsi.md/ro/vizualizare\_articol/160762</u>.
- CHIRIAC, E. Înnovative technologies for training ecological culture in primary classes.
   În: Research Innovation Innovative Entrepreneurship, International Congress, 13-14 octombrie 2023, Chişinău. Chişinău: CEP UPSC, 2023, pp. 88-95. ISBN 978-9975-46-8312. <u>https://ibn.idsi.md/sites/default/files/imag\_file/88-95\_23.pdf</u>. Available: https://ibn.idsi.md/ro/vizualizare\_articol/192437.
- CHIRIAC, E. Evaluation of the effectiveness of methods for forming ecological culture in young schoolchildren. In: International scientific and practical conference Training through research for a prosperous society, Ed. 10, March 18-19, 2023, Chisinau. Chisinau: Printing House of the Tiraspol State University, 2023, Edition 10, Vol.2, pp. 43-50. ISBN 9789975-46-716-2. DOI: <u>https://doi.org/10.46727/c.v2.18-19-03-2023.p43-50</u>. Available: https://ibn.idsi.md/ro/vizualizare\_articol/179210.
- 7. **CHIRIAC, E.** *Integrated learning through STEM in the formation of ecological awareness of primary school students.* In: International Symposium School Learning in the Context of Societal Challenges, June 23, 2023, Chisinau. Chisinau: 2023, pp. 288-294. ISBN 978-9975-46-859-6. Available: <u>https://ibn.idsi.md/vizualizare\_articol/197704</u>.
- CHIRIAC, E. Environmental education and the formation of ecological culture in primary education – questionnaire for teachers. In: Research – Innovation – Innovative Entrepreneurship: International Congress, Ed. Edition 2, May 17-18, 2024, Chisinau.Chisinau: CEP UPSC, 2024, Edition 2, pp. 381-390. ISBN 978-9975-46-964-7. DOI: <u>https://doi.org/10.46727/c.17-18-05-2024.p381-390</u>. Available: https://ibn.idsi.md/ro/vizualizare articol/21835.
- CHIRIAC, E. Integrated approach to ecological education in primary education. In: International Conference on Research-based Education for a Prosperous Society, Ed. 11, 16-17 May 2024, Chisinau. Chisinau: CEP UPSC, 2024, Edition 11, Vol.2, pp. 203-210. ISBN 978-9975-46-904-3.

http://dir.upsc.md:8080/xmlui/bitstream/handle/123456789/6441/Conf-UPSC-16-17-052024-V2-p203-210.pdf?sequence=1&isAllowed=y. DOI: https://doi.org/10.46727/c.v2.16-17-05-2024.p203-210. Available: https://ibn.idsi.md/ro/vizualizare\_articol/206900.

 CHIRIAC, E., HADÎRCĂ, M. Development of the ecological culture of young pupils in the modern school system/ Formation of ecological culture in young schoolchildren in the modern school system In: New research directions in pedagogy, editors Katarzyna Jagielska, Joanna M. Łukasik, Norbert G. Pikuła, Krakow, University Press "National Education Commission" of Krakow, Poland, 2023, pp 98-111. ISSN 245-7865. ISBN 978-83-8084-9853. e-ISBN 978-83-8084-986-0. DOI: 10.24917/9788380849853.

#### ANNOTATION

#### **Chiriac Elena**

## "The formation of the ecological culture of students of small school age through the integration of curricular contents", doctoral thesis in educational sciences, Chisinau, 2025

**The structure of the thesis includes:** introduction, 3 chapters, general conclusions and recommendations, bibliography from 197 sources, annotation (in Romanian), key concepts, list of abbreviations, 143 pages of basic text, 18 tables, 32 figures, 12 annexes.

**Key words:** culture, ecological culture, ecological education, formation of ecological culture, curriculum integration, primary education. **Field of study:** General theory of education.

**The purpose of the research** determining the theoretical and methodological bases for forming ecological culture in young school-age students through the integration of curricular content.

**The objectives of the investigation:** examining theoretical approaches, defining concepts regarding ecological education and ecological culture; determining theoretical benchmarks and ways of integrating curricular contents for the formation of ecological culture of young schoolchildren; developing a pedagogical model for the formation of ecological culture of young schoolchildren by integrating curricular contents; establishing effective strategies, methods and techniques for integrated formation of ecological culture; experimental validation of strategies and methods for the formation of ecological culture in young schoolchildren; formulating general conclusions and practical recommendations.

The novelty and scientific originality of the research consists in: systematization of theoretical approaches to the research topic; development of a new vision regarding the formation of ecological culture at the primary school level; scientific argumentation of the integration of curricular contents in the formation of ecological culture of primary school students; development of the model and adaptation of the STEAM methodology in the process of integrated formation of ecological culture in early school-age students, as well as pedagogical tools for integrated teaching-learning of contents, which favor the process of forming ecological culture.

The scientific problem solved in the research is embodied in: determining the theoretical and methodological benchmarks necessary for the formation of the ecological culture of young schoolchildren; developing the authorial concept regarding the integrated formation of ecological culture at the primary education stage; conceptualizing and validating the Pedagogical Model for the formation of the ecological culture of primary schoolchildren; establishing the levels of formation of the ecological culture of primary schoolchildren; developing the STEAM methodology, algorithm and strategies for the formation of ecological culture by integrating curricular content.

The theoretical significance of the research is argued by: synthesizing theoretical approaches regarding the formation of ecological culture; defining the concepts of ecological education and ecological culture; revealing the components of the concept of ecological culture; operationalizing the concept of ecological culture, performance indicators and descriptors, as well as the levels possible to achieve at that age; designing strategies for forming ecological culture in young school-age students from the perspective of integrating curricular content.

The applied value of the research results from: determining the educational contents that can be integrated into a STEAM curriculum; adapting the STEAM methodology to the specifics of forming ecological culture in young school-age students; outlining the set of curricular tools necessary in the process of forming ecological culture; developing educational resources for forming ecological culture; didactic valorization of the optional curriculum "Little Ecologist" for second-grade students in the process of forming ecological culture; developing and implementing the Continuous Training Program for Teachers "Forming Ecological Culture in Students by Integrating STEAM"; developing a collection of didactic projects with the valorization of STEAM.

**The implementation of the scientific results**: ascertaining the status of the investigated topic, experimenting and validating the methodology for training ecological culture in primary school students and the related tools - the optional curriculum "Little Ecologist" applied within the Secondary School No. 11 "Ștefan Octavian Iosif" Brașov, Romania (2023 - 2024) and the Teacher Training Program "Training ecological culture in students through STEAM integration" applied within the AO "Innovation in performance education" ICITT, period 18.03.2024 - 30.03.2024.

**The approval and validation of the scientific** results was carried out through publications in: (**a**) scientific journals and (**b**) through communications at national and international scientific conferences, congresses, as well as at scientific and methodological seminars organized 2020-2025 in the R. Moldova and Romania. The results obtained are published in 15 scientific papers.

#### ADNOTARE

#### **Chiriac Elena**

#### "Formarea culturii ecologice a elevilor de vârstă școlară mică prin integrarea conținuturilor curriculare", teză de doctor în științe ale educației, Chișinău, 2025

**Structura tezei** include: introducere, 3 capitole, concluzii generale și recomandări, bibliografie din 197 de surse, adnotare (în română), concepte-cheie, lista abrevierilor, 143 pagini de text de bază, 18 tabele, 32 figuri, 12 anexe.

Cuvinte-cheie: cultură, cultură ecologică, educație ecologică, formare a culturii ecologice, integrare curriculară, învățământ primar.

Domeniul de studiu: Teoria generală a educației.

**Scopul cercetării:** determinarea bazelor teoretice și metodologice de formare a culturii ecologice la elevii de vârstă școlară mică prin integrarea conținuturilor curriculare.

**Obiectivele cercetării:** examinarea abordărilor teoretice, delimitarea conceptelor privind educația ecologică și cultura ecologică; determinarea reperelor teoretice și a modurilor de integrare a conținuturilor curriculare pentru formarea culturii ecologice a școlarului mic; elaborarea modelului pedagogic de formare a culturii ecologice a școlarului mic prin integrarea conținuturilor curriculare; stabilirea strategiilor, metodelor și tehnicilor eficiente de formare integrată a culturii ecologice; validarea experimentală a strategiilor și metodelor de formare a culturii ecologice la elevii de vârstă școlară mică; formularea concluziilor generale și a recomandărilor practice.

Noutatea și originalitatea științifică a cercetării constă în: sistematizarea abordărilor teoretice la tema de cercetare; elaborarea unei viziuni noi privind formarea culturii ecologice la nivelul claselor primare; argumentarea științifică a integrării conținuturilor curriculare în formarea culturii ecologice a elevilor de clasele primare; elaborarea modelului și adaptarea metodologiei STEAM în procesul de formare integrată a culturii ecologice la elevii de vârstă școlară mică, precum și a unor instrumente pedagogice de predare-învățare integrată a conținuturilor, care favorizează procesul de formare a culturii ecologice.

**Problema științifică soluționată în cercetare** se concretizează în: determinarea reperelor teoretice și metodologice necesare pentru formarea culturii ecologice a școlarului mic; elaborarea conceptului auctorial privind formarea integrată a culturii ecologice la etapa învățământului primar; conceptualizarea și validarea Modelului pedagogic de formare a culturii ecologice a elevilor de vârstă școlară mică; stabilirea nivelurilor de formare a culturii ecologice a elevilor din clasele primare; dezvoltarea metodologiei STEAM, a algoritmului și a strategiilor de formare a culturii ecologice prin integrarea conținuturilor curriculare.

Semnificația teoretică a cercetării este argumentată prin: sintetizarea abordărilor teoretice privind formarea culturii ecologice; delimitarea conceptelor educație ecologică și cultură ecologică; relevarea componentelor conceptului de cultură ecologică; operaționalizarea conceptului de cultură ecologică, a indicatorilor și descriptorilor de performanță, precum și a nivelurilor posibil de atins la vârsta respectivă; proiectarea strategiilor de formare a culturii ecologice la elevii de vârstă școlară mică din perspectiva integrării conținuturilor curriculare.

**Valoarea aplicativă a cercetării** rezultă din: determinarea conținuturilor educaționale ce pot fi integrate într-un curriculum STEAM; adaptarea metodologiei STEAM la specificul formării culturii ecologice la elevii de vârstă școlară mică; conturarea ansamblului de instrumente curriculare necesare în procesul de formare a culturii ecologice; dezvoltarea resurselor educaționale pentru formarea culturii ecologice; valorificarea didactică a curriculumului opțional "Micul ecologist" pentru elevii de clasa a II- a în procesul de formare a culturii ecologice; elaborarea și aplicarea Programului de formare continuă pentru cadrele didactice "Formarea culturii ecologice la elevi prin integrarea STEAM"; elaborarea culegerii de proiecte didactice cu valorificarea STEAM.

**Implementarea rezultatelor științifice** ale cercetării a fost realizată prin: investigarea, experimentarea și validarea metodologiei de formare a culturii ecologice la elevii din clasele primare și a instrumentelor acesteia - Curriculumul opțional "Micul ecologist" aplicat în cadrul Școlii Gimnaziale NR.11 "Ștefan Octavian Iosif" Brașov, România (anul de studii 2023 – 2024) și Programul de formare a cadrelor didactice "Formarea culturii ecologice la elevi prin integrarea STEAM" aplicat în cadrul AO "Inovație în educație de performanță" ICITT, perioada 18.03.2024 – 30.03.2024.

**Aprobarea și validarea rezultatelor științifice** s-a efectuat prin publicații în: (a) reviste științifice și (b) prin comunicări în cadrul conferințelor, congreselor științifice naționale și internaționale precum și în cadrul seminarelor științifice și metodologice organizate în 2020-2025 în R. Moldova și România. Rezultatele obținute sunt publicate în 15 lucrări științifice.

### CHIRIAC ELENA

## THE FORMATION OF THE ECOLOGICAL CULTURE OF PUPILS OF YOUNG SCHOOL AGE THROUGH THE INTEGRATION OF CURRICULAR CONTENTS

### 531.01 – GENERAL THEORY OF EDUCATION

### THE ABSTRACT of the doctoral thesis in educational sciences

Approved for printing: 05.05.2025

Offset paper. Offset printing.

Printing papers: 1,5

Paper size 60x84 1/16 Print run of 40 copies. Order no. 210

Type made at the Professor's House (CAVAIOLI, SRL), str. Doina, 173, Chisinau, Republic of Moldova